BURO HAPPOLD

NOMA 2&3 Angel Square

Ground Engineering Desk Study Report

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1 Executive Summary

Buro Happold Limited were appointed by MEPC Ltd to undertake a Phase I Desk Study to provide an initial assessment of the likely ground conditions specific to the proposed development at for 2 & 3 Angel Square Plots (plots M & N of the NOMA Masterplan), Manchester. The site area is currently occupied by public car parking areas, managed by RCP Parking Ltd, with the main access from Angel Street. The immediate surrounding area comprises urban development including residential, warehouses, offices and manufacturing facilities.

The Proposed Development comprises the erection of two high quality commercial office buildings of 13 and 14 storeys, alongside public realm, car parking, extensive cycle parking facilities, and associated highways and access arrangements. At this stage the phasing and delivery strategy is not fixed.

Reviews of historical maps indicate that the proposed development site has undergone a rich industrial history including the remains of cotton mills and associated reservoirs (Arkwright's Mill - Shudehill Mill), an iron foundry, a saw mill and timber yard, a brewery, a public baths and wash house, public houses, shops and housing of various types. The past and present uses of the site and its surroundings indicates the potential for a variety of contaminants to be present.

Two scheme specific intrusive ground investigations have been undertaken (SSL 2015/2021 GI's) which comprised a number of exploratory holes to determine the depth and properties of any Made Ground, superficial deposits and the bedrock; soil, rock and groundwater sampling and testing, monitoring of ground gas and groundwater and assessment of contamination risk specific to the development and current guidelines. The ground conditions comprise a variable depth of Made Ground, overlying superficial deposits (Glacial Till – sand, gravel and clay), underlain by the Chester Formation (Sherwood Sandstone Group). The Sherwood Sandstone Group is classified as a 'Principal Aquifer' (formerly a 'Major Aquifer').

The SSL 2021 GI groundwater data indicates static water level (SWL) between ~30.08 m AOD and 24.97 m AOD (15.69 to 21.92 m bgl) within the sandstone bedrock (Chester Formation). Localised perched groundwater is also recorded within the Made Ground/superficial deposits (~0.50 to 3.95 m BGL). It is worthy of note that there were no groundwater strikes within the trial pits or window samples during the SSL 2021 GI. In relation to ground gas, it is considered that Characteristic Situation 1 (CS1) is a suitable classification for the entire site. In accordance with Table 4 (page 22, BS 8485:2015+A1:2019) if the Site is classified as CS1, 0 points are required and thus ground gas protection is therefore not required.

SSL 2021 GI: 10 No. soil samples underwent soil chemical analysis and were assessed against the C4SL and S4UL screening criteria. 2 No. of the 10 No. samples tested recorded determinands that exceeded the relevant 'commercial' threshold for lead (2,330 mg/kg). TP104 at 0.50 m BGL – Lead: 5910 mg/kg (located under 2 AS plot) and TP111 at 1.80 mg/kg – Lead: 4300 mg/kg (located in between 3 AS and NMS). Given the depths of the samples, is likely that this material will be removed from site during the lower ground level excavation. If left insitu, the area will be covered in hardstanding or appropriate soft landscaping builds, thus breaking any source-pathway-receptor linkage.

14 No. tests on samples within Made Ground deposits were screened for ACM. 1 No. sample recorded the presence of asbestos fibres, namely Chrysotile in TP108 at 0.60 m BGL (located under 3 AS plot).

Waste Acceptance Criteria (WAC) testing was also carried out on 10 No. samples. 7 No. soil samples tested were classified as 'Non-Hazardous' and 3 No. soil samples were classified as 'Hazardous'. TP102 at 0.70 m bgl – Lead (1060 mg/kg) and

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Zinc (1580 mg/kg - located under 2 AS plot). TP104 at 0.50 m bgl – Lead (5910 mg/kg - located under 2 AS plot) and TP111 at 1.80 m bgl – Lead (4300 mg/kg - located in between 3 AS and NMS)).

Minor historical ground contamination is present within the Made Ground materials. Based on the qualitative risk assessment and the results from the SSL 2015/2021 GI, the risk of ground contamination affecting the Proposed Development is considered to be predominantly low to low/moderate.

The Zetica Unexploded Bomb Risk Map shows the Site to be in an area of 'Moderate' risk. It is known that Arkwrights Mill on/adjacent to the western site boundary was bombed in 1940 during the 'Manchester Blitz' and post-war historical maps show a number of 'Ruins' on site and immediately to the east. The site has not undergone any significant post-war development, with the site made into an open air car park during the 1980s. A detailed UXO risk assessment has been carried out which classifies the site as 'medium' and recommends UXO mitigation measures during any groundworks, boreholes or piled foundations.

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2 Introduction

Buro Happold Engineering has been appointed by NOMA (GP) Ltd to undertake site investigation works for the proposed development of two new build office developments on 2&3 Angel Square (Plots M and N) within the NOMA Masterplan. Please note, for the purposes of this Desk Study report, 2&3 Angel Square have been evaluated as one proposed development site herein referred to as 'the Site'.

The Site is located to the north of Manchester City Centre and approximately 220 m east of Manchester Victoria Railway Station, centred on National Grid reference ^{3}8440 E, ^{3}99053 N. It is also in the immediate vicinity of the existing Co-operative Insurance Society (CIS) Tower which lies just beyond the corner of the western boundary. The site area is currently occupied by public car parking areas, managed by RCP Parking Ltd, with the main access from Angel Street. The immediate surrounding area comprises urban development including residential, warehouses, offices and manufacturing facilities. The site location plans are included as Figure 2-1 / Figure 2-2 and an aerial photograph is included as Figure 2-3.

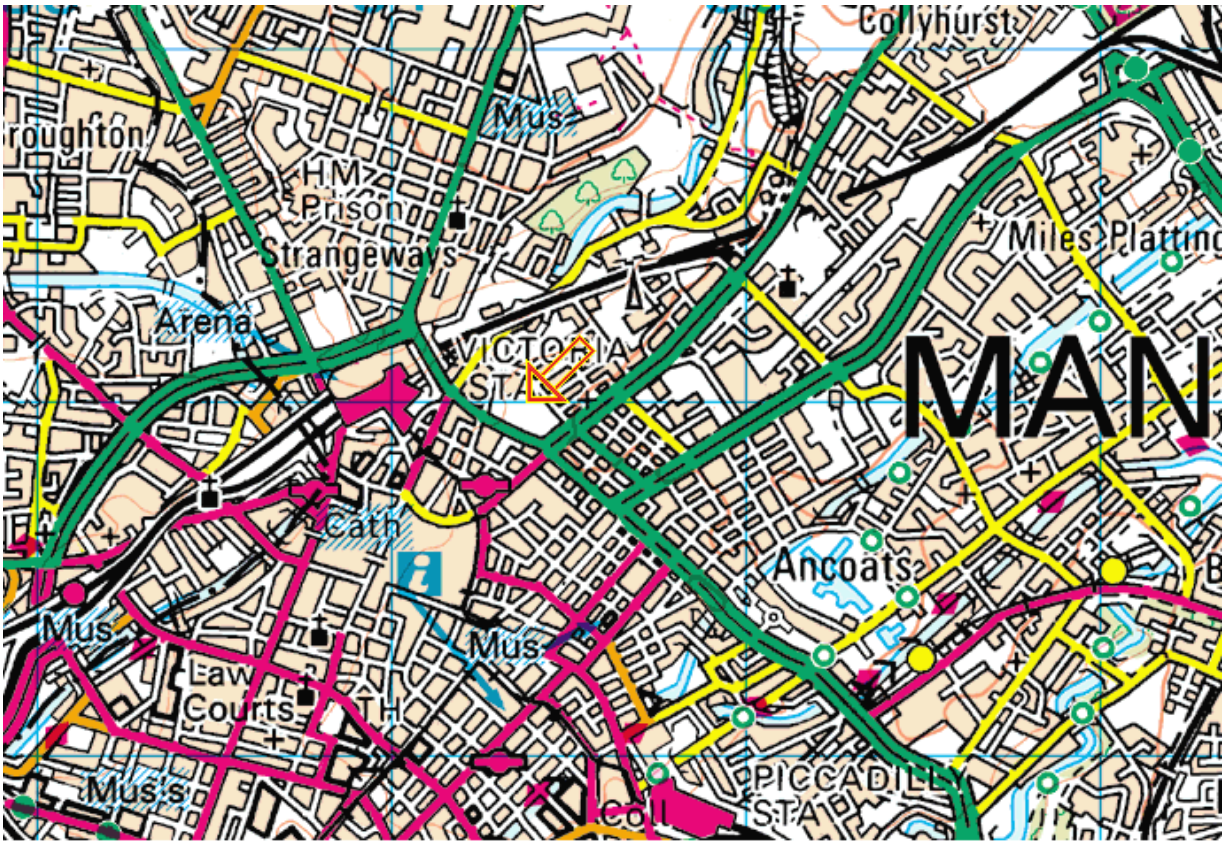


Figure 2-1 Site Location

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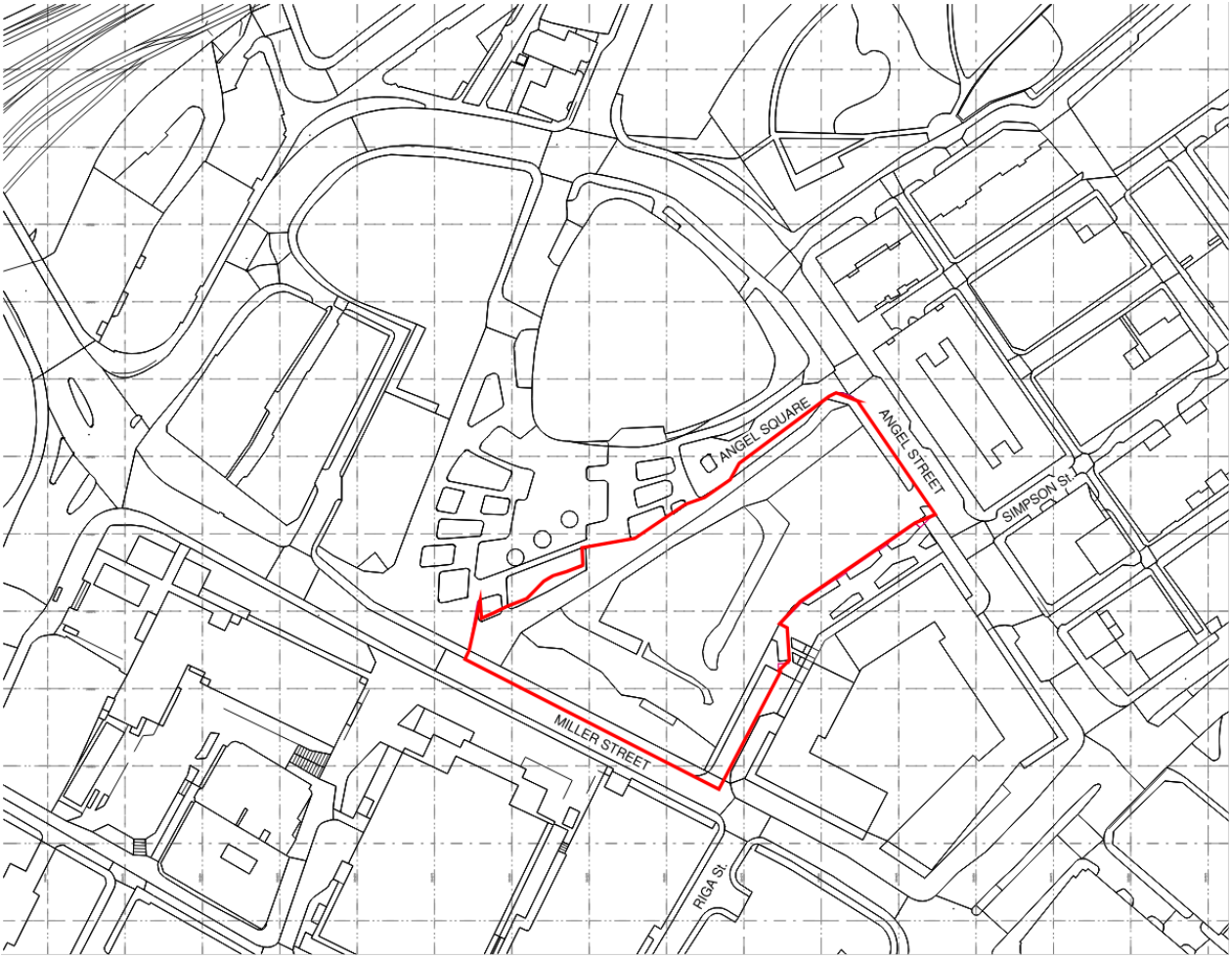


Figure 2-2: Angel Square Plots 2 & 3 Existing Site Plan (Ref: 947-CPA-ZZ-ZZ-DR-A-0100 P02)

The Proposed Development comprises the erection of two high quality commercial office buildings of 13 and 14 storeys, alongside public realm, car parking, extensive cycle parking facilities, and associated highways and access arrangements. At this stage the phasing and delivery strategy is not fixed. It is possible that either 2 Angel Square or 3 Angel Square could be delivered first as a standalone building, or the delivery could be concurrent. In advance of works starting on 2 & 3 Angel Square, the Noma Marketing Suite is under construction on the Site as a temporary building in the southwestern corner of the Site and will consist of a single storey temporary building with associated car parking and public realm. This is proposed to be relocated for the construction of 3 Angel Square.

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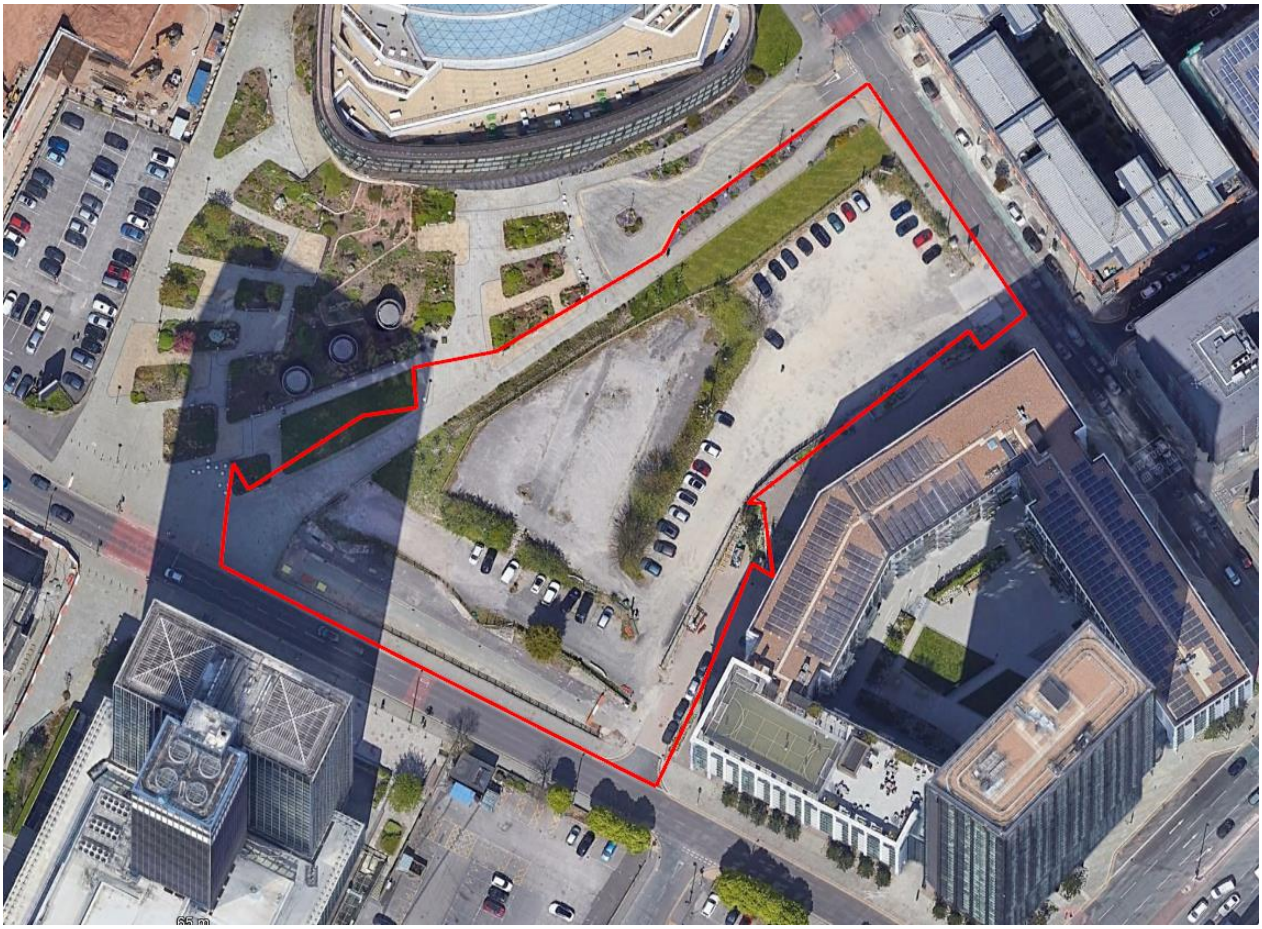


Figure 2-3 Aerial Photo (2&3 AS redline boundary shown)

The redevelopment options for the area surrounding the site are also being considered as part of a masterplanning exercise for NOMA, but this is outside the scope of this study. The wider masterplan area with the Site positioned for overall context is presented in Figure 2-4. An architect's impression of the proposed development and associated layout is included as Appendix A.

A desk study has been undertaken to allow an appropriate ground investigation to be designed and to optimize, as far as possible, the positioning of the exploratory holes. The purpose of this report is to collate and summarize the information for the Site and immediate surrounding area, including:

- The general physical constraints of the Site such as topography, landscape and existing structures;
- An assessment of the generalized past and present usage of the Site;
- An assessment of the anticipated ground conditions in respect of geology, hydrology, hydrogeology, mining activity and geohazards, if any;
- An assessment of the environmental setting of the Site, including the possibility of encountering ground gas as well as potentially contaminating substances; and
- A summary of current development proposals.

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Figure 2-4 NOMA SRF (2020) Masterplan (2&3 Angel Square shown as Plot M and N)

The principal source of information relied upon is a Groundsure® Report[1], which provides a database of information within a 1 km radius of the site as supplied by different statutory authorities and other relevant bodies.

A summary of all the information sources used in this report is included as Appendix B. Other references typically include:

- British Geological Survey. 2010. Manchester. England and Wales Sheet 85. Bedrock. 1:50,000. (Keyworth, Nottingham: British Geological Survey).
- British Geological Survey. 2011. Manchester. England and Wales Sheet 85. Bedrock and Superficial. 1:50,000. (Keyworth, Nottingham: British Geological Survey)
- Structural Soils Limited (Factual) Report entitled '*Report on Ground Investigation at Co-operative Head Office, Manchester*' (Ref: 761072 Rev 1 Final), dated September 2009, prepared on behalf of the Co-operative Group Limited.
- Structural Soils Limited Report entitled '*Factual Report on Ground Investigation - NOMA Plot L, Manchester*' (Ref: 762850 Rev 2 Final), dated January 2014, prepared on behalf of the Co-operative Group Limited.

[1] Groundsure Report Order Number GS-6225239 (August 2019) NOMA 2&3 Angel Square.

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- Structural Soils Limited Report entitled '*Factual Report on Ground Investigation – 2&3 Angel Square, Manchester* (Ref: 763315 Rev 2 Final), dated July 2015, prepared on behalf of the Co-operative Group Limited.
- Sanctus Limited report entitled 'Contract Completion Report, Angel Square, Manchester' (Report No. S1918), dated June 2015, on behalf of NOMA.
- Salford Archaeology report entitled 'NOMA Plots 2&3, Angel Street, Manchester – Archaeological Evaluation Report' dated June 2021, on behalf of NOMA GP Limited;
- 1st Line Defence report entitled *'2&3 Angel Square, Manchester – Detailed Unexploded Ordnance (UXO) Risk Assessment*' (ref: DA13039-00) dated April 2021, on behalf of MEPC.
- Structural Soils Limited Report entitled *'2&3 Angel Square and NOMA Marketing Suite, Manchester – Report on Ground Investigation'* (ref: 765325), dated October 2021, on behalf of MEPC.
- Buro Happold report entitled '*2&3 Angel Square & Marketing Suite – Ground Engineering Summary Report*' (Ref: 043434-BH-XX-XX-RP-GE-0001 Rev 03) dated December 2021, on behalf of MEPC.

Please note that further documentation has been reviewed and a more detailed commentary of ground related aspects for the site and the immediate surrounding area are included in the following Buro Happold documents:

- BuroHappold Engineering Report entitled 'The Co-Operative Group HQ Building, Manchester Ground Engineering Desk Study Report' (Ref: 023842 Rev 00), dated July 2009, prepared on behalf of the Co-operative Group Limited.
- BuroHappold Engineering Report entitled 'The co-operative Head Office, Manchester Ground Engineering Interpretative Report' (Ref: 023842 Rev 00), dated October 2009, prepared on behalf of the Co-operative Group Limited.
- BuroHappold Engineering Report entitled 'NOMA Plot L, Manchester Ground Engineering Desk Study Report' (Ref: 032292 Rev 00), dated November 2013, prepared on behalf of the Co-operative Group Limited.
- BuroHappold Engineering Report entitled '2&3 Angel Square, Manchester Ground Engineering Desk Study Report' (Ref: 033536 Rev 00), dated August 2015, prepared on behalf of the Co-operative Group Limited.
- BuroHappold Engineering Report entitled 'NOMA 2&3 Angel Square - Ground Engineering Desk Study Report' (Ref: 043434 Rev 00), dated September 2019, prepared on behalf of NOMA (GP) Limited.
- The British Geological Survey (BGS);
- The Coal Authority;
- Published technical reports;
- Historical literature;
- Documents found during internet searches; and
- Any information provided by the Client i.e. previous desk studies or ground investigation / utilities information.

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Based on the currently available data an assessment of the existing ground conditions has been undertaken in order to assess potential foundation solutions and to identify key issues likely to affect the groundworks associated with the current development proposal.

It should be noted that this assessment is based on some information in respect of works undertaken in the general vicinity of the Site as opposed to the specific site area. Such information has been taken to be representative of the ground conditions underlying the footprint of the Site supported by the site specific data.

In addition, it should be noted that groundwater conditions summarized are those observed as part of previous ground investigations and take no account of fluctuations due to seasonal, local drainage, the River Irwell or any other localised effects.

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3 The Site

3.1 Site Location

The Site is located north of Manchester City Centre, approximately 220 m east of Manchester Victoria Railway Station and to the east of the CIS Tower. The Ordnance Survey (OS) National Grid Reference (NGR) for the centre of the site is [3]84400 E, [3]99053 N. The site location is shown in Figure 2-1.

3.2 Site Description

The Site is trapezoidal in shape and measures approximately 110 m to 145 m in length and 50 m to 85 m in width, with the widest section in the southwest of the Site. The Site measures approximately 0.83 hectares of previously developed land. The Site is bound by 1 Angel Square (the Co-operative Group headquarters), Miller Street, Angel Gardens and Angel Street. The Site currently comprises two development plots, identified as Plots 2 & 3, which are in temporary use as surface car parking. The public car park is operated by RCP Parking Ltd, which occupies the area between Angel Street and Miller Street over a number of terraces with retaining structures or trees and vegetation on the slopes separating the various levels. Access to the Site is currently from the west via an entrance on Angel Street. The Site is located to the northern edge of Manchester City centre, and the range of retail, office, leisure, residential and transport infrastructure associated with the city.

The existing site layout is presented in Figure 2-3 and the site boundaries can be described as follows:

- To the northeast - Angel Street with commercial & residential buildings beyond.
- To the southeast - Existing car parking (53˚ NOMA - Plot L) with Rochdale Road beyond.
- To the southwest - NOMA Marketing Suite (under construction) with Miller Street and car parking beyond.
- To the northwest - No.1 Angel Square with existing car parking beyond.

There is a substantial change in level across the Site, falling away from Angel Street down to Miller Street. Overall, the proposed development site generally slopes in a westerly direction towards the western corner of the Site midway along Miller Street. The Site can be split into two areas separated by an existing rough S Shaped embankment, namely:

- The eastern area predominantly comprises the former archaeological excavation for Arkwrights Mill. The majority of the platform is between 46 – 47 m AOD, however, the maximum elevation (to the nearest metre) is ~48 m AOD in the far eastern corner of the platform, with a minimum elevation of ~45 m AOD in the northern corner.
- The western area currently comprises existing car parking, however, during the construction of 1 Angel Square this area of site was utilised as a site compound with two temporary buildings. The area slopes to the southwest from a maximum elevation of ~44.5 m AOD in the northern corner, with a minimum elevation of ~41 m AOD in the western corner.

There is thus currently a ~7 m difference in height across the Site separated by slopes with localised or potentially buried retaining structures.

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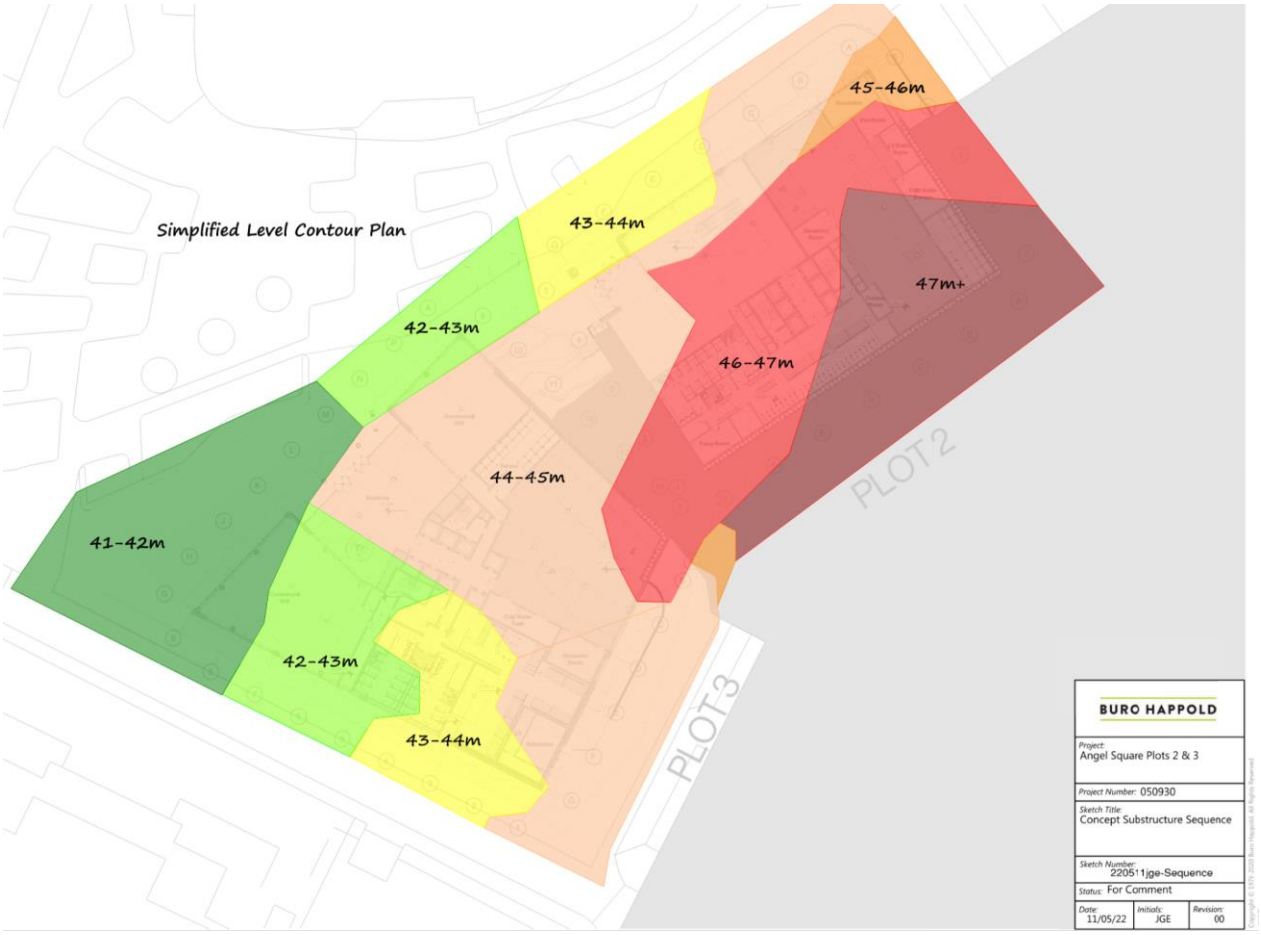


Figure 3-1 Site levels (simplified)

3.3 Site Utilities

Service plans have been obtained from the relevant utility companies in order to obtain information on the expected position and extent of buried and overground cables, pipes, wires etc, which may present constraints on future site development works. In addition, site specific surveys have been carried out by Charter Oaks Limited on behalf of William Downie Associates (WDA - ref: NOMA Marketing Suite (with topo) dated April 2021) and WDA (ref: 157-WDA-SS-EX-DR-UC-MU100(211222) dated May 2021). These plans have been consolidated and are included as Appendix C. It should be noted that the service plans issued by the various utility companies generally only record the public mains locations and do not include individual private supply routes. As such, the information available for most development sites is usually restricted to the periphery (unless public roads or rights of way cross the site) and, therefore, the absence of service routes beneath the footprint of the proposed development site on such drawings is not confirmation that the site is clear of services. Any additional private service routes connecting the mains to existing buildings need to be identified and located.

It should also be noted that during the SSL 2021 GI a ~3.2 m below ground chamber was encountered in TP110a. This is not recorded on any previous surveys, therefore it is recommended that further investigation is undertaken to understand if the existing chamber / infrastructure is still in use and requires diverting, or if it is part of an abandoned system to be grubbed up/ grouted up.

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Guidance issued by the individual service providers should be followed at all times when excavating in the vicinity of buried services. Where appropriate, the service providers should be consulted to mark their equipment in the vicinity of any proposed excavation works.



Figure 3-2-Abandoned chamber found during GI



Figure 3-3-Abandoned chamber found during GI

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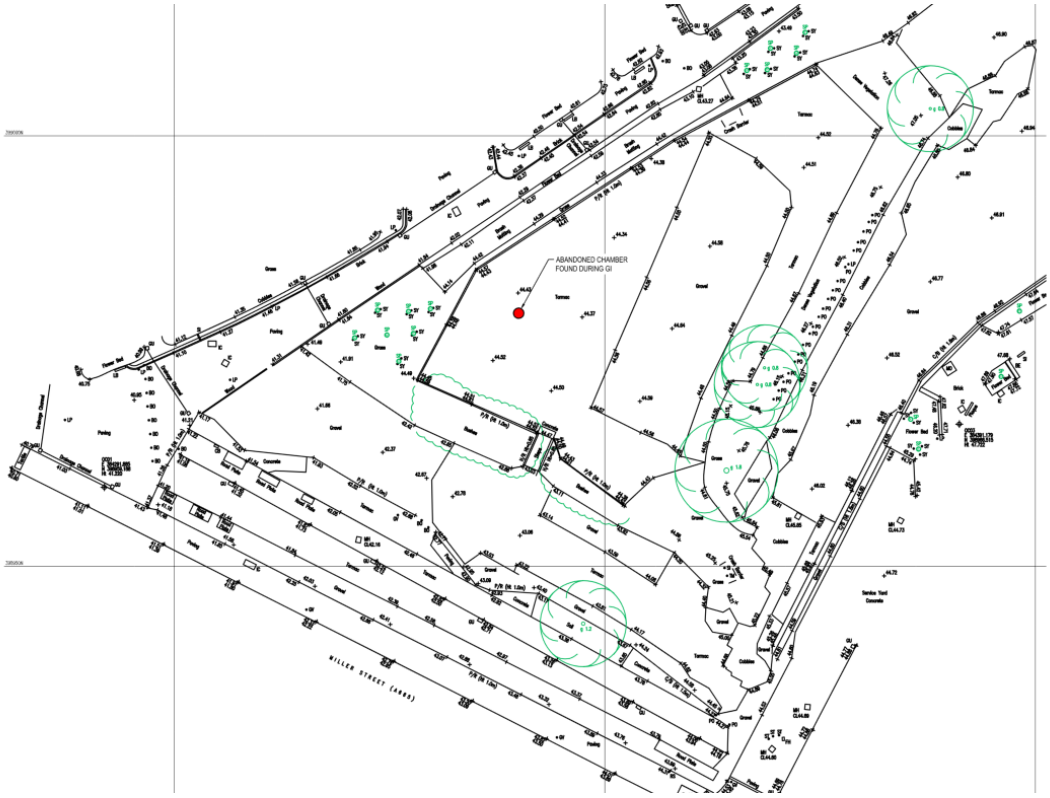


Figure 3-4-Abandoned chamber found during GI

3.4 Site History

Historical Ordnance Survey (OS) maps covering the Site have been studied to detail the historical development of the Site and the immediate surrounding area (~ 100 m radius of the site). Extracts of historical maps as provided in the Groundsure Report are included in Appendix D. Key features are identified in the following paragraphs in chronological order.

OS maps covering the Site have been studied to detail the historical development of the Site and the surrounding area. In addition, a number of reports have been completed by Oxford Archaeology North / Salford Archaeology as well as a historical archaeological desk study and a report of an investigation by Channel Four's Time Team, which include several earlier maps (1650 to 1848) as discussed below. Extracts of historical maps are included in Appendix D with key features identified in the following paragraphs. It should be noted that historical maps and data included within the archaeology reports are not reproduced herein. Reference should be made to these reports, and these should be read in conjunction with this report.

The earliest map available is a plan of Manchester dating to c 1650 and shows the proposed development site as open fields.

The 1741 map records the Site as open fields. In the immediate vicinity, '*Mill Lane*' is recorded along the southern boundary of the Site.

The 1793 map records '*Simpson's Factory*' along the southeast border of the Site and its associated reservoirs in the centre of the Site. In the immediate and surrounding area, '*Mill Lane*' is now recorded as '*Millers Street*' and '*Angel*

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Street' is recorded along the northern boundary of the Site. A number of unnamed industrial buildings are recorded surrounding the Site, in particular to the west of the site where associated infrastructure (including roads recorded as '*Factory Court, Factory Lane, Joiner Street*') are recorded. '*Alms Houses*' are recorded immediately to the south of the Site on the opposite side of '*Millers Street*'.

The 1794 map records '*Simpsons Factory*' is now recorded as '*Mr Simpsons Cotton Works*' and the reservoir is shown to be slightly reduced in size. There are no significant changes to the immediate surrounding area.

The 1822 plan of Arkwright's Mill (thought to be formerly '*Mr Simpsons Cotton Works'*) shows a mill in the western corner of the site bordering Miller Street with '*Cottages*' to the north of the main mill building.

The 1831 map (Banck's and Co's) records a number of residential properties along the northeastern boundary and there is an unnamed industrial building along the southern section of the northwestern boundary of the Site. '*Mr Simpsons Cotton Works*' is now recorded as '*Norris & Hodgess Cotton Mill*' and the reservoir to the west of the mill is indicated to be larger in size. In the immediate surrounding area, the road adjacent to the unnamed industrial building is recorded as '*Ropery*' and the '*Alms Houses*' are no longer recorded.

The earliest OS map available is dated 1848 (extract of 60 inch map), which shows '*Norris & Hodgess Cotton Mill*' is now recorded as a '*Warehouse*' and is part of a complex labelled '*Manchester Mills (Cotton)*'. The far western mill is now recorded as a '*Warehouse*' and the western extent of the '*Manchester Baths & Wash Houses*' is recorded in the south corner of the Site. In the immediate vicinity, '*Ropery*' is now recorded as '*Rope Walk*' with predominantly residential housing and a '*Timber Yard*' beyond. A '*Brewery*' is recorded immediately west of the far western '*Warehouse*'. To the east of the Site, '*Manchester Foundry*' and 2 No. associated '*Boilers*', a '*Saw Mill*' and associated '*Reservoir*', '*The Brewery Arms Public House*', a '*Timber Yard*' and '*Keynon Street*' are recorded. Two '*Timber Yards*' and a '*Saw Mill*' are recorded to the south of the Site over '*Miller Street'*. '*Victoria Station*' is also recorded approximately 220 m to the east of the Site.

The 1848 1:10,560 map identifies a number of industrial sites in the wider surrounding area, including a railway line and a '*Gas Works*' approximately 250 m and 300 m to the northeast respectively.

The 1892/1893 1:2,500 edition map records the reservoir associated with '*Manchester Mills (Cotton)*' has decreased in size with only the northern extent remaining. A number of unnamed industrial buildings are recorded to the south of the remaining reservoir. The far western '*Warehouse*' has expanded to the west and north and '*Rope Walk*' is no longer recorded. '*Manchester Baths & Wash Houses*' are also no longer recorded. A network of small roads (one of which is recorded as '*Factory Yard*') are recorded to the east of Arkwrights Mill leading to the new industrial buildings. In the immediate surrounding area, '*Manchester Foundry*' and 2 No. associated '*Boilers*', '*Saw Mill*' and associated '*Reservoir*', '*Brewery*' and the eastern, western and southern '*Timber Yards*' are no longer recorded.

The 1894/1896 1:10,560 edition map no longer records the '*Reservoir*' on site. There are no significant changes to the immediate surrounding area.

The 1908 1:2,500 edition map records the far western '*Warehouse*' has expanded to the east and further north. In the immediate surrounding area, the former reservoir appears to have been infilled and two small unnamed buildings are now located there. An *'Iron Works*' is now recorded immediately to the east of Arkwrights Mill and a '*Printing Works*' is recorded on New Mount Street approximately 40 m to the northeast.

The 1909 1:10,560 and the 1923/1938 1:10,560 edition maps record no significant changes to the Site or the immediate surrounding area.

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The 1922/1933 1:2,500 edition map records no major changes to the Site. In the immediate surrounding area, the '*Iron Works*' is now recorded as '*Disused*'.

The 1949 1:1,250 edition map only shows the northern extent of the Site and records a '*Warehouse*' on the site of the northern extent of the former reservoir and the residential houses along '*Angel Street*' are no longer recorded. There are no significant changes to the immediate surrounding area that is shown.

The 1951/1952 1:2,500 edition map no longer records Arkwrights Mill, the far western '*Warehouse*' and a number of unnamed buildings on Site. In the immediate surrounding area, three '*Ruins*' and a '*Warehouse*' are recorded to the southwest of '*Keynon Street*'. A smaller 'Ruin' is recorded at the junction of '*Naples Street*' & '*Angel Street*'. A '*Garage*' is also recorded 30 m to the north.

The 1948-1953 1:2,500 edition map records 3 No. small '*Ruins*' to the south of the '*Warehouse*'.

The 1952/1955 1:1,250 edition map does not cover the majority of the site. There are no significant changes to the site or immediate surrounding area that is shown.

The 1956 1:10,560 edition map records the eastern part of a new unnamed T-shaped building in the western corner of the Site (considered to be Baxendale's Iron Works based on archive photographic evidence). There are no major changes to the immediate surrounding area.

The 1953/1958 & 1954-1959 1:2,500 edition maps does not record any significant changes to the Site. In the immediate surrounding area, the small '*Ruins*' to the south of '*Kenyon Street*' are no longer recorded.

The 1958/1963 1:1,250 edition map records a '*Car Park*' to the west of '*Factory Road*'. In the immediate surrounding area, the '*Printing Works*' is now recorded as a '*Works*' and the nearby '*Ruin*' is no longer recorded.

No major changes are recorded on subsequent maps until the 1978-1980 1:1,250 edition map which no longer records the Baxendales Building and records the entire site as a '*Car Park*' – its current condition. In the immediate surrounding area, the map no longer records the '*Warehouse*' and '*Kenyon Street*' is now recorded as '*Kenwright Street*'.

The 1984-1988 1:1,250 edition map records that Miller Street has been widened along the southern boundary of the Site.

The 1985/1988 and 1988/1991 1:10,000 edition maps do not record any significant changes to the Site or the immediate surrounding area.

The 1992/1995 1:1,250 edition map only shows the northern extent of the Site but does not record any significant changes to the Site or the immediate surrounding area.

No further major changes are recorded to the Site or the surrounding area until the 2002 1:10,000 edition map which records no significant changes to the Site itself, but an *'Arena'* is now recorded adjacent to '*Victoria Station*' approximately 300 m to the northwest (the Manchester Evening News Arena, opened 1995 [2]) and two Metrolink tram lines are recorded running northeast and southeast from '*Victoria Station*'.

The 2010 1:10,000 edition map records no significant changes to the Site or surrounding area.

[2] www.men-arena.com.

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For ease of reference, the key points of site history likely to affect the proposed development are summarised as site constraints in Figure 3-5.

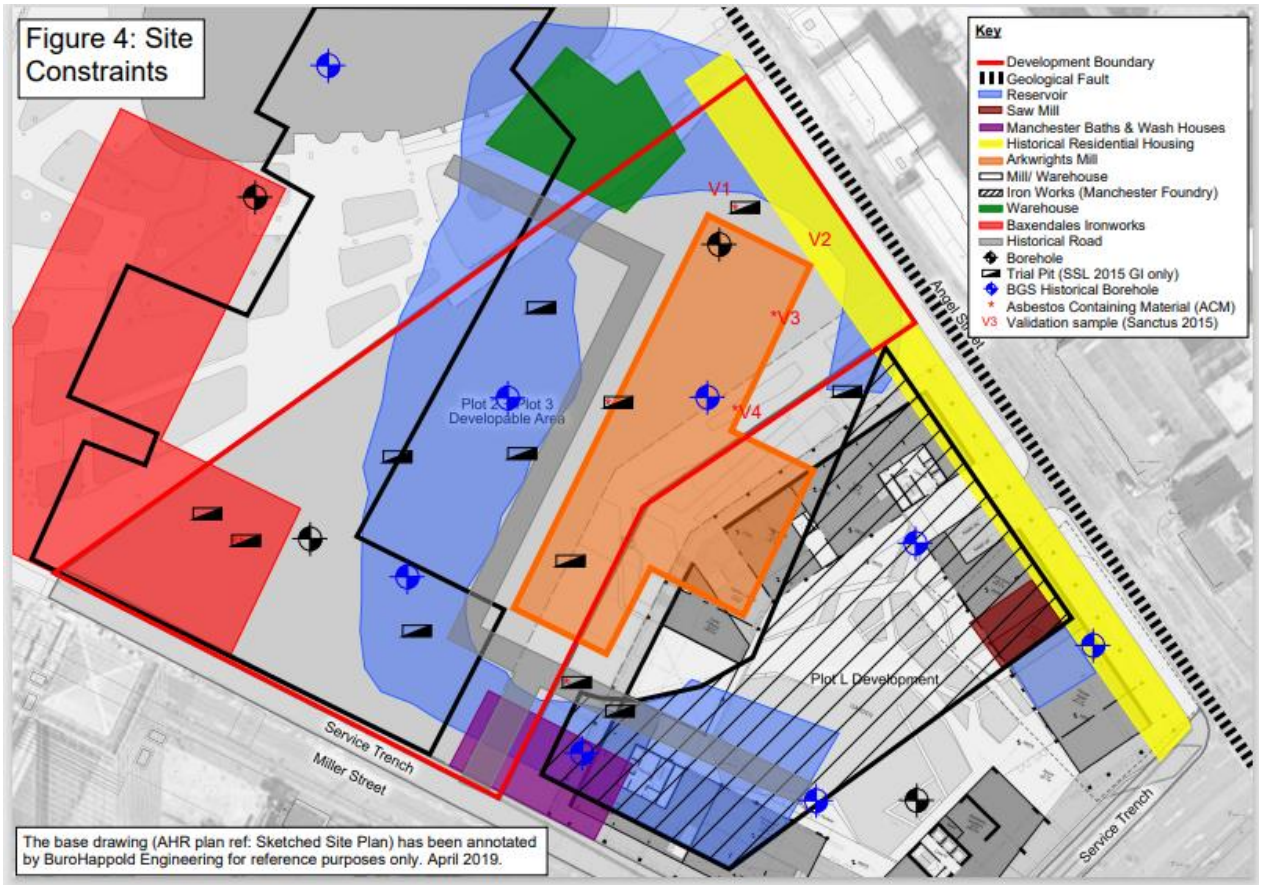


Figure 3-5 Site Constraints

3.5 Archaeology

Manchester is an area of archaeological interest with developments taking place within the city from the Roman period, but the major interest is in industrial archaeology. A number of recent archaeological reports for the Site and surrounding area have been completed by Gifford Limited, Oxford Archaeology North & Salford Archaeology as well as another report produced by Wessex Archaeology in April 2006 following an investigation by Channel Four's Time Team (filmed by Videotext Communications Ltd). Reference should be made to these reports, and they should be read in conjunction with this report. An overview of the items detailed in the reports are outlined in the following paragraphs, however, it should be noted that the detailed interface between proposed construction and existing archaeology are beyond the scope of this report.

The potential archaeological remains that exist on or adjacent to the Site may include the remains of cotton mills and associated reservoirs, an iron foundry, a saw mill and timber yard, a brewery, a public baths and wash house, public houses, shops and housing of various types. Although some evidence of features along Miller Street are likely to have been destroyed either during the Manchester Blitz or during road widening works in the early 1990s, the Time Team investigation and Oxford Archaeology Norths recent works shows that evidence of Arkwright's Mill both on site and to the west of the proposed development site is well preserved and close to the surface (Figure 3-6 refers). The mill was

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'*Manchester's first steam-powered cotton mill*' and was of great archaeological importance to the city. Existing foundations may also be present within the Site.

During 2014, Arkwright's Mill was subject to an intrusive archaeological excavation by Oxford Archaeology North which comprised an evaluated excavation of the majority of the main footprint of the building as well as the Engine House. Full and detailed photographic records were taken as well as surveying to Ordnance Datum with the remains left insitu. The study concluded that the site is '*of considerable archaeological and historical significance on a regional level*', however the '*overall group value is reduced by extensive loss of the component buildings and infrastructure*' over the years that followed its use. In addition, Salford Archaeology completed further trenching across the site during 2021. Reference to the findings of this study should be made in conjunction with these reports.

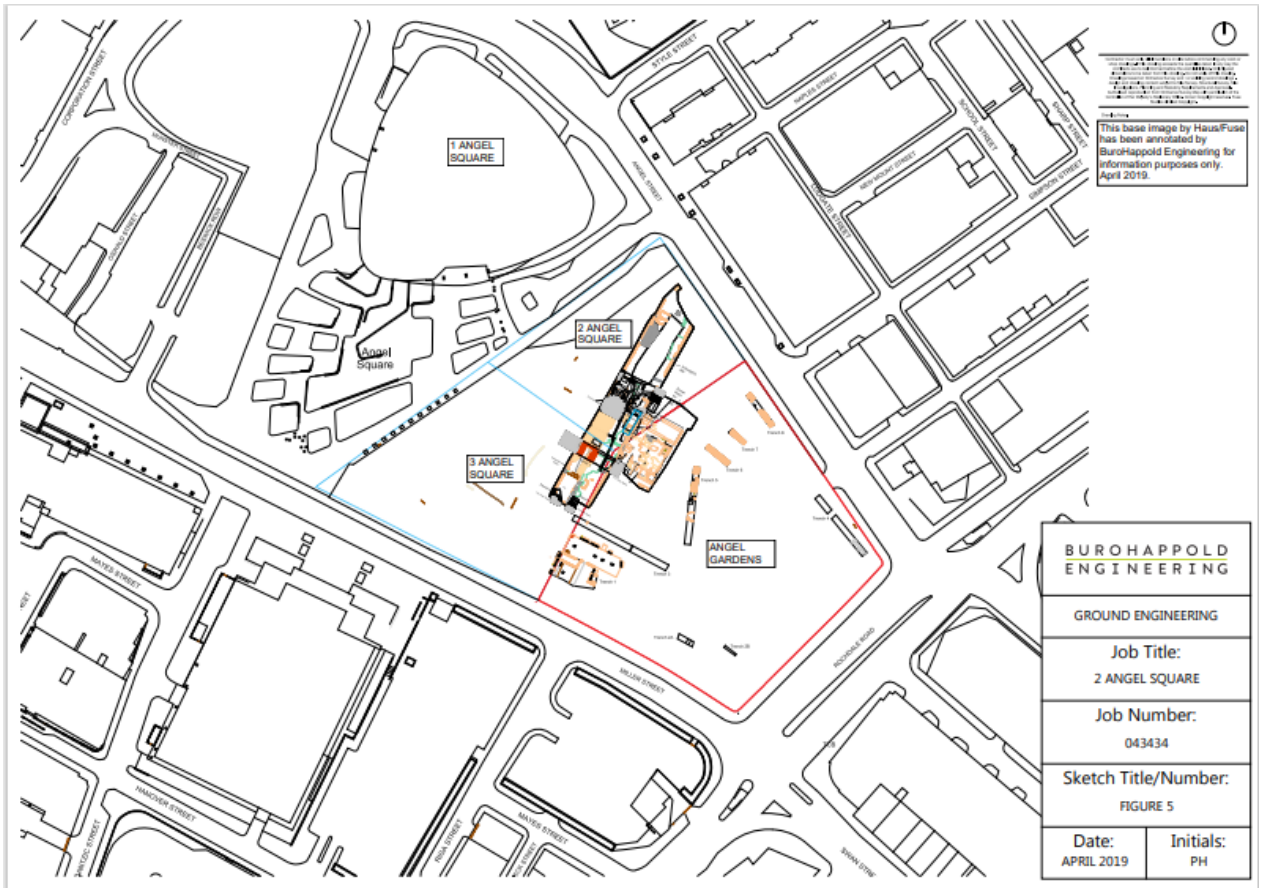


Figure 3-6 Archaeological Trenches (2014)

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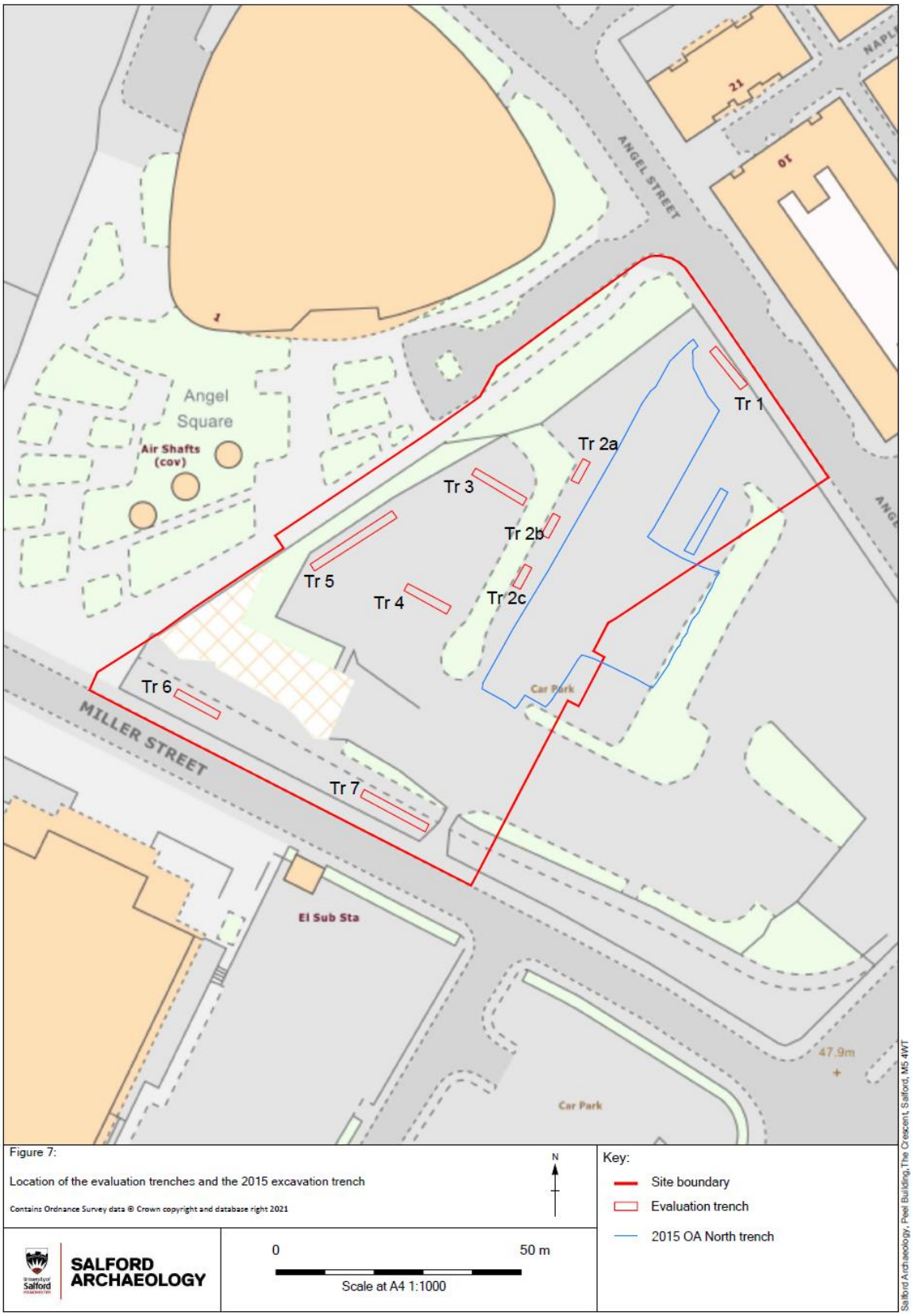


Figure 3-7 Extract from Salford Archaeology Report – Arkwright's Mill and 2021 trenches

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4 Ground Conditions

4.1 General

The anticipated ground conditions underlying the Site have been assessed on the basis of both published and unpublished data available for the Site and the immediate surrounding area. The available data has been summarised in the following sections and has been combined to establish as accurate a ground model as possible.

4.2 Published Geology

The British Geological Survey (BGS) Maps[3] [4], and Regional Geology Guides [5] have been obtained and reviewed as part of this study, with relevant information presented below. The geological information from the Groundsure report is included in Appendix EThe geological map indicates the Site is directly underlain by Boulder Clay overlying Triassic Chester Formation (CF - Sherwood (Bunter) Sandstone Group). No Made Ground is recorded within the site boundary on the map.

The Groundsure report states that the Site is underlain by Glacial Till (Diamicton) overlying the Chester Formation. In addition, 'Made Ground (undivided)' is also recorded on site. Given the urban setting and development history of the site, including numerous buildings of different ages and reprofiling of the Site to create terraced levels for car parking, a reasonable thickness of Made Ground is anticipated. Made Ground material due to its nature is likely to be very variable in both composition and characteristics.

4.2.1 Drift Geology

The 1" to 1 mile and 1:50,000 geological maps were studied to determine the probable nature and extent of any drift deposits under the site and in the surrounding area. The maps indicate that the site is underlain by Quaternary Boulder Clay. The total thickness of the drift deposits is not recorded on the geological map.

4.2.2 Solid Geology

The Groundsure report states that the Site is underlain by the Chester Formation (CF). The 1" to 1 mile and 1:50,000 British Geological Survey (BGS) maps indicate the solid geology on site to be Triassic Sherwood Sandstone (formerly Bunter Sandstone). The Sherwood Sandstone Group typically comprises well cemented medium and coarse grained sandstones and pebbly sandstones/conglomerates with occasional red brown mudstones. The Sherwood Sandstone is indicated to be underlain by the Manchester Marls (mudstone) over the Collyhurst Sandstone lying unconformably over Carboniferous Warwickshire Group which is underlain by the Carboniferous Upper Coal Measures (Westphalian C) typically comprising a mixture of mudstones, siltstones and sandstones with coal seams. The geological map cross-section indicates that productive coal measure strata are at least 250 m beneath the Site.

The Site is located between two faults both trending northwest-southeast, namely, the Ardwick Fault which is indicated to run 400 m southwest of the Site, downthrown to the northeast by approximately 100 m, and an unnamed fault approximately 100 m northeast of the Site, downthrown to the northeast by an unknown magnitude. The angle and

[3] BGS (1970). Manchester. England and Wales Sheet 85. Solid and Drift Geology. 1" to 1 mile. British Geological Survey.
[4] BGS (1975). Manchester. England and Wales Sheet 85. Solid Geology, 1: 50,000, British Geological Survey.
[5] BGS (2002) British Regional Geology: The Pennines and Adjacent Areas, (4th Ed), British Geological Survey Nottingham.

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direction of dip of the bedrock strata between these faults is not recorded but the regional dip is indicated to be to the south and southwest.

4.3 Unpublished Geology

As part of this study the BGS Geoscience Database has been consulted to ascertain whether any exploratory hole records exist for the site or the immediate surrounding area. Borehole records from this source have been obtained and examined below.

Two site specific GI's have been undertaken by Structural Soils Limited (SSL), both under the supervision of Buro Happold. Historical GI's for the adjacent sites have also been taken into consideration to inform the ground model - SSL 2009 GI at 1 Angel Square to the northwest and SSL 2013 GI at Angel Gardens to the southeast. Please note, BHL01 and BHL03 from the SSL 2013 GI for Angel Gardens were located on the 2&3 Angel Square site.



Figure 4-1 Historical and Recent GI Locations

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The SSL 2015 GI was undertaken during January 2015 and comprised 13 No. machine excavated trial pits (TP1 - TP4, TP4A, TP5 – TP10, TP10A and TP11) across the Site and its surrounds, along with associated chemical testing including asbestos identification and quantification. Groundwater and ground gas monitoring was also carried out in historical borehole BHL01 on the Angel Gardens site. All other historical borehole installations could not be found.

The second site specific ground investigation was undertaken by SSL between the 19th of July and the 3rd of August 2021, (herein referred to as the SSL 2021 GI). It comprised 4 No. boreholes (BH101-104), 5 No. window samples (WS101-105) and 12 No. trial pits (TP101-112 and 110a) across the Site. The boreholes were drilled to depths ranging between 25.00 and 31.00 m BGL using cable percussive drilling with rotary drilling follow to obtain rock core. Sampling, geotechnical and geo-environmental testing (including asbestos identification and quantification) and groundwater and ground gas monitoring was also undertaken as part of the SSL 2021 GI.

Please note, during the archaeological excavation of Arkwrights Mill (blue outline on Figure 3-7), the presence of asbestos within the Made Ground was recorded. A strategy for dealing with asbestos contamination within the footprint of Arkwrights Mill was completed during May 2015 comprising the removal of all Asbestos Containing Material (ACM) in this area off site.

4.3.1 Material Type and Distribution

The ground conditions have been assessed on the basis of the available information. The ground conditions have been assessed as part of the NOMA Marketing Suite planning application and as part of the 2&3 Angel Square planning application. The general sequence of strata encountered based on available BGS borehole logs in the surrounding area and that of the ground conditions encountered during the SSL 2015/2021 GI's are summarized in Table 4—1.

The ground conditions comprise varying depths of Made Ground which is underlain by superficial deposits (dense to very dense sand, gravel and firm to very stiff clay), underlain by completely weathered sandstone bedrock, in turn underlain by very weak to weak sandstone bedrock (Chester Formation). It is considered that the seepages encountered are localised and variable perched groundwater may be encountered within the Made Ground and superficial deposits.

The relevant BGS records and the deeper SSL exploratory hole records are included as Appendix E herein.

4.4 Hydrology

The hydrology relevant to the Site has been reviewed based on information provided on current and historical OS maps. The nearest surface water feature to the Site is the River Irk located approximately 250 m north of the Site, flowing to the southwest to its confluence with the River Irwell on the south side of Manchester Victoria Railway Station. The River Irk is understood to be culverted beneath the railway station.

The Site is not indicated to be within Flood Zone 2 or 3 as presented in the Groundsure Report[1], based on the relevant Environment Agency information and reproduced in Appendix F.

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Table 4—1 Conceptual Ground Model based on SSL 2015 / 2021 GI data.

Depth to Top of Strata (m BGL)	Typical Thickness (m)	Generalised Description
0.00	0.15 – 5.00	Black brown slightly clayey slightly sandy angular to subangular GRAVEL of brick and ash with high cobble and medium boulder content. Gravel comprises various materials including sandstone, mudstone, limestone, glass, tarmac, coal, slag, concrete, slate, clinker, brick, rare granite and ceramic fragments. AND Black sandy fine to coarse GRAVEL in clayey matrix with pottery and snail shells (1.80 - 2.20 m BGL in TP5 only – former reservoir) [MADE GROUND]
0.35 – 4.65	>0.20 - 14.80	Firm to very stiff brown/red brown slightly sandy silty gravelly CLAY. Gravel is fine to coarse angular to rounded of sandstone & mudstone. AND Dense to very dense orange brown, slightly clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to rounded of quartzite, limestone, sandstone and ironstone. Occasional layers of brown, sandy, gravel. [GLACIAL TILL / GLACIOFLUVIAL]
11.10 – 21.90	>10.00 - >17.00 (thickness not proven)	Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to course of quartzite. AND Very weak to weak, red/brown, medium to coarse grained sandstone with occasional layers of marl. [CHESTER FORMATION]

Note: During the SSL 2015 GI groundwater was recorded in TP1, TP5 and TP7 as 'slight seepage' at 1.10, 1.80 and 0.50 m BGL (44.56, 45.57 and 44.24 m AOD respectively).

During the SSL 2021 GI groundwater was recorded in: BH101 at 11.70 m bgl, BH103 at 5.70 m bgl, and BH104 at 5.20 m bgl. No groundwater strikes were recorded within the window samples or trial pits during the SSL 2021 GI.

4.5 Hydrogeology

4.5.1 Groundwater Vulnerability

The Environment Agency Groundwater Vulnerability Map Sheet 17 (Derbyshire and North Staffordshire) indicates that the Site is underlain by a '*Major Aquifer*' with '*Soils of High Leaching Potential (U)*' (Appendix G refers). It should be noted that the site is labelled 'U' for urban, and a note is normally included on the maps explaining that such a classification means that '*Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) is assumed until proved otherwise*'.

The Groundsure Report[1] records that the Site is underlain by a 'Principal Aquifer' (formerly termed a 'Major Aquifer') with soils of 'High Leaching Potential' defined as '*Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale*'. This is considered to refer to the Chester Formation (Sherwood Sandstone) beneath the Site.

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The Groundsure Report[1] records no water abstractions within the site boundary or within 500 m of the Site. There are 6 No. abstractions locations within 1 km of the Site including: Interbrew UK Ltd (520 & 524/5 m NW), British Telecommunications plc (639 m SW & 955 m NW), Joseph Holt Ltd (721 m NW), Lancashire Dairies Ltd (907 m NW).

4.5.2 Groundwater

Examination of the general topography and hydrology of the locality, based on the current and historic OS maps indicates that the prevailing direction of groundwater flow is likely to be to the northwest, towards and in the direction of flow of the nearest watercourses as summarised in Section 4.4.

It is considered likely that groundwater underlying the Site will be in hydraulic continuity with the River Irk due to the close proximity of this watercourse to the Site. Localised groundwater may be encountered in the Made Ground deposits perched on underlying low permeability Glacial Boulder Clay. Deeper groundwater conditions within the weathered and intact sandstone bedrock are likely to be controlled by the hydraulic conductivity of the sandstone (degree of cementation, degree of fissuring, faults etc).

4.5.2.1 SSL 2009/2013 Groundwater Data

Ground investigations for the adjacent plots have been considered in this assessment for completeness. A total of 12 No. groundwater monitoring visits were undertaken as part of the SSL 2009 GI for 1 Angel Square and the SSL 2013 GI for Angel Gardens. A further 3 No. visits were carried out to monitor any historical installations left in-situ, namely BHL01 (SSL 2013 GI).

The majority of the post fieldwork groundwater monitoring results for the Chester Formation show a typical range of between 25.49 m AOD and 26.20 m AOD (~20.00 to 23.30 m bgl).

4.5.3 SSL 2021 Groundwater Data

As part of the SSL 2021 GI groundwater and gas monitoring wells were installed in the 4 No. boreholes and 5 No. window samples. All (6 No.) post-fieldwork monitoring visits have been undertaken, between the 13th of August 2021 and the 22nd of October 2021. The SSL 2021 GI groundwater data indicates static water level (SWL) between ~30.08 m AOD and 24.97 m AOD (15.69 to 21.92 m bgl) within the sandstone bedrock (Chester Formation). Localised perched groundwater is also recorded within the Made Ground/superficial deposits (~0.50 to 3.95 m BGL). It is worthy of note that there were no groundwater strikes within the trial pits or window samples during the SSL 2021 GI.

The hydraulic regime within the bedrock is considered to be controlled by the nature of the cementation and fracturing of the rock mass. It is also important to note that the Chester Formation is classified as a Principal Aquifer by the Environment Agency, therefore consideration for the prevention of the migration of contamination (if any) and protection of the Principal Aquifer may be required.

Groundwater ingress is not considered to cause significant problems for envisaged excavation works. It is envisaged that any perched water seepages will be relatively minor and could be controlled by sump pumping methods. It should be noted, however, that where locally more significant water ingress is encountered then more substantial water control measures may be required.

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4.5.4 Mining Activity

The Groundsure Report[1] states that the site is *'the site lies in or in proximity to the coal mining reporting area as defined by the Coal Authority'*. A Coal Authority (CA) Reports for each plot[6] (Appendix H refers) has been obtained for the proposed development as the Site overlies coal bearing strata and, as such, further assessment in respect of previous coal mining activity was considered necessary.

The CA Report states that:

- The Site is within the likely zone of influence from workings in 1 No. seam of coal at 820 m depth which was last worked in 1965. Furthermore, reserves of coal do exist in the locality which could be worked in the future subject to feasibility, licences and planning consents.
- There are no recorded mine entries within the Site or within 20 m of the site boundary.
- In respect of opencast mining, the Site is not within the boundary of any past or present workings. In addition, there is no licence to extract or proposed licence to extract coal by opencast methods within the immediate vicinity of the Site.
- No subsidence, in respect of the Coal Mining Subsidence Act 1991, has been recorded in respect of the immediate site area.

Given the published and unpublished geology of the Site, the site history and the CA Report information it is considered that the risk arising from former coal mining operations can be considered to be low.

4.6 Ground Instability and Geo-Hazard

A summary of the anticipated risk in respect of typical causes of instability or geo-hazards specific to this Site which are not covered in other sections of this report is presented in Table 4—2.

Table 4—2 Summary of Natural Ground Subsidence Hazards at the Site

Subsidence Hazard Type	Applicable to this Site?		Comments
	No	*Yes*	
Collapsible Ground	✓	-	Groundsure states *'Very Low'*.
Compressible Ground	✓	-	Groundsure states *'Very Low'*.
Ground Dissolution	✓	-	Groundsure states *'Negligible'*.
Landslide	✓	-	Groundsure states *'Very Low'*.
Shrinking/Swelling Clay	✓	-	Groundsure states *'Very Low'*.
Running Sand	✓	-	Groundsure states *'Very Low'*.

On the basis of the desk study work undertaken and the nature of the strata likely to be encountered on site, collapsible or compressible ground, ground dissolution, landslides, shrinking/swelling clay and running sand are not considered to be issues for the proposed development.

[6] Coal Authority CON29M Reports (51002015179001 & 51002015179002). (April 2019)

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4.7 Trees

The presence of existing trees and shrubs on the Site has been noted (particularly on embankments along the eastern boundary) and may need to be considered in the development proposals for the Site. An Ecological Survey and Assessment[7] was undertaken by ERAP (Consultant Ecologists) in June 2022 which identifies the site as suitable for "*development in accordance with ecological considerations and the National Planning Policy*". The presence of the existing trees may impact on the depth of the proposed foundations and service runs in the vicinity of any trees to be retained.

[7] ERAP (Consultant Ecologists) Ltd Report entitled "Ecological Survey and Assessment (including a licensed Bat Survey), Angel Square, 2 & 3, Manchester, M4 4GL" dated June 2022.

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5 Environmental Setting

5.1 General

The environmental setting of the Site has been reviewed on the basis of both published and unpublished data obtained for the Site and the immediate surrounding area. The available data is summarised in the following sections and has been combined to establish any ground or groundwater contamination as well as ground gas generation that may potentially be present in relation to both the NOMA Marketing Suite & 2& Angel Square planning applications.

5.2 Potential Contaminative Land Uses

A review of the historical development of the Site and surrounding area, as outlined in Section 3.4 of this report, has shown that the Site and the immediate surrounding area have been subject to a reasonable degree of historical development. Land uses considered to be potentially contaminative with respect to human health, controlled waters, ecosystems and/or the built environment can be summarised as follows.

Within the Site Boundary

- Simpsons Factory (later known as Mr Simpsons Cotton Works, Norris & Hodges's Cotton Mill, Manchester Mills & Warehouses) and associated reservoirs.
- Residual asbestos within Made Ground (beneath Arkwrights Mill footprint – now remediated).
- Mill and associated cottages, Warehouse and Baxendale's Iron Works (name shown in historical photographs of the Site) in the far west of the Site.
- Residential properties along the northwestern boundary.
- Western extent of Manchester Baths & Wash Houses in the southern corner of the Site.
- Car park and any oil/petrol spills from car parking.

Outside the Site Boundary

- Manchester Foundry (Iron Works) and associated boilers to the east of the Site.
- Timber Yards (to the west, east and south of the Site), Saw Mills (to the east & south of the site) & associated reservoirs.
- The Brewery Arms Public House to the east of the Site.
- Ruins to the southwest of Kenyon Street (later recorded as Kenwright Street).
- Car parking to the east of the Site and any oil/petrol spills from car parking.
- Printing Works to the northeast of the Site.
- Garage to the north of the Site.
- Various industrial/commercial land uses in the vicinity of the Site including the railway infrastructure and associated goods warehouses etc.

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Given the types of land use specific to the Site and the close proximity of some off site facilities, it is considered possible that some contamination of the soils and groundwater may have occurred. The degree of contamination arising from previous land uses is typically a function of previous site practices, operational procedures and the degree/condition of any hardstanding that may have been in place when any specific land use was in operation. As such, the determination of the actual degree of contamination present has been assessed as part of the site specific investigation works.

5.3 Potential Contaminants of Concern

Due to the rich industrial site history of the proposed development site and information from the SSL 2021 GI, variable thicknesses of Made Ground were recorded. Further information regarding other potential sources of contamination is presented in Section 7.2.

Made Ground typically comprises reworked site material due to former development or material that has been imported onto the site from an external source. As such, any Made Ground present may represent a potential source of contamination. Urban fill commonly contains heavy metals, arsenic, and polycyclic aromatic hydrocarbons (PAHs) in background concentrations and can include locally elevated 'hotspots' which may pose a risk to human health and/or controlled waters.

Potentially contaminative on-site historical land uses identified in Section 5.2 which are considered to have affected the Site include the infilled reservoirs, asbestos in Made Ground, Manchester Baths & Wash Houses, residential properties and the industrial land uses namely the Simpsons Factory (later known as Mr Simpsons Cotton Works, Norris & Hodgess Cotton Mill, Manchester Mills), Mill and associated cottages, Garage, Printworks, Warehouse and Baxendale's Iron Works, existing car park and any oil/petrol spills from car parking.

With the exception of asbestos, minor historical ground contamination is present within the Made Ground materials (Section 5.3 refers), however, at least half of the material is likely to be removed as part of the proposed excavation works with the remainder covered with an appropriate material (hardstanding or soft landscaping build up ~0.50m). Removal of material from site is a key consideration - further chemical testing may be required during groundworks for classification purposes.

Based on the chemical testing undertaken for the adjacent plots, the Site and the proposed end development, it is considered that the chemical concentrations in soils are not likely to pose a significant risk to end users of the Proposed Development.

It is worthy of note that gross asbestos removal has occurred in the former footprint of (Arkwrights Mill) and the former Manchester Foundry (on the adjacent site) via hand picking during archaeological works.

Potential offsite historical sources which are considered to be up hydraulic gradient (i.e., located to the southeast of the proposed development site) include a variety of former mill, factory and works sites.

5.3.1 SSL GI 2015 Geoenvironmental Assessment

All Made Ground sampled recorded concentrations of all determinants below "commercial" thresholds with the exception of Lead at a concentration of 3750 mg/kg in TP4A at 2.00 m BGL. Please note, TP4A is not located within the confines of the proposed 2&3 Angel Square development boundary and as such is not discussed further.

All natural soils sampled recorded concentrations of all determinants below commercial thresholds.

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5 No. samples recorded the presence of Asbestos Containing Material (ACM). TP1 / TP2 have been removed as part of the Arkwrights Mills remediation. TP4A is located offsite. The waste materials recorded in TP10A (1.00 / 2.00 m bgl) are located beneath the southwestern corner of 3AS (also under the NOMA Marketing Suite). A strategy for dealing with any waste materials has been provided within the NMS planning application documents. The material is to be removed & segregated if encountered during excavations. Material can also be left in-situ and capped appropriately (no change from existing situation).

The leachate results record a number of minor exceedances (less than an order of magnitude) of lead, barium, antimony, sulphate and fluoride. Given the extremely limited number of exceedances, the magnitude of the exceedances, the low soil concentrations recorded on the respective samples and the fact that the assessment criteria used are considered to be overly onerous for the purpose of the analysis, it is considered that leaching of such determinants to controlled water receptors is unlikely and as such no further analysis on the associated leachate concentrations is considered necessary.

5.3.2 SSL 2021 GI

10 No. soil samples underwent soil chemical analysis and were assessed against the C4SL and S4UL screening criteria. 2 No. of the 10 No. samples tested recorded determinands that exceeded the relevant 'commercial' threshold for lead (2,330 mg/kg). Given the depths of the samples, is likely that this material will be removed from site during the lower ground level excavation. If left insitu, the area will be covered in hardstanding or appropriate soft landscaping builds, thus breaking any source-pathway-receptor linkage.

- TP104 at 0.50 m BGL – Lead: 5910 mg/kg (located under 2 AS plot)
- TP111 at 1.80 mg/kg – Lead: 4300 mg/kg (located in between 3 AS and NMS)

14 No. tests on samples within Made Ground deposits were screened for ACM. 1 No. sample recorded the presence of asbestos fibres, namely Chrysotile in TP108 at 0.60 m BGL (located under 3 AS plot).

Waste Acceptance Criteria (WAC) testing was also carried out on 10 No. samples. 7 No. soil samples tested were classified as 'Non-Hazardous' and 3 No. soil samples were classified as 'Hazardous'.

The 3 No. 'Hazardous' soil samples were classified for the following properties:

- TP102 at 0.70 m bgl – Lead (1060 mg/kg) and Zinc (1580 mg/kg - located under 2 AS plot);
- TP104 at 0.50 m bgl – Lead (5910 mg/kg - located under 2 AS plot); and
- TP111 at 1.80 m bgl – Lead (4300 mg/kg - located in between 3 AS and NMS)).

5.4 Landfill Entries

The Groundsure Report[1] identifies 2 No. waste treatment, transfer or disposal sites within a 250 m radius of the Site, as follows:

- 204 m NE of site. Breakers Yard. NGR: 384516, 399239. Date 1984.
- 209 m NE of site. Breakers Yard. NGR: 384493, 399247. Date 1990.

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No landfill sites are recorded by the local authority or the BGS within a 500 m radius of the site. The nearest recorded landfill site is 698 m N of the Site:

- Queens Road Tip, Collyhurst. Deposited waste included Inert, Commercial, Industrial and Special Waste and Liquid Sludge. Input dates: 31 December 1955 to 31 December 1970. License status: Not supplied.

The above facilities are considered to be down or along hydraulic gradient of the Site and are typically in the Irk Valley or on the opposite side of the river, thus the risk of contamination to the proposed development site arising from these facilities is considered to be low.

5.5 Ground Gas

Ground gas typically consists of methane and carbon dioxide generated by the decomposition of organic materials. Although other gases are often associated with gas generation, methane and carbon dioxide are those which are typically measured during ground investigations, along with measurements for oxygen concentrations (to assess oxygen depletion) and flow rate. Ground gas is generally generated by and associated with the following ground conditions:

- Made Ground – typically non-engineered and poorly sorted material containing an organic component including soil, vegetation and timber;
- Alluvium/Peat – natural drift deposits often associated with river floodplains and generally having a high organic content sometimes with peat inclusions or peat layers;
- Coal Measures – 'mine' gas is often generated in such strata and can permeate through old workings and rock masses disturbed by mining activities; and
- Landfill – 'landfill' gas is often generated by the decomposition of organic materials placed in landfills. 'Inert' waste is similar to the Made Ground described above with the degree of gas generation dependent upon the amount of organic material present. Domestic waste, however, has a very high organic content and generates large quantities of gas over a sustained period (decades).

An appraisal of the likelihood of the above features affecting the proposed development is summarised below:

- There is Made Ground recorded within the unpublished geology as summarized in Section 4.3 which is of substantial thickness (0.30 to 4.00m). However, the Made Ground encountered is mainly comprised of rubble and ash, which are unlikely to represent a significant source of ground gas. It is worthy of note that timber is recorded locally within BGS logs. Based on the available data, it is reasonable to assume that the likelihood of ground gas being encountered within the Made Ground materials can be considered to be low.
- The published and unpublished geology as summarized in Sections 4.2 and 4.3 respectively do not indicate that peat or alluvial material is likely to be present across the Site and in the immediate surrounding area. As such, the likelihood of ground gas being encountered arising from alluvial materials can be considered to be low.
- The published and unpublished geology (Sections 4.2 and 4.3) indicate that productive coal bearing strata exist beneath the Site but are at significant depth. As such the likelihood of ground gas being encountered arising from coal mining activities can be considered to be low.
- The Groundsure Report[1] does not identify any landfill sites within 250 m of the Site – the nearest is 700 m to the north, on the far side of the River Irk. The report also identifies small Waste Transfer/Management sites within

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500 m of the Site, however, given the distance of these facilities from the Site and their settings, the likelihood of ground gas being encountered arising from landfill sites can be considered to be low.

Given the environmental setting of the Site, ground gas is not considered to be a major issue at this stage. Notwithstanding this, ground gas monitoring has been undertaken as part of the site specific ground investigation to clarify the ground gas regime beneath the Site and allow appropriate protection measures to be assessed and incorporated into any substructure designs as necessary.

5.5.1 SSL 2021 GI – Ground Gas

As part of the SSL 2021 GI, 11 No. ground gas monitoring wells were installed for monitoring. All post-fieldwork monitoring visits have been undertaken between on the 13th of August 2021 and the 22nd of October 2021. It should be noted that in a number of occasions it was not possible to access the monitoring wells due to cars being parked over the exploratory position, however, this is not considered to have a significant influence over the final classification of characteristic situation.

The ground gas concentrations and flow rates obtained from the installations to date have been assessed against the classification scheme presented in CIRIA C665 (Assessing risks posed by hazardous ground gas to buildings (2007)). A short summary is provided below;

- Gas flow rates recorded to date suggest very low flow ranging between -1.5 and 1.0 l/hr.
- Oxygen (O_2) levels generally range between 19.0 and 21.0 % in all boreholes. A relatively low oxygen concentration of 9.8 % was recorded in WS102 (response zone 0.00-1.00 m bgl in Made Ground) on the 6th October 2021 and 13.0% in WS105 (response zone 0.00-4.00) on the 13th August 2021. Bulk gas analysis in WS102 recorded elevated nitrogen.
- Carbon Dioxide (CO_2) levels generally range between 0.1 and 1.0% across the site. An elevated concentration of 5.0 % was recorded in WS102 (in Made Ground) on the first monitoring visit only (13th August 2021).
- Methane (CH_4) levels generally ranged between 0.0 and 0.1% across all monitoring wells. Slightly elevated Methane (CH_4) concentrations were noted in BH102 (Sandstone) ranging between 1.3% and 1.4% on the 22nd of October 2021 and 6th of October 2021. It is noted that no identifiable sources of methane were recorded in the exploratory logs during the SSL 2021 GI. It is also considered that any pathway between the Sandstone (bedrock) and the proposed building is broken by the superficial glacial till / glaciofluvial deposits.

The post-fieldwork ground gas monitoring results identified a maximum Characteristic Situation 2 (CS2) in BH102 and a typical Characteristic Situation CS1 for the rest of the site. It should be noted that the monitoring well recording CS2 was a deep flooded well located in the sandstone and that any pathway between the sandstone and the proposed building is considered to be broken by the overlying superficial glacial till and glaciofluvial deposits.

In addition, the maximum Characteristic Situation recorded in the Made Ground material (the most likely source of any ground gas) is CS1. It is therefore considered that Characteristic Situation 1 (CS1) is a suitable classification for the entire site. In accordance with Table 4 (page 22, BS 8485:2015+A1:2019) if the Site is classified as CS1, 0 points are required and thus ground gas protection is therefore not required.

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5.6 Radon Affected Areas

The Groundsure Report[1] records that '*the site is in an area where less than 1% of homes are above the action level*' and the corresponding BRE[8] guidance document indicates that no radon protection measures are required for development undertaken in this area.

5.7 Japanese Knotweed

We understand that Japanese Knotweed was cleared as part of the site wide operations extending from No. 1 Angel Square during 2010-2011. The ERAP report[7] does not record the presence of invasive species, including Japanese Knotweed during the ecological survey undertaken in 2022.

Japanese Knotweed is an invasive, non-native plant species. The Wildlife and Countryside Act (1981) made it illegal to spread Japanese Knotweed and guidance on the management of Japanese Knotweed on development sites is given in the Environment Agency's (EA) code of practice, 2001. Currently available information indicates that the material is not hazardous but is highly invasive, destroying other flora and habitats for fauna. It spreads by root growth so can invade from neighbouring sites as well. There are a variety of methods available for treating infested areas including spraying with herbicides or digging, spraying and removal to landfill.

5.8 Unexploded Ordnance

The Zetica Unexploded Bomb Risk Map (Appendix I refers) shows the Site to be in an area of *'Moderate'* risk. It is known that Arkwrights Mill on/adjacent to the western site boundary was bombed in 1940 during the *'Manchester Blitz'* and post-war historical maps show a number of *'Ruins'* on site and immediately to the east. In addition, these maps do not record many buildings which were recorded on site pre-war (World War II).

The Site has not been significantly redeveloped since World War II thus the risk from unexploded ordnance is considered to be reasonably high. A detailed unexploded ordnance desktop study[9] has been prepared for the site by First Line Defence Limited and should be read in conjunction with this report. It recommended that UXO supervision is required for ground investigation and construction works.

5.9 Pollution Incidents

The Groundsure Report[1] records that there have been no pollution incidents on the Site itself, however, there have been 5 No. pollution incidents within 500 m of the Site as recorded below:

- Category Three – Minor Incident Water (Oils & Fuel - mixed waste oils) 282 m to the NW;
- Category Three – Significant Incident Land (Waste - Household) 411 m to the N;
- Category Three – Significant Incident Land (Waste - Commercial) 411 m to the N;
- Category Three – Significant Incident Land (Waste - Asbestos) 411 m to the N; and
- Category Three – Significant Incident Land (Waste - Tyres) 411 m to the N.

[8] BRE 1999. Radon. Guidance on protective measures for new dwellings. British Research Establishment. 1999.
[9] First Line Defence Limited report *'2&3 Angel Square, Manchester – Detailed Unexploded Ordnance (UXO) Risk Assessment'* (ref: DA13039-00) dated April 2021.

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There are no recorded Substantiated Pollution Incidents within 500 m of the Site.

Given the minor categorisations of many of the impacts recorded, their distance from the Site and the fact that none are located directly up hydraulic gradient of the site (Section 4.4 refers), the potential impact of contamination from these sources on the proposed development site is considered to be low.

5.10 Radioactive Substances

1 No. Registered Radioactive Substances has been identified to be present within a 500 m radius of the Site:

- 31 m E of the Site, Brooke Edgeley Specialist Technical Services Ltd. Disposal of radioactive waste (was Rsa60 Section 6). Date: 7 August 2000. Status: Authorisation revoked or cancelled/Cancelled.

Brooke Edgeley Specialist Technical Services Ltd advised the following: The licence was for storage of old lightening conductor air terminals between 2000 and 2002 in a specialized metal cabin. The metal cabin was decommissioned by a radioactive specialist as part of the closure of the Angel Street premises in 2003. Subsequently the Site has been re-developed and new build flats now occupy the site. As such the risk to the proposed development site from this source can be considered to be low.

5.11 Nitrate Vulnerability

The Site is located in a Nitrate Vulnerability Zone (NVZ). Given the urban location of the proposed development site, nitrate vulnerability is not considered to pose a significant constraint on the proposed development.

5.12 Area of Conservation

The Groundsure Report[1] records that the Site is not located within a specific area of conservation, a National Park or a RAMSAR site. Nor is the Site recorded to be in a Site of Special Scientific Interest (SSSI). As such, it is not considered that this will pose a constraint on the Proposed Development.

5.13 Current Industrial Data

The Groundsure Report[1] indicates that there are 5 No. potentially contaminative industrial sites within 100 m of the Site, namely:

• Infrastructure & Facilities	Electricity Substation	Electrical Features	12 m to the SW.
• Transport, Storage & Delivery	Warehouse	Container & Storage	34 m to the E.
• Infrastructure & Facilities	Electricity Substation	Electrical Features	70 m to the SE.
• Industrial Products	Business Comms Consultant	Radar/Telecomms	71 m to the NE.
• Repair & Servicing	Computermend	Electrical Eq. Repair/Service	12 m to the SW.

Given the commercial rather than industrial nature of the active facilities and their distance from the proposed development site, the risk of contamination arising from these sources can be considered to be low.

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5.14 Fuel Station Entries

The Groundsure Report records 4 No. Fuel Stations within 500 m of the Site, namely:

• Unbranded (12 Rochdale Road)	Obsolete	296 m to the E	Up hydraulic gradient.
• Obsolete (95-109 Rochdale Road)	Obsolete	408 m to the E	Up/along hydraulic gradient.
• Texaco (58-76 Cheetham Hill Road)	Open	426 m to the NW	Down hydraulic gradient.
• Obsolete (37-41 Cheetham Hill Road)	Obsolete	455 m to the NW	Down hydraulic gradient.

There are 2 No. fuel stations considered to be up or up/along hydraulic gradient and 2 No. fuel stations down hydraulic gradient from the Site. Given the fact that the 2 No. which are located up or up/along are obsolete, the risk of contamination of the Site arising from the fuel stations can be considered to be low.

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6 Proposed Development



Figure 6-1 Architects visuals of the two buildings

The current development proposals consist of the following main elements (Appendix A refers), namely:

2 Angel Square

- A new build split level office complex with 14 storeys (LG, UG,12 upper), basement car parking and landscaping of the periphery and public realm area.

3 Angel Square

- A new build split level office complex with 13 storeys (LG, UG,11 upper), basement car parking and landscaping of the periphery and public realm area.

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Key Design Considerations

The key elements of the proposed development in respect of the ground investigation works undertaken can be summarized as follows:

- Column loadings associated with up to 14 storeys of commercial development including plant loadings.
- Retaining structures between split levels associated with current topographical considerations.
- Locally confined/restricted site boundary possibly requiring both temporary and permanent support.
- Material assessment for bulk earthworks.
- UXO risk mitigation procedures for any intrusive site or construction works.
- Excavation and removal of any buried obstructions.
- Hard and soft landscaping to the periphery and central part of the site.
- Ground gas and groundwater regime.
- Contamination - residual asbestos fibres within the Made Ground.

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7 Preliminary Conceptual Site Model

7.1 Ground Model

The anticipated ground conditions underlying the Site based on the information available can be summarized as follows:

- Made Ground: recorded as black brown slightly clayey slightly sandy angular to subangular GRAVEL of brick and ash with high cobble and medium boulder content. Gravel comprises various materials including sandstone, mudstone, limestone, glass, tarmac, coal, slag, concrete, slate, clinker, brick, rare granite and ceramic fragments. Highly variable thickness and distribution (0.15 m and 5.00 m BGL). Please note, a black sandy fine to coarse GRAVEL in clayey matrix with pottery and snail shells was recorded at 1.80 - 2.20 m BGL in TP5 SSL 2015 GI only – thought to be representative of a former reservoir.
- Glacial Till: recorded as firm to very stiff brown/red brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to rounded of sandstone & mudstone AND orange brown, slightly clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to rounded of quartzite, limestone, sandstone and ironstone. Occasional layers of brown, sandy, gravel. Thicknesses varied between >0.20 -14.80 m.
- CF – Chester Formation: Soft becoming medium hard, red/brown, medium to coarse grained SANDSTONE with occasional layers of marl. Rockhead between 11.10 and 21.90 m BGL (SSL 2021 GI).

The River Irk is situated approximately 250 m to the northwest of the Site and flows in a southwesterly direction towards Manchester Victoria Railway Station to its confluence with the River Irwell. It is considered likely that the groundwater underlying the Site may be in hydraulic continuity with the River Irk. Perched water may also be present within any Made Ground encountered particularly where there are buried obstructions. The hydraulic connectivity within the Made Ground materials is expected to be highly variable and any perched water is likely to be present in localised pockets of granular fill.

7.2 Potential Sources of Contaminants

Potential contamination sources from review of regulatory data and historical maps have been identified and are summarised in Table 7-1. The 'Contaminants of Concern' in this risk assessment are based primarily on information from the review of historical information.

Table 7-1 Potential Sources of Contamination

Potential Source	Location	Likely Age	Potential Contaminants of Concern
Made Ground	Onsite	From 1800s to present	Metals, sulphates, PAHs, solvents, fuel and oil waste and asbestos.
Fuel and oil spills from car parking retained within soils	On and off site	From 1970s to present	Petroleum hydrocarbon, fuel, oils.
Ground gas sourced from Made Ground and nearby infilled reservoir	On and off site	From 1800s to present	Methane, carbon dioxide.
Various commercial / industrial site uses	On and off site	From 1800 to present	Leachable contaminants: metals, PAHs, petroleum, hydrocarbons.

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7.3 Receptors and Pathways

Site specific pathway-receptor linkages have been identified in Table 7-2 with respect to the sources outlined in Table 7-3 and with respect to the anticipated future uses.

Table 7-2 Receptor and Pathways

Receptor		Pathway
Human Health	Future site users / visitors.	Direct / dermal contact. Inhalation of contaminated dusts, gas & vapour.
	Offsite land users.	Inhalation / ingestion of contaminated dust.
	Investigation and construction workers.	Direct / dermal contact. Ingestion / inhalation of contaminated soils. Inhalation of gas / vapour.
Controlled Waters	Principal Aquifer within the Chester Formation.	Leaching of contaminants through permeable strata.
Below Ground Infrastructure	Buried concrete foundations. Services pipework (if any).	Direct contact.

7.4 Risk Assessment

The qualitative risk assessment of the potential pollutant linkages described above is presented in Table 7-3. Based on the assessment, the risk of ground contamination affecting the Proposed Development is considered to be predominantly low to low/moderate.

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Table 7-3 Qualitative Risk Assessment

Pollutant Linkage				**Risk Assessment**			**Description of source [bold text]** Comment on hazard realisation [normal text]
Source	Contaminants of Concern	Pathway	Receptor	Consequence	Probability	Risk	
Historic warehouses Made Ground material used to backfill basements Car parking Urban Made Ground material	Metals, cyanide, chlorides, phenols, PAHs, solvents, fuel and oil wastes and asbestos	**The site has a variety of historic uses**					
		Direct /dermal contact, ingestion, inhalation	Construction / Maintenance workers	Medium	Unlikely	Low	Potential for direct contact with contaminated materials during excavations / earthworks. Can be mitigated by good working practice, health and safety and use of PPE if necessary.
		Direct / dermal contact, ingestion, inhalation	Future site occupants and visitors	Medium	Low	Low	Pathway likely be removed in the end use as the site is envisaged to be covered either by the building(s) or hard / soft landscaping with clean build-ups. To be finalised as the development proposals evolve.
		Ingestion / inhalation	Occupants and visitors of neighbouring properties	Medium	Unlikely	Low	Residential / commercial neighbours surrounding and adjacent to the site. Good working practices i.e. dust suppression will need to be in place.
		Migration via permeable strata	Groundwater (Principal A Aquifer – Chester Fm.)	Medium	Unlikely	Low	Downward leaching of contaminants into the Principal Aquifer (Chester Fm) due to infiltration is considered unlikely – current information suggests that there is a thickness of low permeability clay (Glacial Till) above the Chester Fm. Further prevention will be provided in the end use by drainage networks and potentially cover by hardstanding (depending on exact development proposals – to be reviewed). Procedures must be taken to avoid the creation of pathways during construction.
		Direct contact	Below ground services / infrastructure	Mild	Low Likelihood	Low	Any new services likely to be in clean corridors / trenches. Underground substructure will be designed to withstand appropriate concentrations of any chemicals that may be encountered (e.g. sulphate).
Potentially contaminative historic land uses to east / northeast (mills, warehouses, existing car parking etc.)	Leachable contaminants – metals, fuels, PAHs, petroleum hydrocarbons	**Mills/Warehouses recorded from1848 until 1933. Existing car parking potential source contamination from petrol and oils spills.**					
		Direct / dermal contact, ingestion, inhalation	Construction / Maintenance workers	Medium	Unlikely	Low	Potential for exposure to contaminated waters during foundation / service run excavation and ground works. Capable of mitigation by good working practice and use of PPE.
		Direct / dermal contact, ingestion, inhalation	Future site occupants and visitors	Medium	Unlikely	Low	Pathway likely be removed in the end use as the site is envisaged to be covered either by the building(s) or hard / soft landscaping with clean build-ups. To be finalised as the development proposals evolve.
Asbestos fibres and fragments within Made Ground	Asbestos	**Residual Asbestos Containing Material (ACM possibly present in Made Ground beneath the site.**					
		Inhalation	Construction / Maintenance workers	Severe	Unlikely	Low / Moderate	Residual ACM fibres may be present in the Made Ground. Mitigation during groundworks required e.g. damping down material during excavations as well as following good working practice / use of appropriate PPE as required.
			Future site occupants and visitors	Severe	Unlikely	Low	Pathway between any asbestos in Made Ground and receptors is likely to be removed in the end use as the site is envisaged to be covered by either a building, hard landscaping with clean build-up, or soft landscaping with clean topsoil. This will need to be reviewed as the development proposals evolve.
Made Ground	Gas and vapour	**A variable thickness of Made Ground is anticipated to be present onsite, and there is the potential for this to be contaminated and provide a source of hazardous gas and vapour beneath the site.**					
		Inhalation Explosion (methane)	Construction / maintenance workers	Severe	Unlikely	Low	Ground gas classification is CS1. Potential for uncontrolled exposure to hazardous ground gas / vapour (if present) in confined unventilated excavations (if required).

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Appendix A Proposed Development Details

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947 | Angel Square Plots 2 & 3

Building Name
Site

Drawing Title
Topographical Plan

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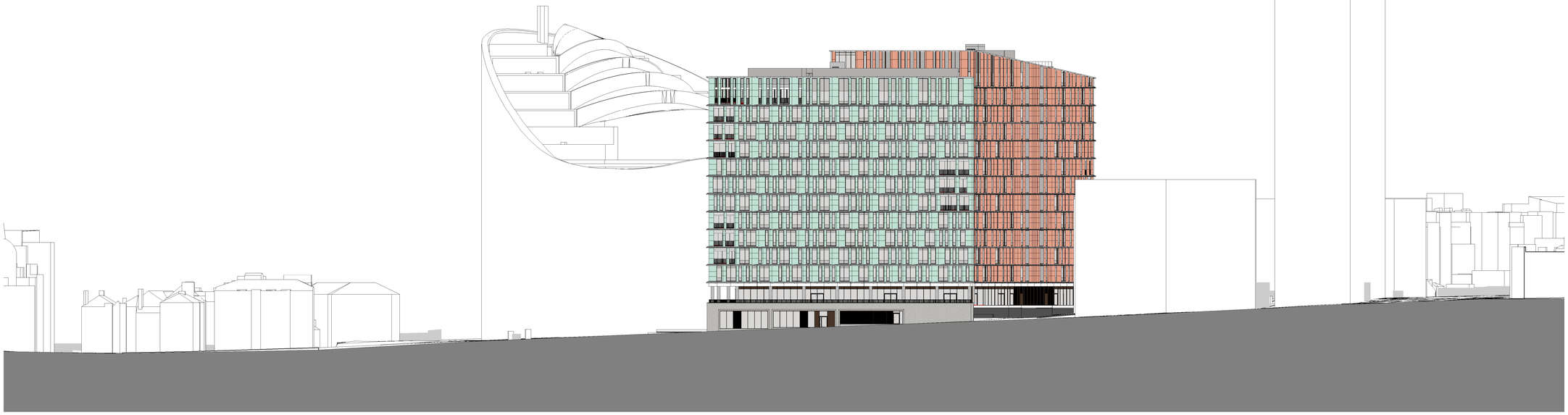
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1 **SW Wide Site**
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Project
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Building Name
Site

Drawing Title
Site Sections - SW

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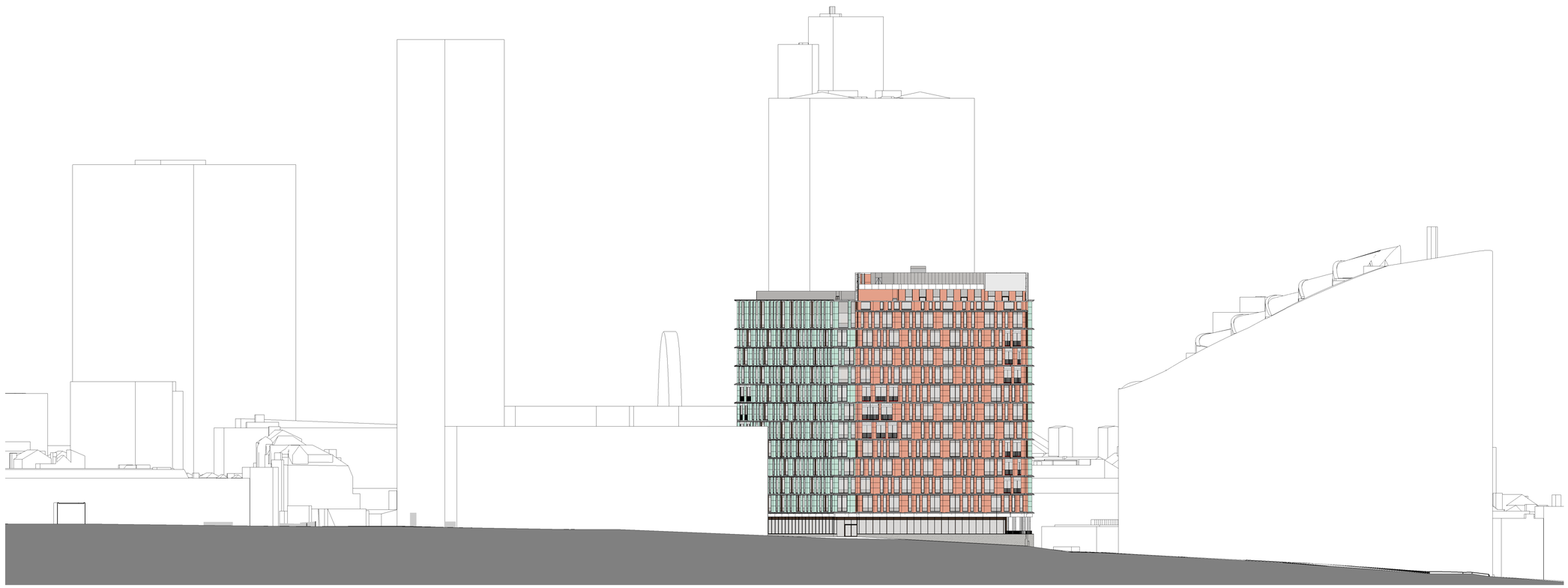
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1 **NE Wide Site**
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1 **SE Wide Site**
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1 **NW Wide Site**
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Site Sections - NW

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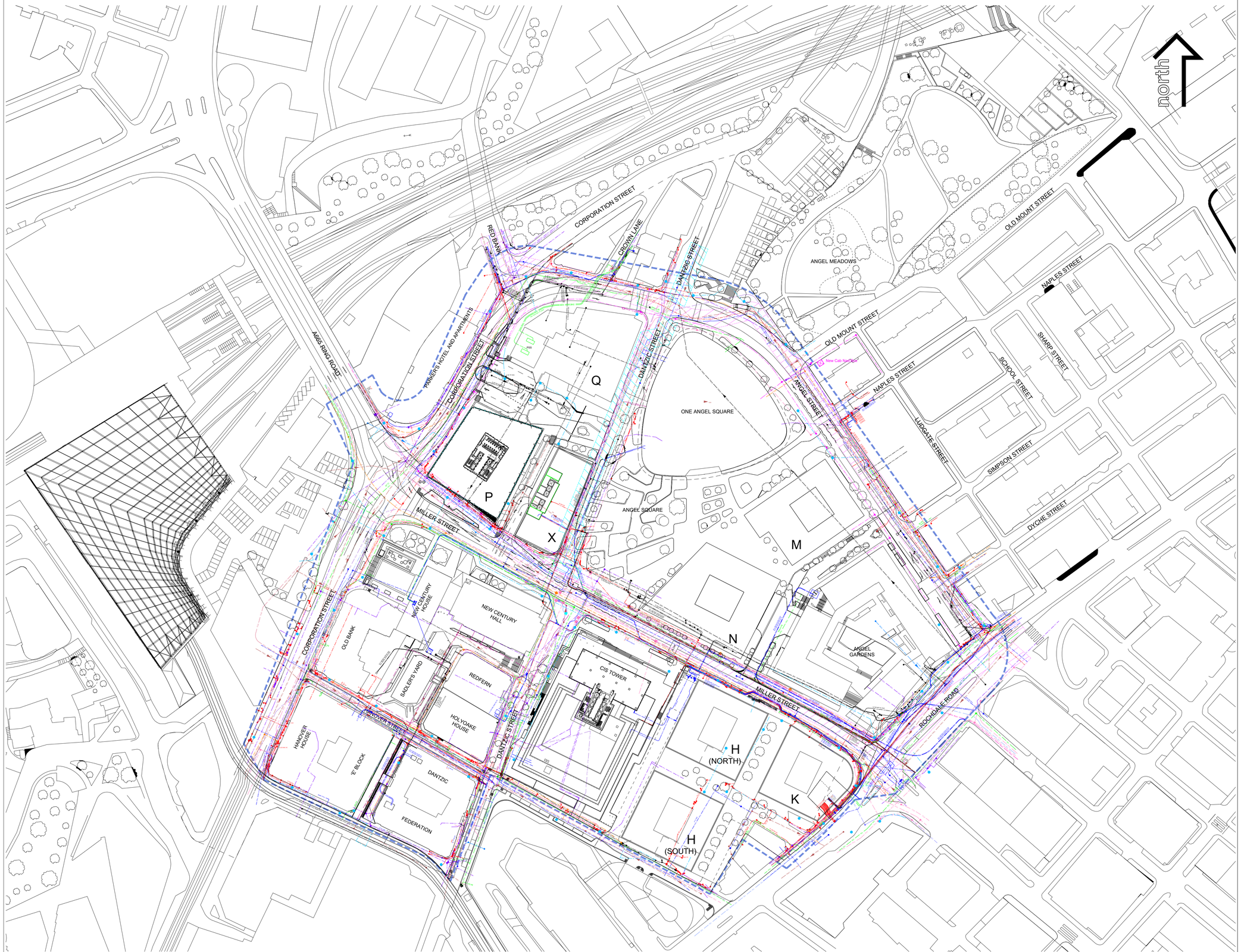
Appendix B Information Source Summary

Information Sources	Information Obtained?		Comments
	YES	NO	
Environment Agency (e.g. for information on landfill sites, water abstraction, pollution incidents)	✓		Groundsure® Report data.
The Local Authority (e.g. for information on environmental health & planning)	✓		Via internet searches.
Archaeological records	✓		Oxford Archaeology Reports, Gifford Report, Wessex Archaeology Report.
Local history sources (e.g. libraries, museums, societies)	✓		Via internet searches.
Coal Authority (coal mining records)	✓		Coal Authority Report Data
British Geological Survey (maps and information about the geology of the area)	✓		BGS maps and memoirs.
Historical borehole information	✓		BGS data.
Aquifers (major and minor, and groundwater vulnerability)	✓		Groundsure® Report data.
Hydrogeology (groundwater levels)	✓		Groundsure® Report data and BGS data.
Ordnance Survey (current & previous editions of plans)	✓		Groundsure® Report data.
Newspaper reports		✓	---
Waste, Hazardous Substances	✓		Groundsure® Report data.
Service/Utility Companies	✓		WDA 56_UMP_(A)_01 Rev 2 (dated 14/05/19)
Existing site investigations	✓	-	Onsite and adjacent site (SSL 2009, 2013 & 2015 data).

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Appendix C Utilities Information

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ELECTRICITY:	157-WDA-SS-EX-DR-UC-E100-001
GAS:	157-WDA-SS-EX-DR-UC-G100-001
TELECOMMUNICATIONS:	157-WDA-SS-EX-DR-UC-T100-001
WATER (POTABLE):	157-WDA-SS-EX-DR-UC-W100-001
WATER (SEWERS):	157-WDA-SS-EX-DR-UC-W100-002
TELECOMS PRIVATE DUCT:	157-WDA-SS-EX-DR-UC-M100-001
GAS PRIVATE PIPEWORK:	157-WDA-SS-EX-DR-UC-M100-002
STREET LIGHTING:	157-WDA-SS-EX-DR-UC-M100-003

Background Plan base on Simpson Haugh & Partners Drg No. 10257-SHP-ZZ-TY-PL-A-G100-001 P02 22/07/2020

UTILITY LEGEND

- Water Main
- Water Main (Abandoned)
- Water-Trunk Main
- Surface Water Drain
- Foul Water Sewer
- Foul Water Sewer (Abandoned)
- 33kV Electricity Cable
- 6.6kV Electricity Cable
- 6.6kV Electricity Cable (Abandoned)
- LV Electricity Cable
- LV Electricity Cable (Abandoned)
- Street Lighting
- Gas - Low Pressure
- Future Proofing Main laid by 3rd parties and not gas charged or connected into the NGG network
- British telecom Cable
- British Telecom Duct (Unoccupied)
- British telecom Cable (Planned)
- Private Telecom Cable Ducts
- CenturyLink Cable
- City Fibre
- Gamma Fibre Duct
- Gamma Fibre Optic in OLO Duct
- Gamma Fibre Optic in Shared Duct
- Sky
- Virgin Media Cable
- Vodafone Cable
- Zayo Cable
- Zayo Cable Abandonned
- Trunk Water Main Easement No Work Permitted over or within 5M (Horizontal) of the asset
- 315mm Water Main Easement No Work Permitted over or within 5M (Horizontal) of the asset

Client(s) NOMA GP Ltd

Project NOMA, MANCHESTER MASTERPLAN STUDY 2021

Drg Title MULTI UTILITY INFRASTRUCTURE CONSTRAINTS PLAN (2021)

Drawing No. 157-WDA-SS-EX-DR-UC-MU100-001 **Rev** 01

Scale	Sheet	Drawn	Checked	Date
1:1000	A1	CP		MAY 2021

Drawing revisions:

Revision	Event	Drawn By	Checked By	Date
01	All Utilities Layouts updated	WD/CP		21/12/2021

Utilities Infrastructure Consultants

William Downie Associates

Site Appraisals | Masterplanning | Diversions | New Infrastructure

m: 07593 789 872 or 07526 943 594 | e: info@wdassociates.co.uk
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www.wdassociates.co.uk

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Appendix D Historical Maps

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

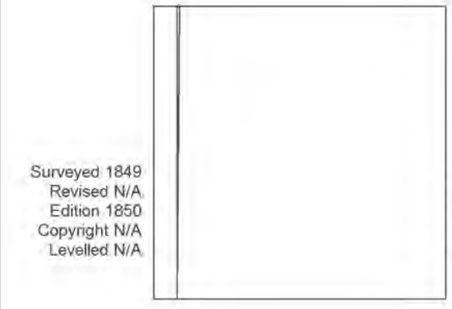
Map Name: 1056 Scale Town Plan

Map date: **1850**

Scale: 1:1,056

Printed at: 1:1,056

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

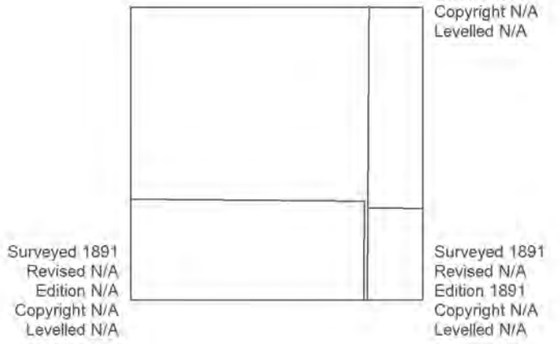
Map Name: County Series Town Plan

Map date: **1891**

Scale: 1:500

Printed at: 1:1,000

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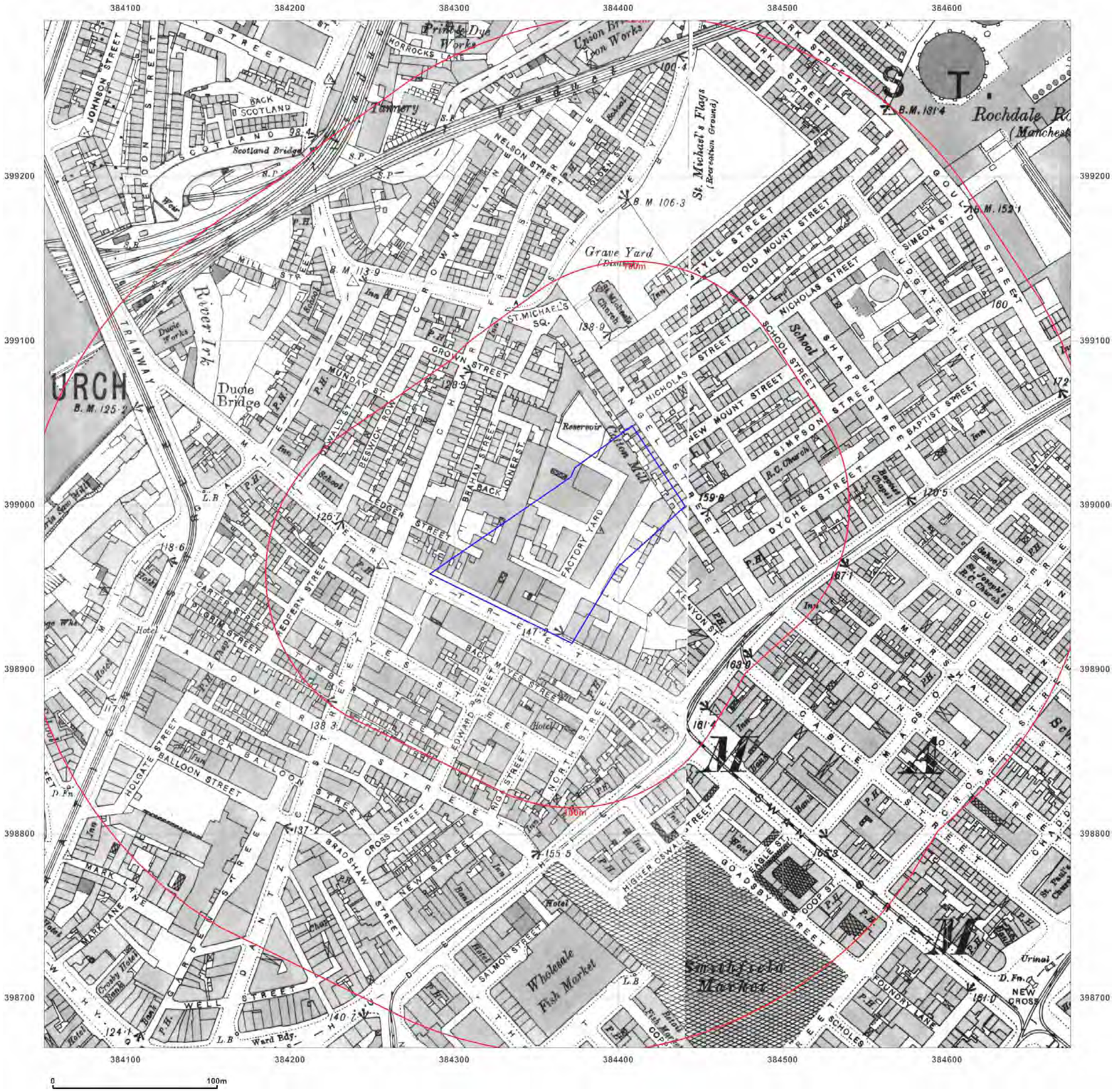
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1892-1893**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1892
Revised N/A
Edition 1892
Copyright N/A
Levelled N/A

Surveyed 1893
Revised N/A
Edition 1893
Copyright N/A
Levelled N/A

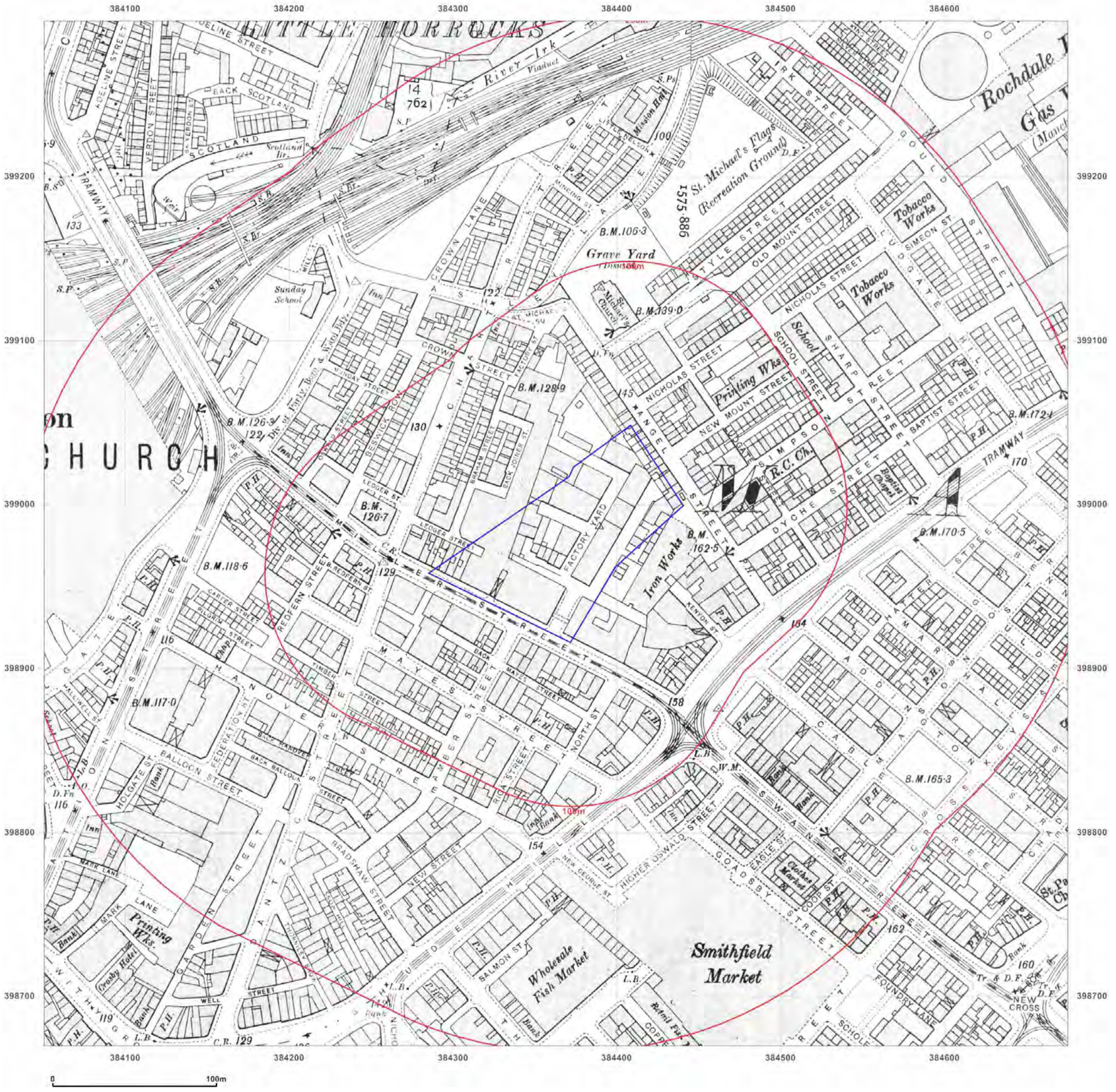
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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1908**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1891
Revised 1905
Edition 1908
Copyright N/A
Levelled N/A

Surveyed 1891
Revised 1905
Edition 1908
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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1922**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1922
Revised 1916
Edition 1922
Copyright N/A
Levelled 1915

Surveyed 1922
Revised 1916
Edition 1922
Copyright N/A
Levelled 1915

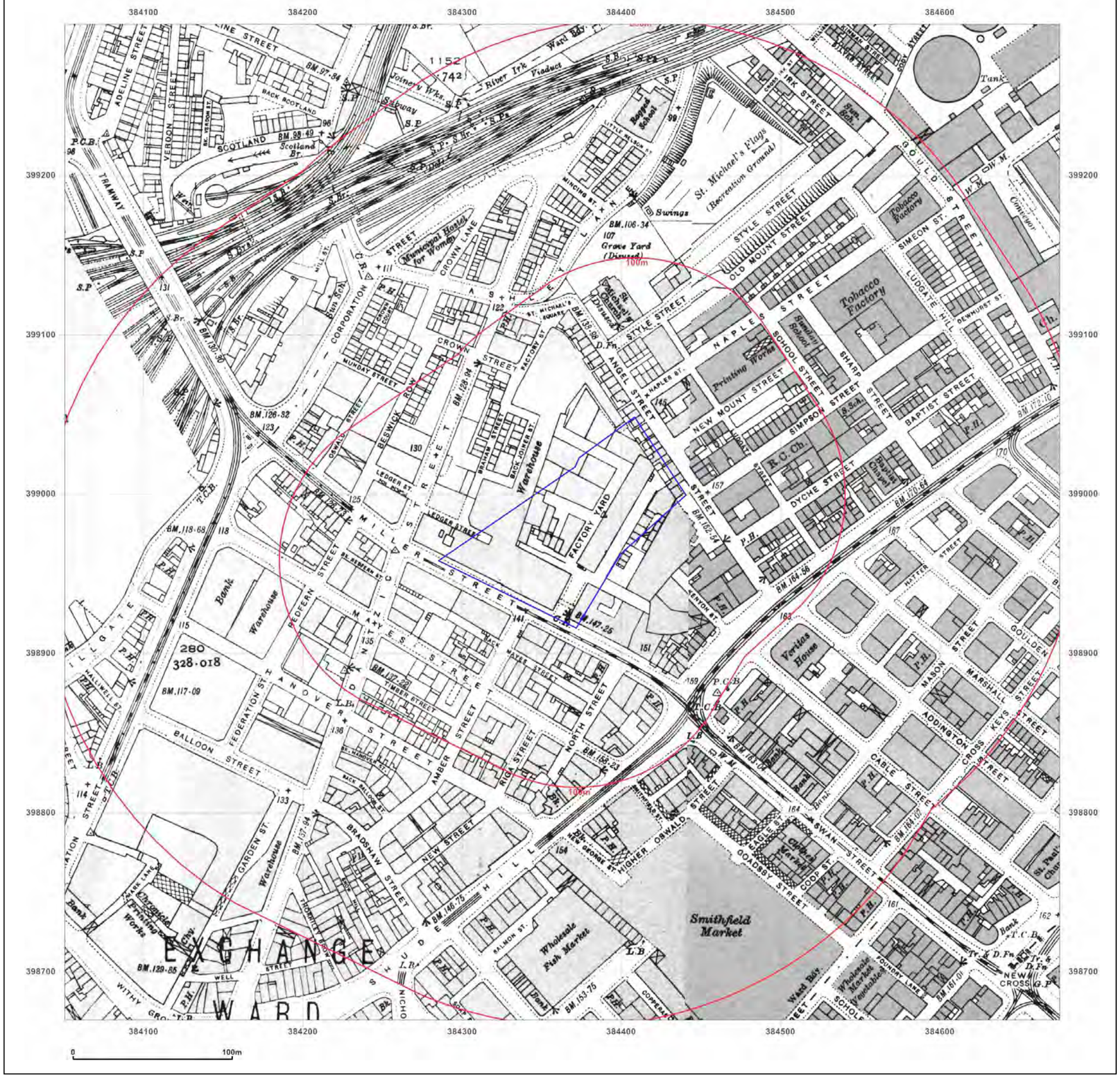
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1931-1933**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1873
Revised 1933
Edition N/A
Copyright N/A
Levelled 1927

Surveyed 1873
Revised 1931
Edition N/A
Copyright N/A
Levelled 1927

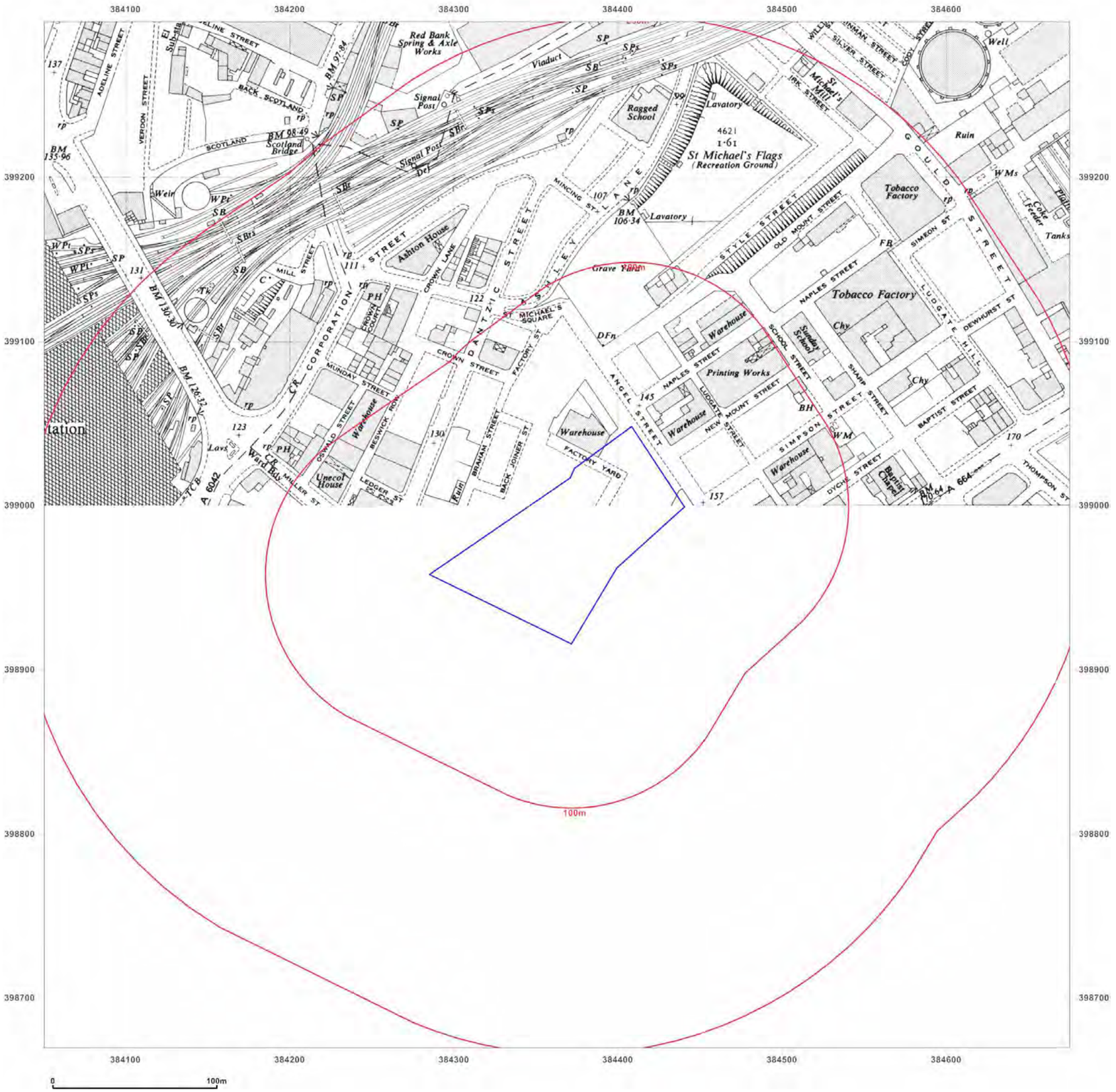
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Edition N/A
Copyright 1950
Levelled 1929

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1949**

Scale: 1:2,500

Printed at: 1:2,500

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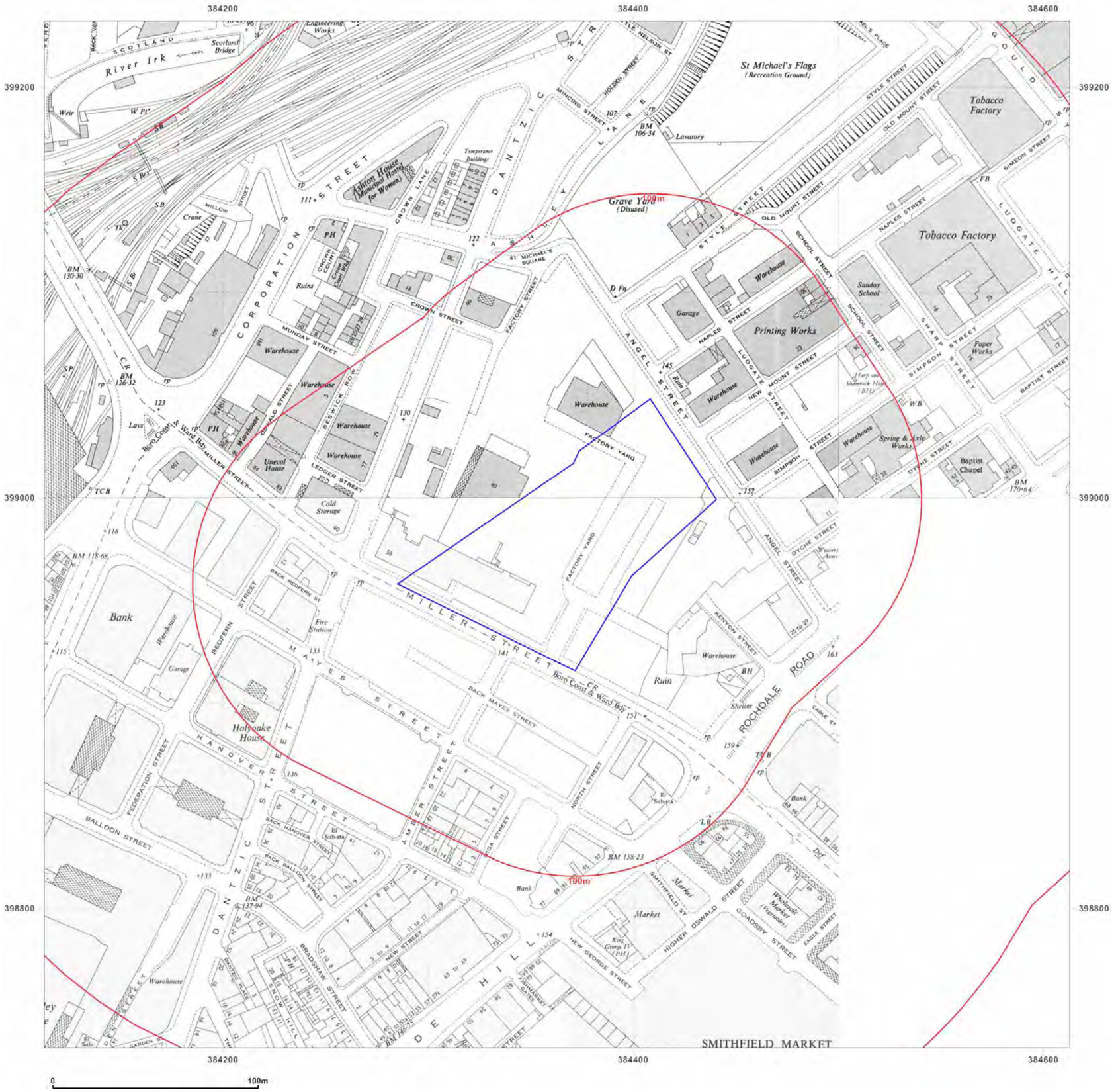
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Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

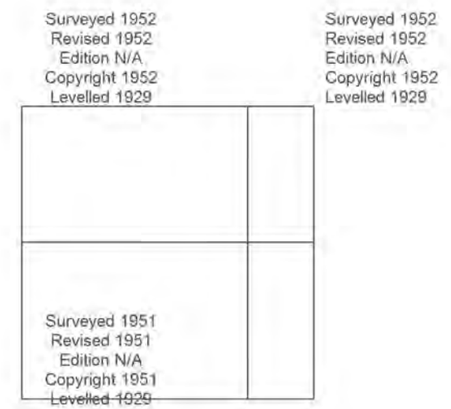
Map Name: National Grid

Map date: **1951-1952**

Scale: 1:1,250

Printed at: 1:2,000

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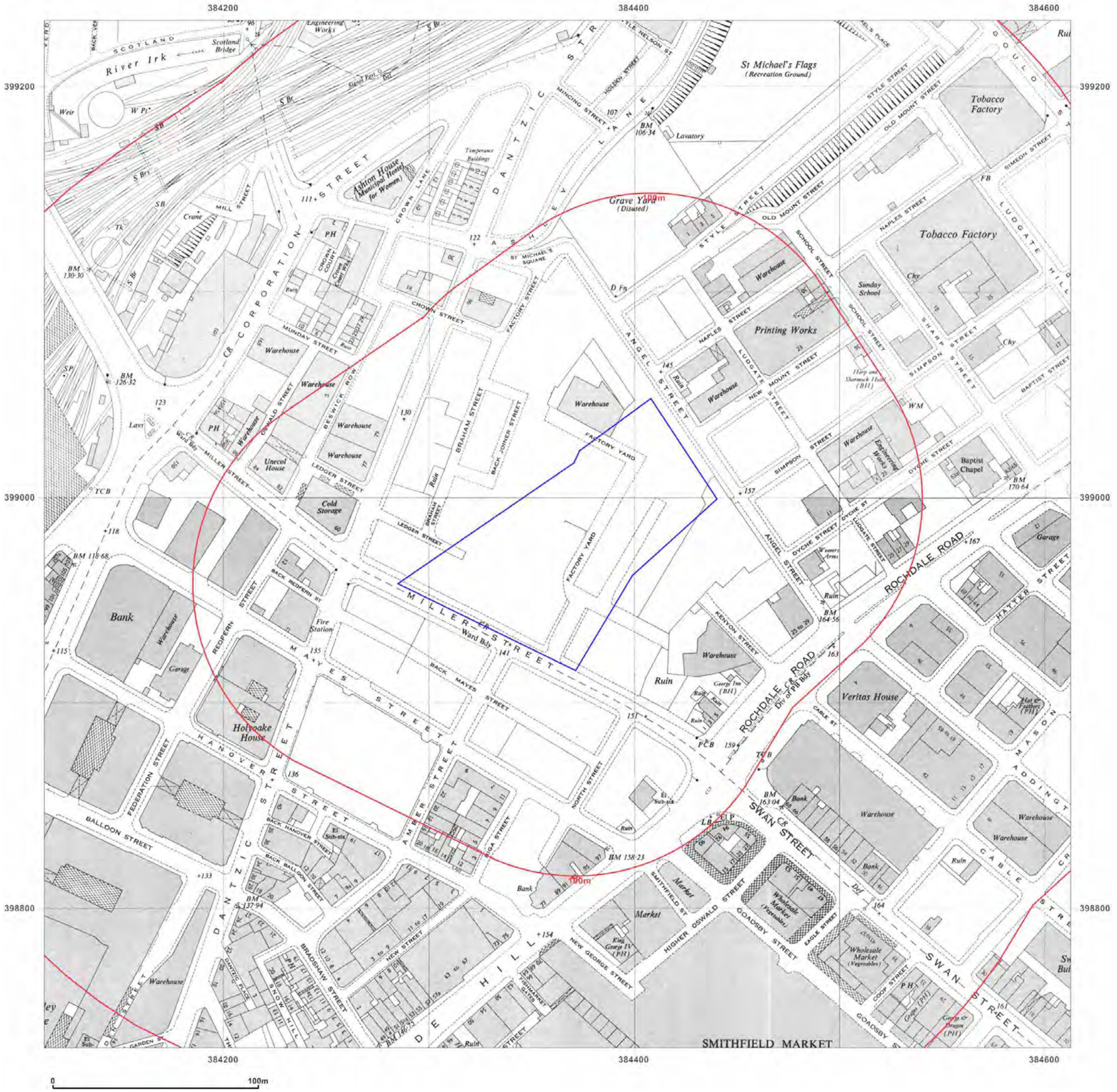
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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1948-1953**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1949
Revised 1949
Edition N/A
Copyright 1949
Levelled 1929

Surveyed 1949
Revised 1949
Edition N/A
Copyright 1949
Levelled 1929

Surveyed 1948
Revised 1948
Edition N/A
Copyright 1948
Levelled 1929

Surveyed 1948
Revised 1953
Edition N/A
Copyright 1953
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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1952-1953**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1952
Revised 1952
Edition N/A
Copyright 1953
Levelled 1929

Surveyed 1948
Revised 1948
Edition N/A
Copyright 1954
Levelled 1929

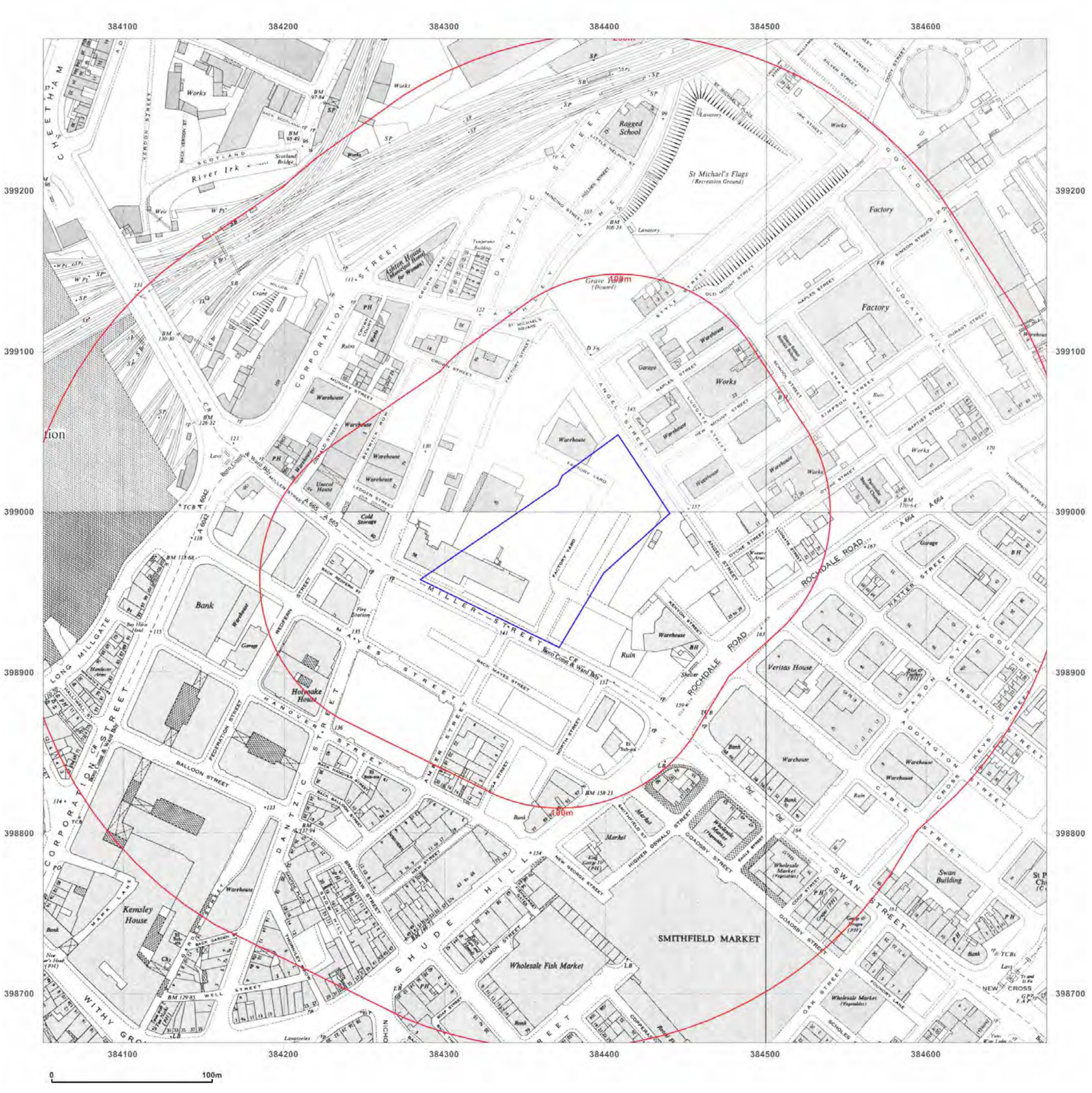
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Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1953-1958**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1958
Revised 1958
Edition N/A
Copyright 1959
Levelled 1929

Surveyed 1953
Revised 1953
Edition N/A
Copyright 1954
Levelled 1929

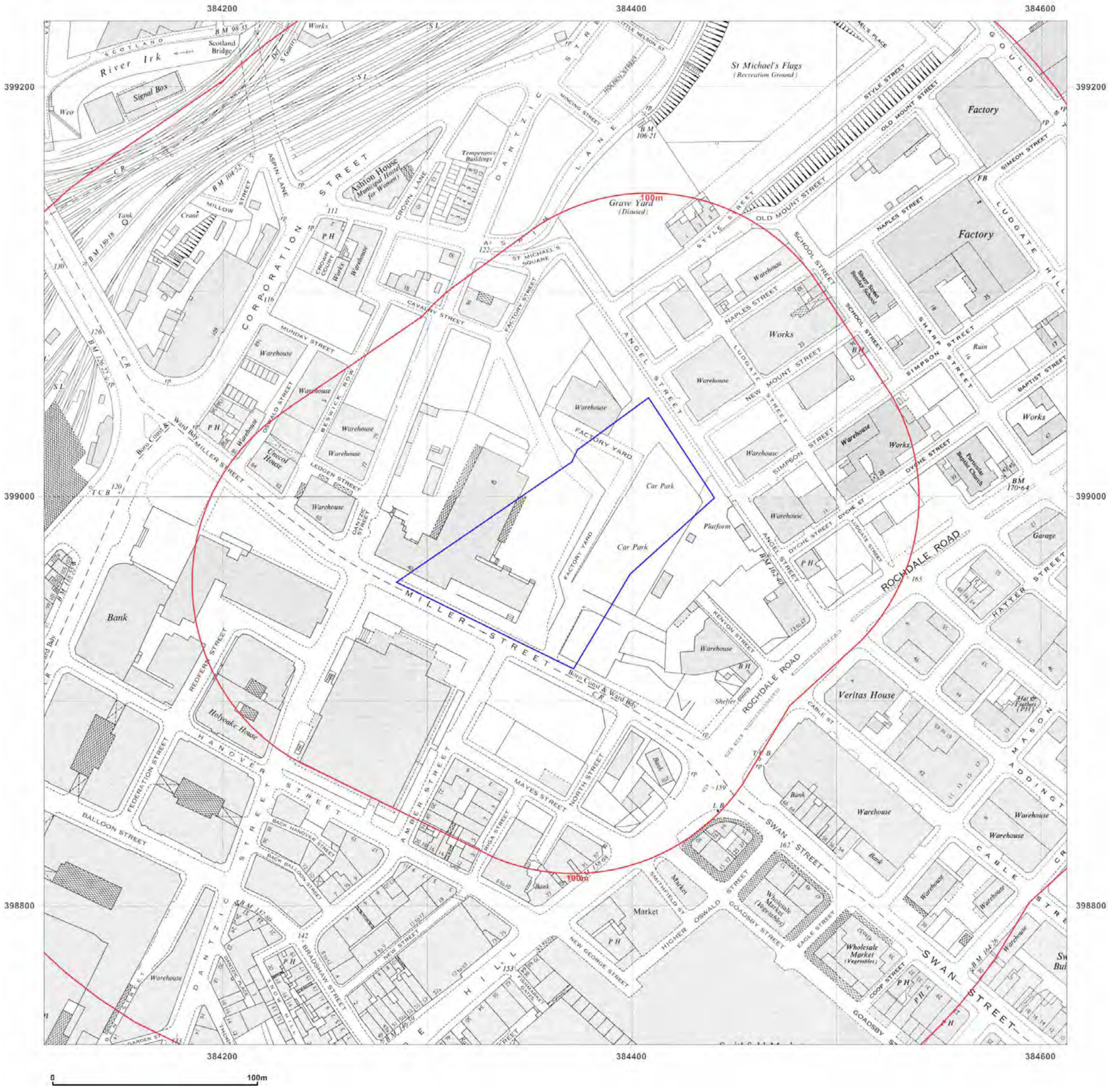
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Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1958-1963**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1949
Revised 1962
Edition N/A
Copyright 1963
Levelled 1959

Surveyed 1949
Revised 1958
Edition N/A
Copyright 1958
Levelled 1929

Surveyed 1948
Revised 1962
Edition N/A
Copyright 1963
Levelled 1959

Surveyed 1948
Revised 1962
Edition N/A
Copyright 1963
Levelled 1959

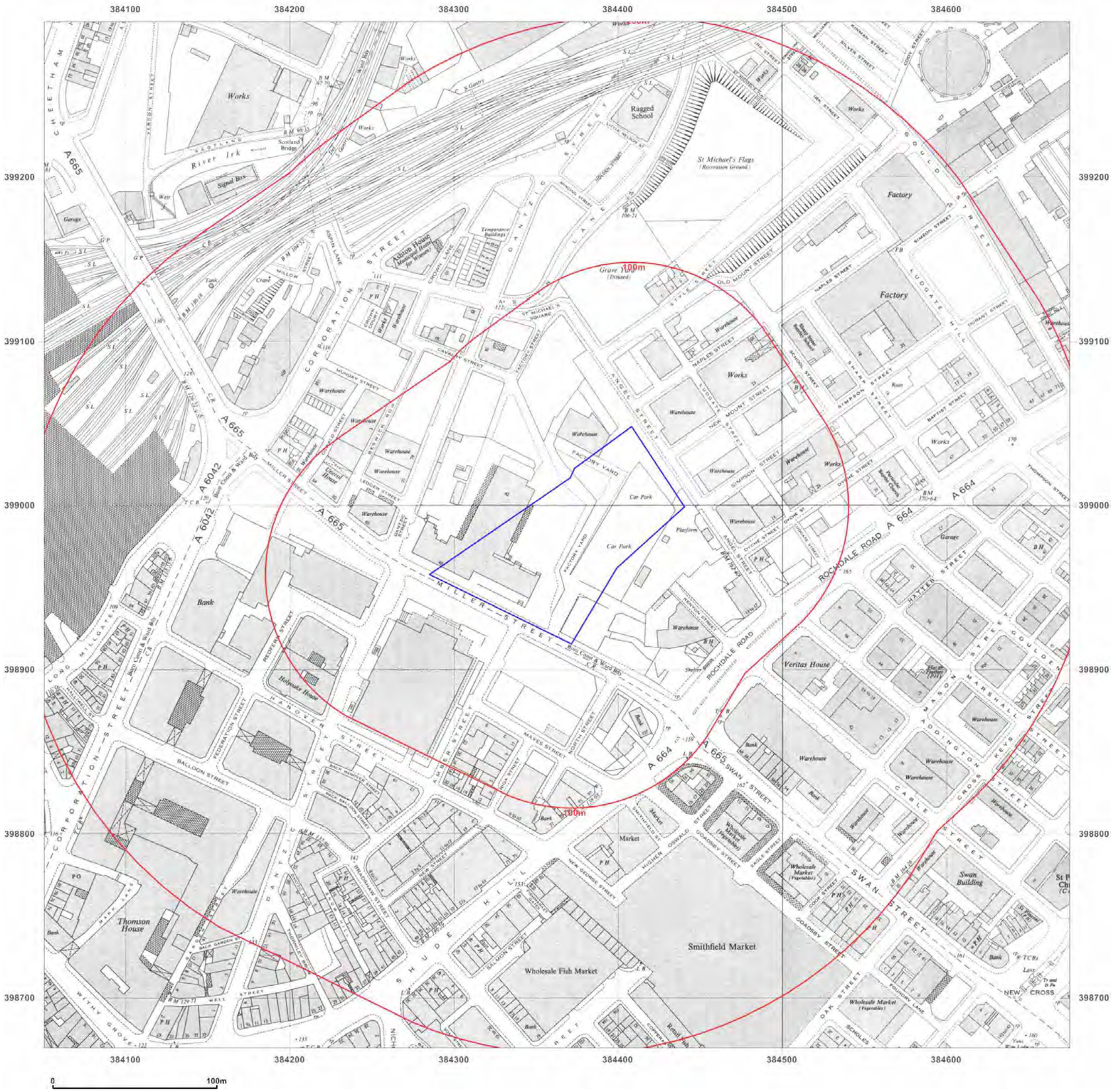
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Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1964-1965**

Scale: 1:2,500

Printed at: 1:2,500

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Edition N/A
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Levelled 1964

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Revised 1964
Edition N/A
Copyright 1965
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Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1967**

Scale: 1:2,500

Printed at: 1:2,500

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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1969**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

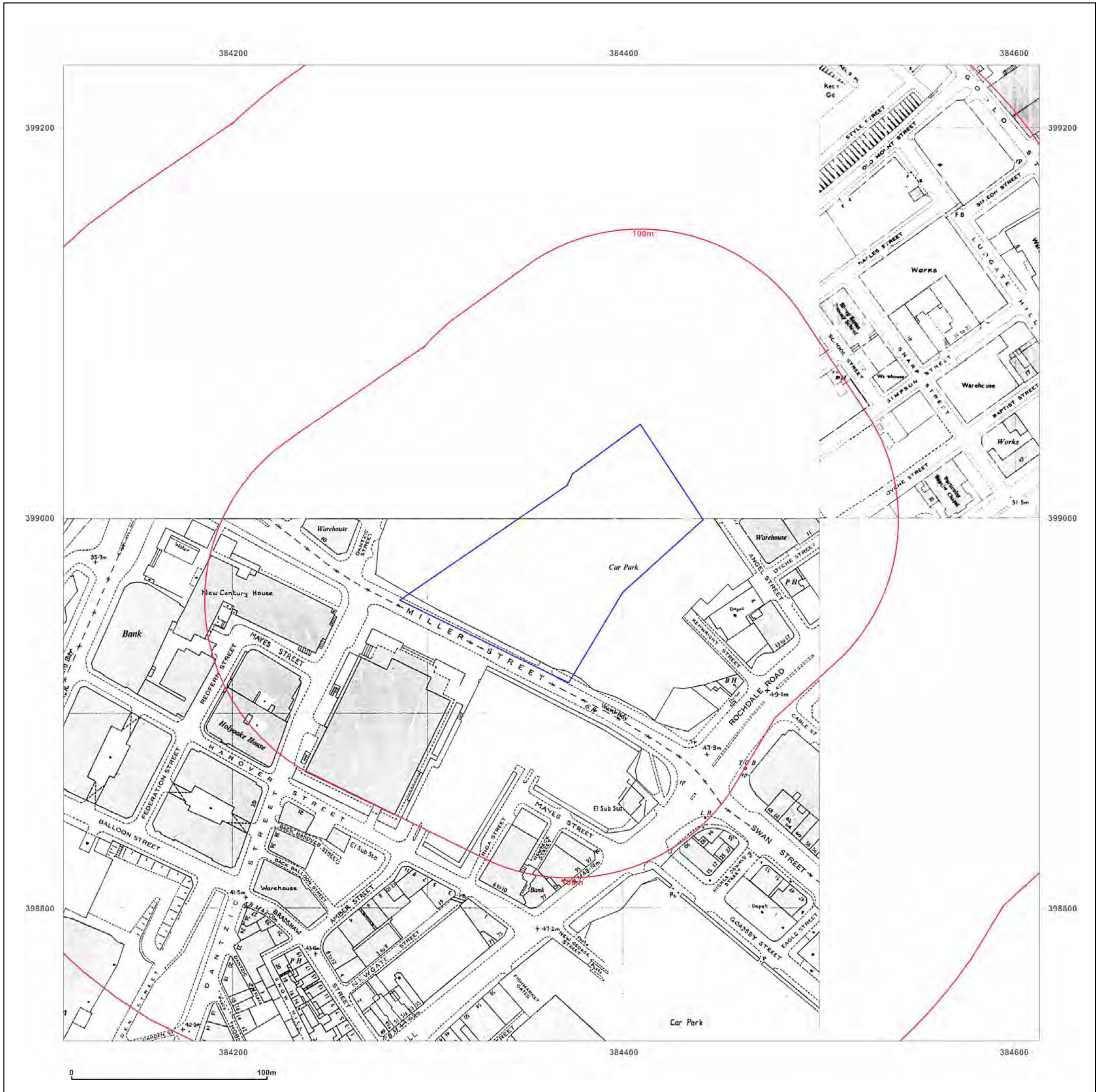
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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1978-1980**

Scale: 1:1,250

Printed at: 1:2,000

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Revised N/A
Edition N/A
Copyright 1978
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1980
Levelled 1964

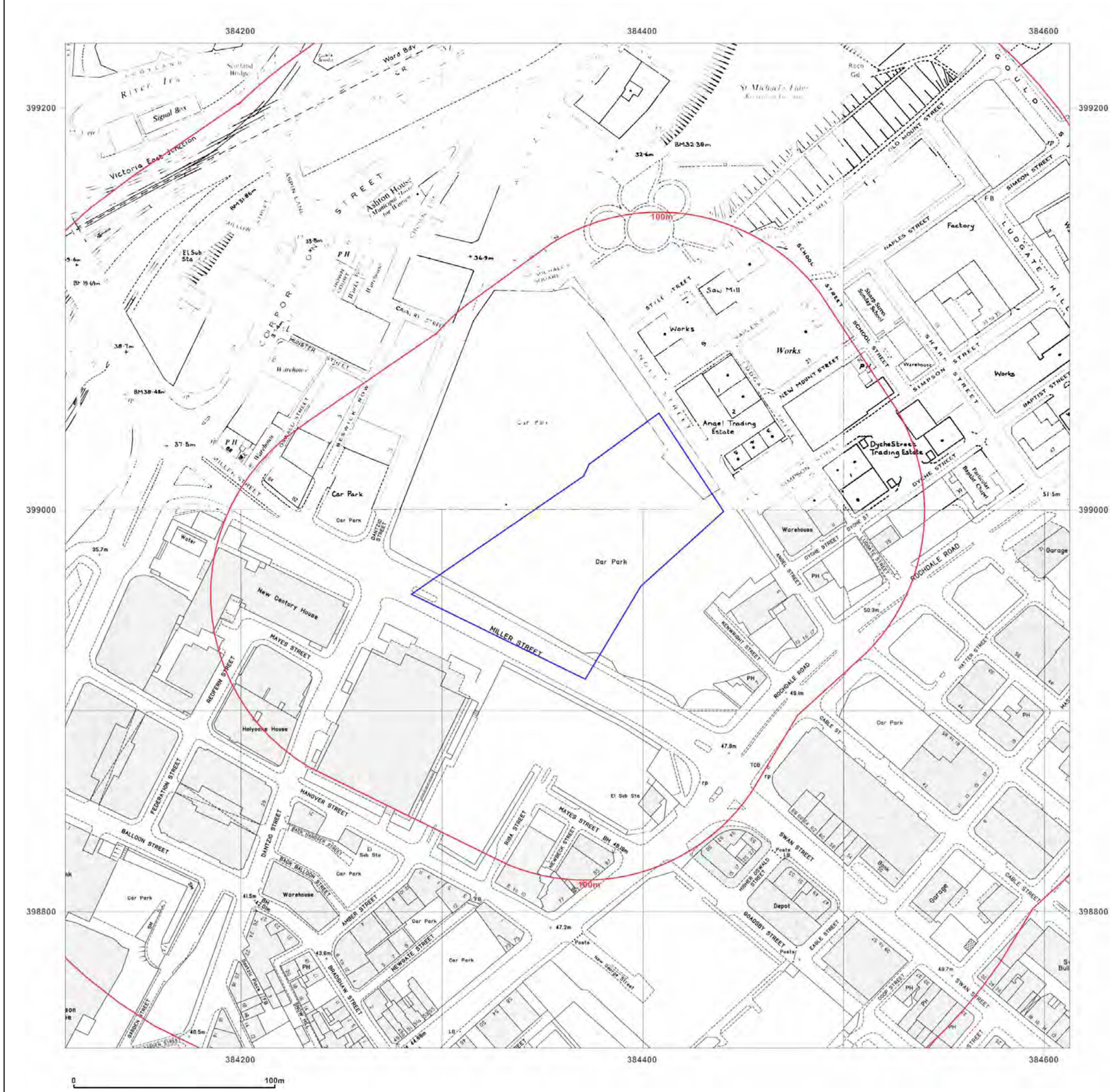
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1984-1988**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed N/A Revised N/A Edition N/A Copyright 1984 Levelled 1964	Surveyed 1964 Revised 1984 Edition N/A Copyright 1984 Levelled 1964
Surveyed 1948 Revised 1985 Edition N/A Copyright 1986 Levelled 1964	Surveyed 1948 Revised 1987 Edition N/A Copyright 1988 Levelled 1964

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1989-1992**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1949 Revised 1989 Edition N/A Copyright 1990 Levelled N/A	Surveyed 1949 Revised 1988 Edition N/A Copyright 1989 Levelled 1964
Surveyed 1992 Revised 1992 Edition N/A Copyright 1992 Levelled N/A	Surveyed 1992 Revised 1992 Edition N/A Copyright 1992 Levelled N/A

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1992-1995**

Scale: 1:1,250

Printed at: 1:2,000

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Revised 1992
Edition N/A
Copyright 1992
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright 1993
Levelled N/A

Surveyed 1995
Revised 1995
Edition N/A
Copyright 1995
Levelled N/A

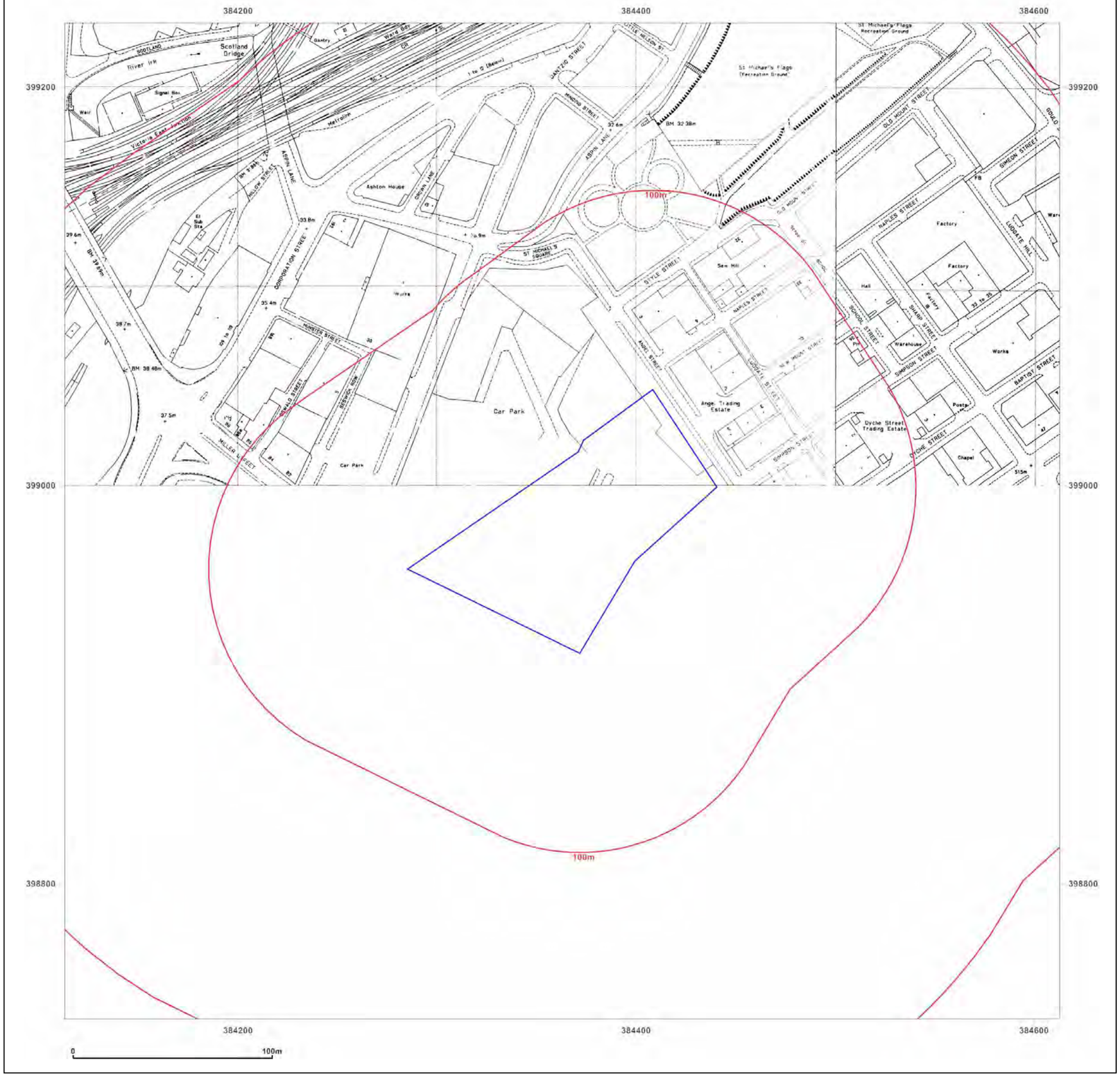
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1993-1995**

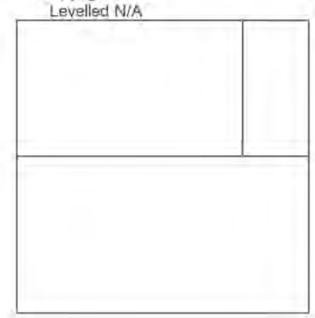
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Printed at: 1:2,000

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Revised 1995
Edition N/A
Copyright 1995
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright 1993
Levelled N/A



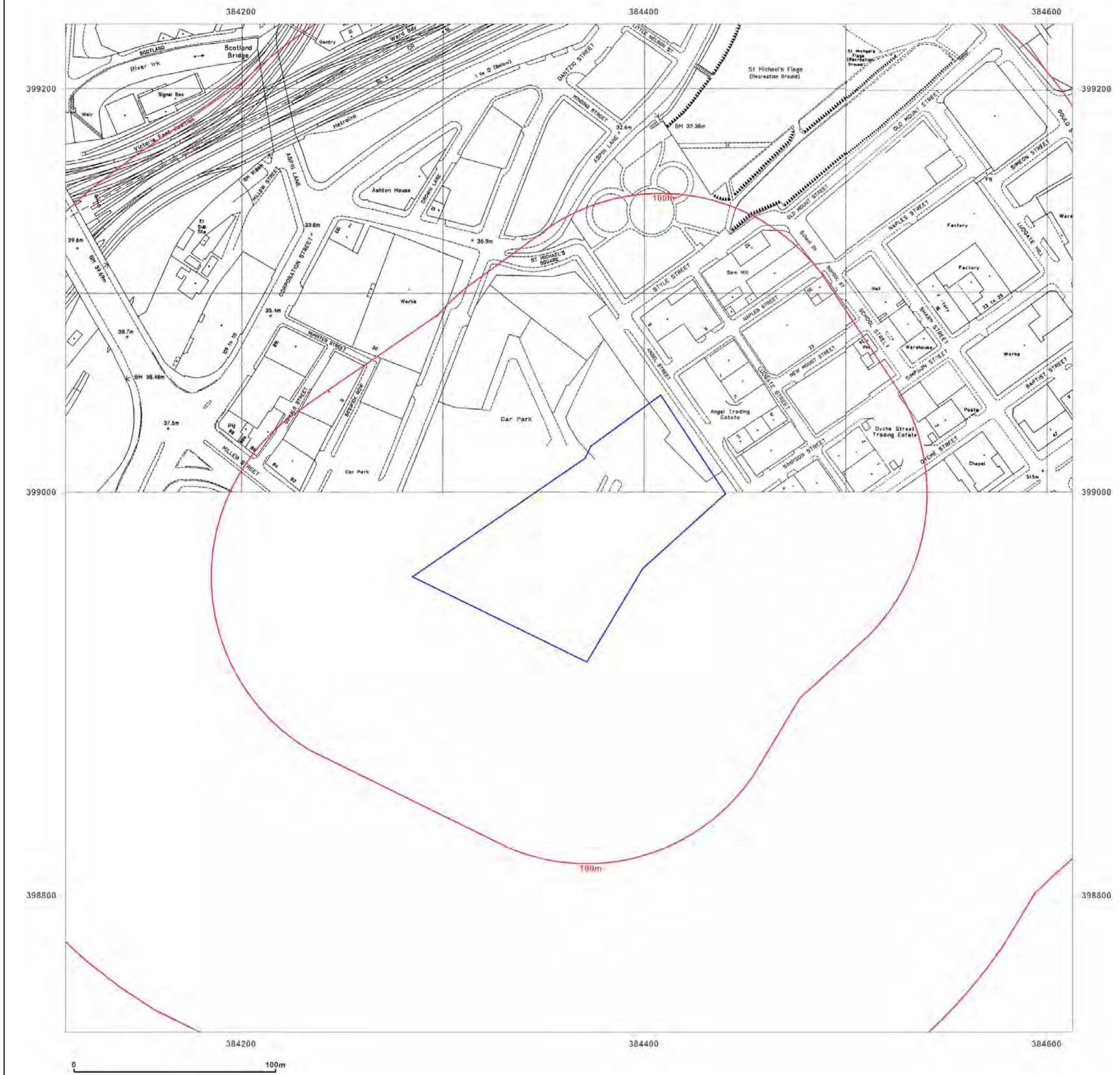
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Production date: 06 August 2019

Map legend available at:
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1994-1995**

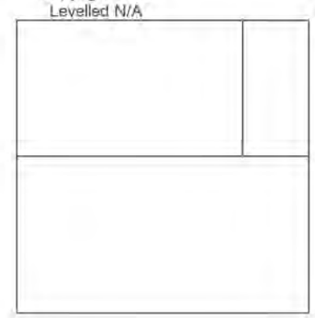
Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1995
Revised 1995
Edition N/A
Copyright 1995
Levelled N/A

Surveyed 1994
Revised 1994
Edition N/A
Copyright 1994
Levelled N/A



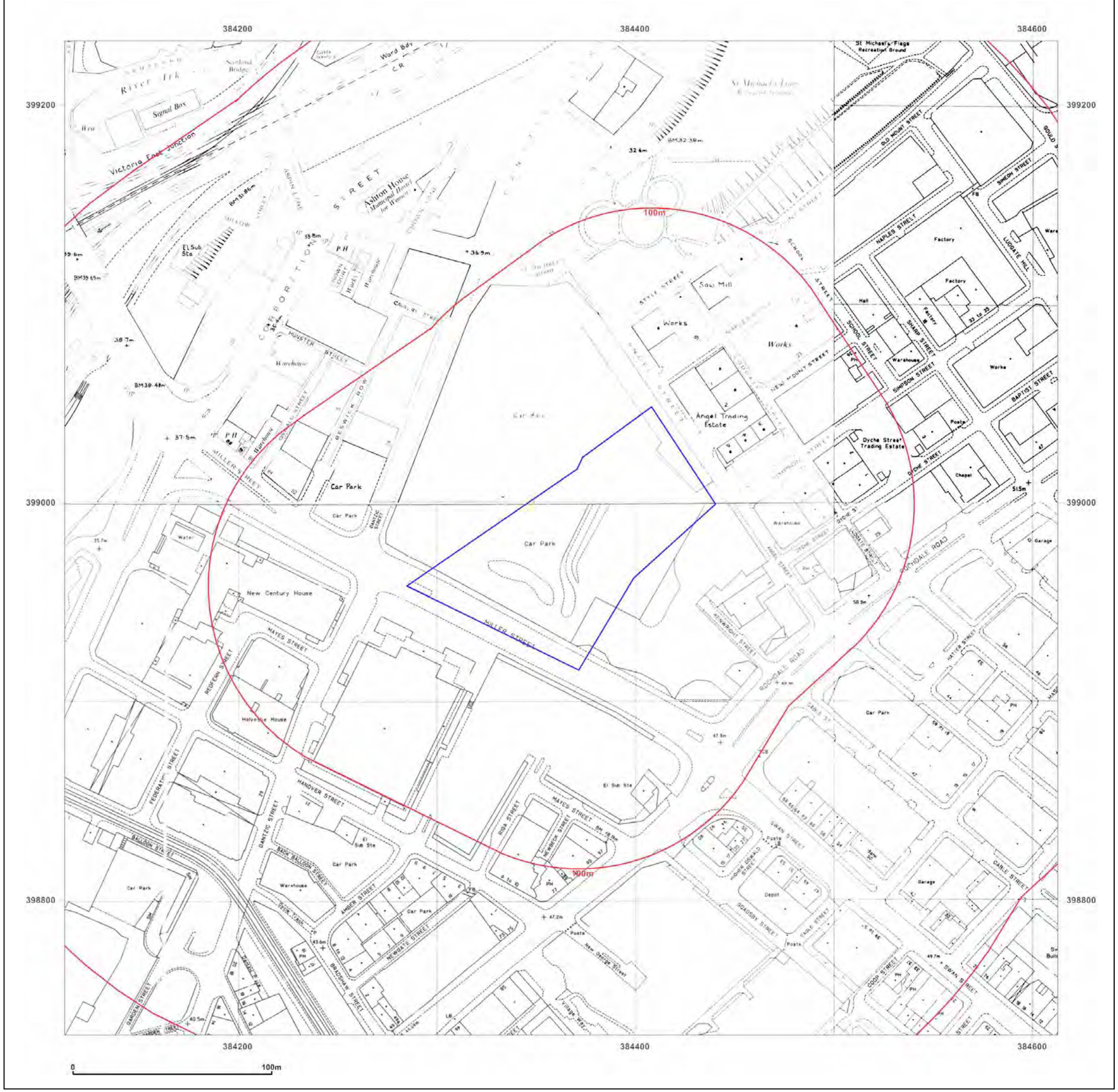
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Groundsure INSIGHTS

Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1990-1995**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1964 Revised 1990 Edition N/A Copyright 1990 Levelled 1964	Surveyed 1992 Revised 1992 Edition N/A Copyright 1992 Levelled N/A
Surveyed 1992 Revised 1992 Edition N/A Copyright 1992 Levelled N/A	Surveyed 1995 Revised 1995 Edition N/A Copyright 1995 Levelled N/A

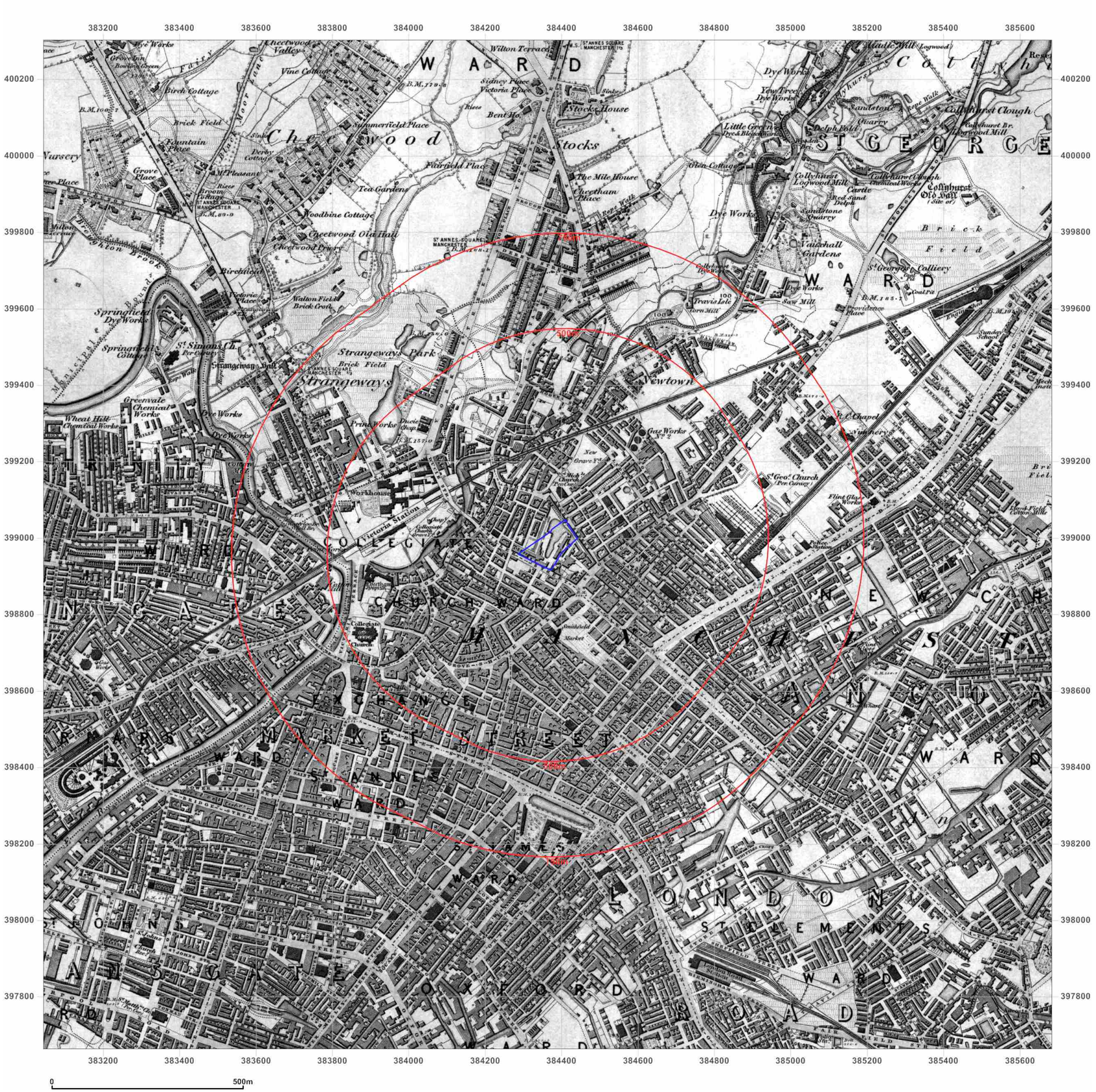
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1848**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1845
Revised N/A
Edition 1848
Copyright N/A
Levelled N/A

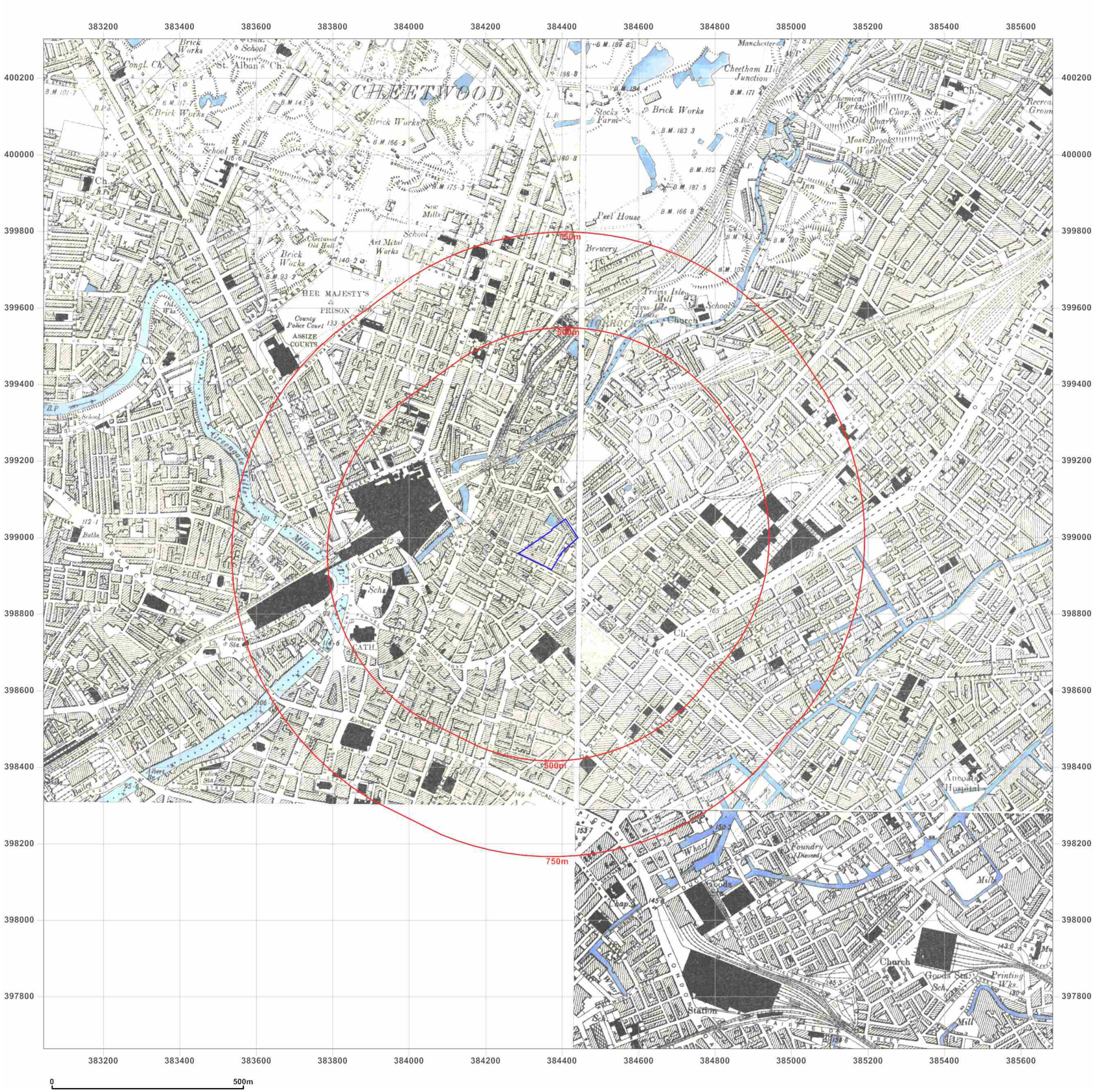
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Production date: 06 August 2019

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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1890-1894**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1889
Revised 1889
Edition 1894
Copyright N/A
Levelled N/A

Surveyed 1891
Revised 1891
Edition 1891
Copyright N/A
Levelled N/A

Surveyed 1890
Revised 1890
Edition 1890
Copyright N/A
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Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1905-1906**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1844
Revised 1906
Edition 1906
Copyright N/A
Levelled N/A

Surveyed 1844
Revised 1906
Edition 1906
Copyright N/A
Levelled N/A

Surveyed 1844
Revised 1905
Edition 1905
Copyright N/A
Levelled N/A

Surveyed 1844
Revised 1905
Edition 1905
Copyright N/A
Levelled N/A

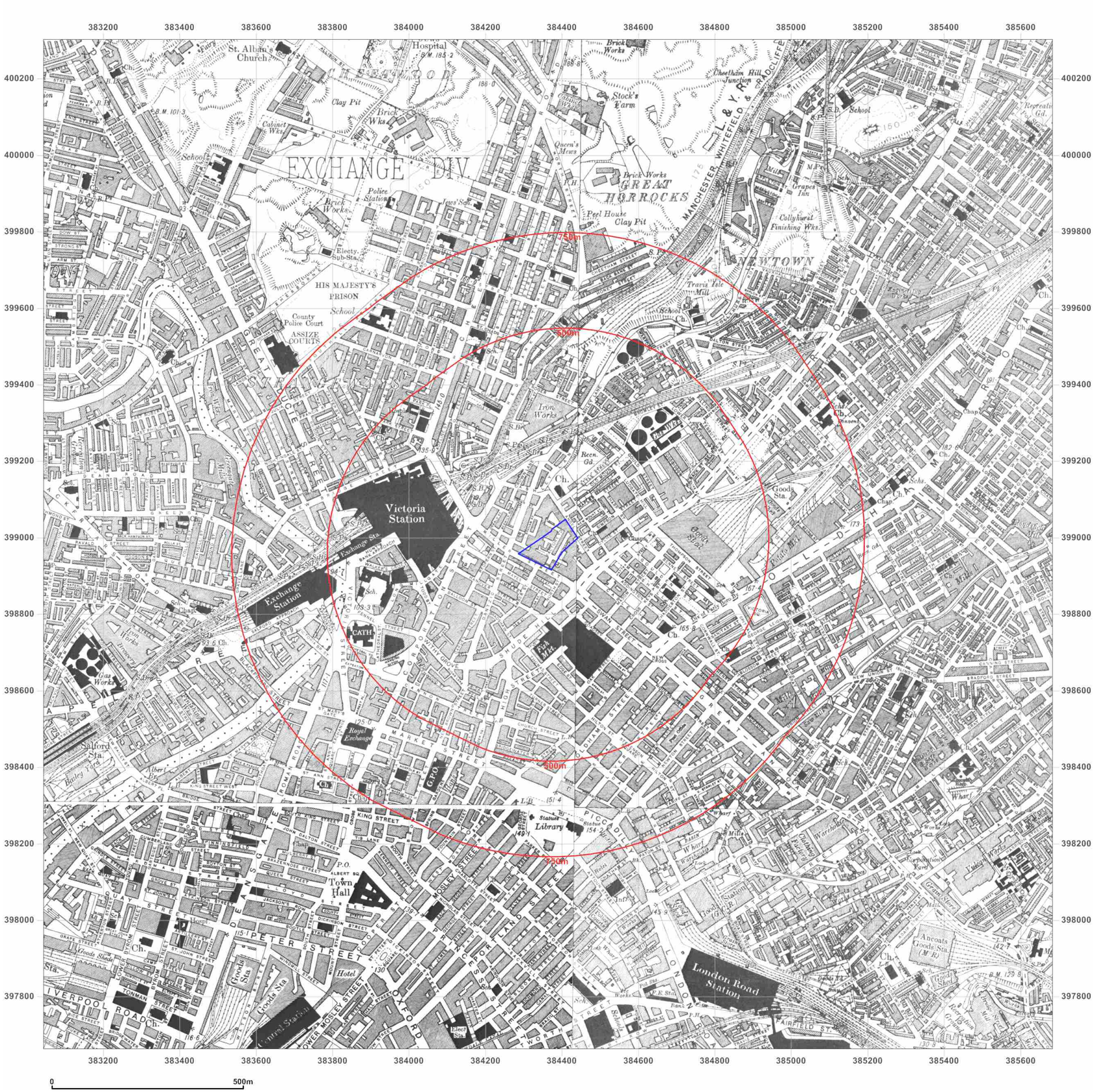
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Groundsure INSIGHTS

Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1923**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1844 Revised 1916 Edition 1923 Copyright N/A Levelled 1915	Surveyed 1844 Revised 1921 Edition 1923 Copyright N/A Levelled 1906
Surveyed 1844 Revised 1916 Edition 1923 Copyright N/A Levelled 1915	Surveyed 1844 Revised 1915 Edition 1923 Copyright N/A Levelled 1915

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Production date: 06 August 2019

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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1923**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1844
Revised 1916
Edition 1923
Copyright N/A
Levelled 1915

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Production date: 06 August 2019

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

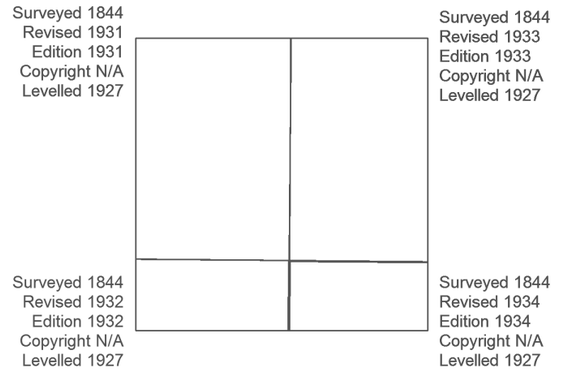
Map Name: County Series

Map date: **1931-1934**

Scale: 1:10,560

Printed at: 1:10,560

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Production date: 06 August 2019

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Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: County Series

Map date: **1938**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1844
Revised 1938
Edition 1938
Copyright N/A
Levelled 1927

Surveyed 1844
Revised 1938
Edition 1938
Copyright N/A
Levelled 1927

Surveyed 1844
Revised 1938
Edition 1938
Copyright N/A
Levelled 1927

Surveyed 1844
Revised 1938
Edition 1938
Copyright N/A
Levelled 1927

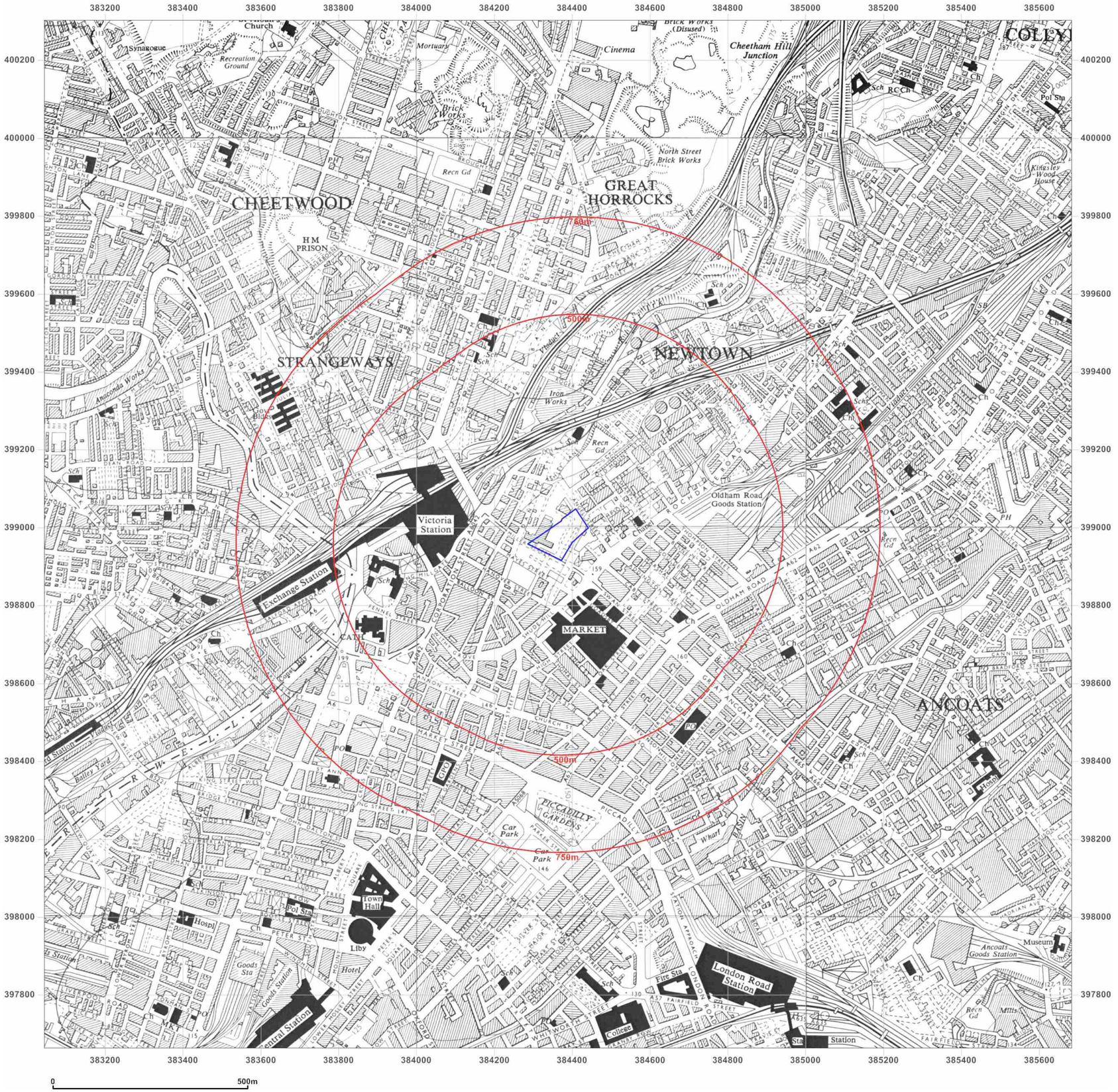
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Site Details:

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Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: Provisional

Map date: **1956**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1956
Revised 1956
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1956
Revised 1956
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1956
Revised 1956
Edition N/A
Copyright 1956
Levelled N/A

Surveyed 1956
Revised 1956
Edition N/A
Copyright 1956
Levelled N/A

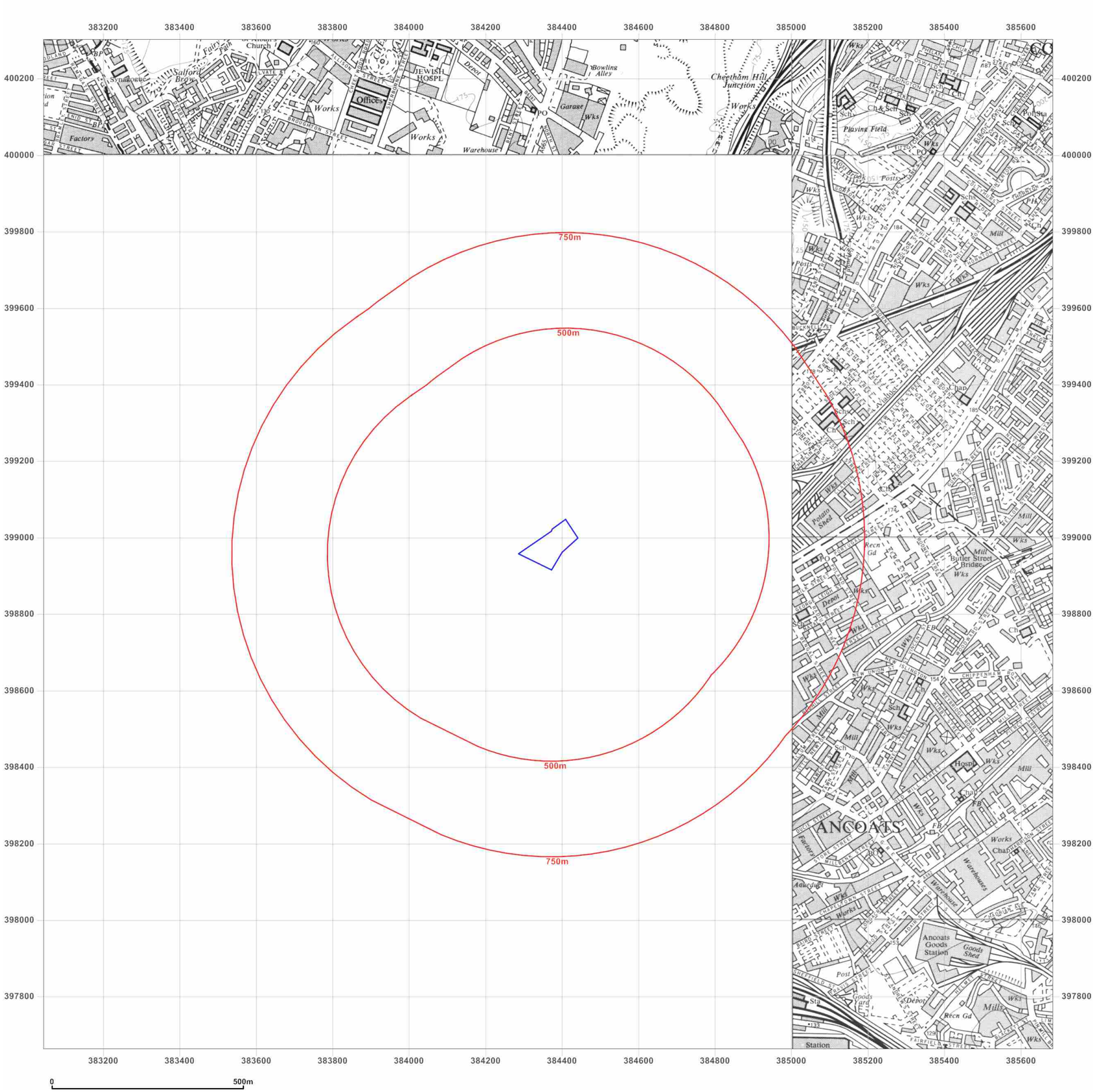
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Production date: 06 August 2019

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: Provisional

Map date: **1966-1968**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1968
Revised 1968
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1966
Revised 1966
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1968
Levelled N/A

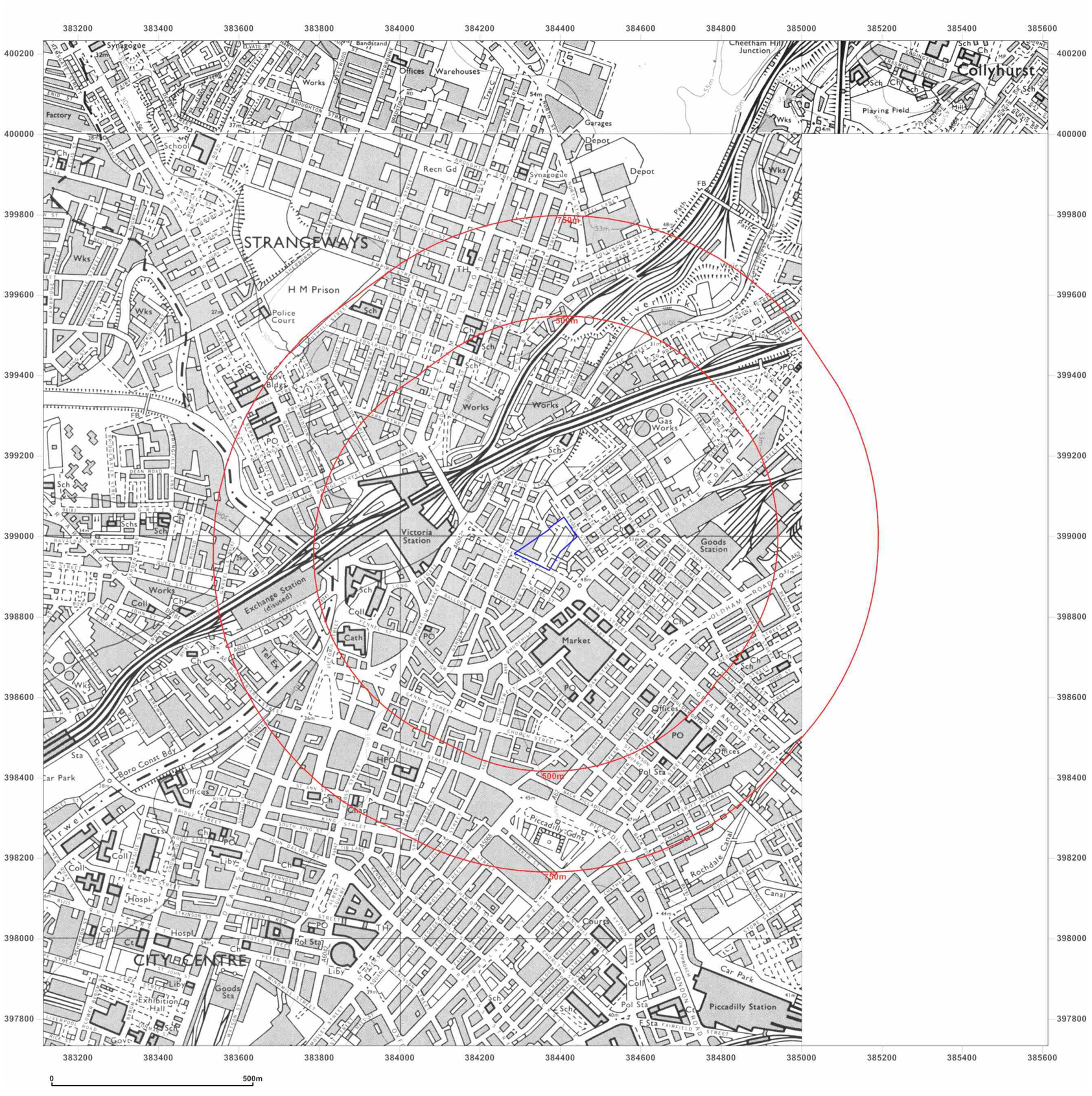
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Production date: 06 August 2019

Map legend available at:
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1972-1977**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1975
Revised 1977
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1975
Revised 1975
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1971
Revised 1972
Edition N/A
Copyright 1972
Levelled 1972

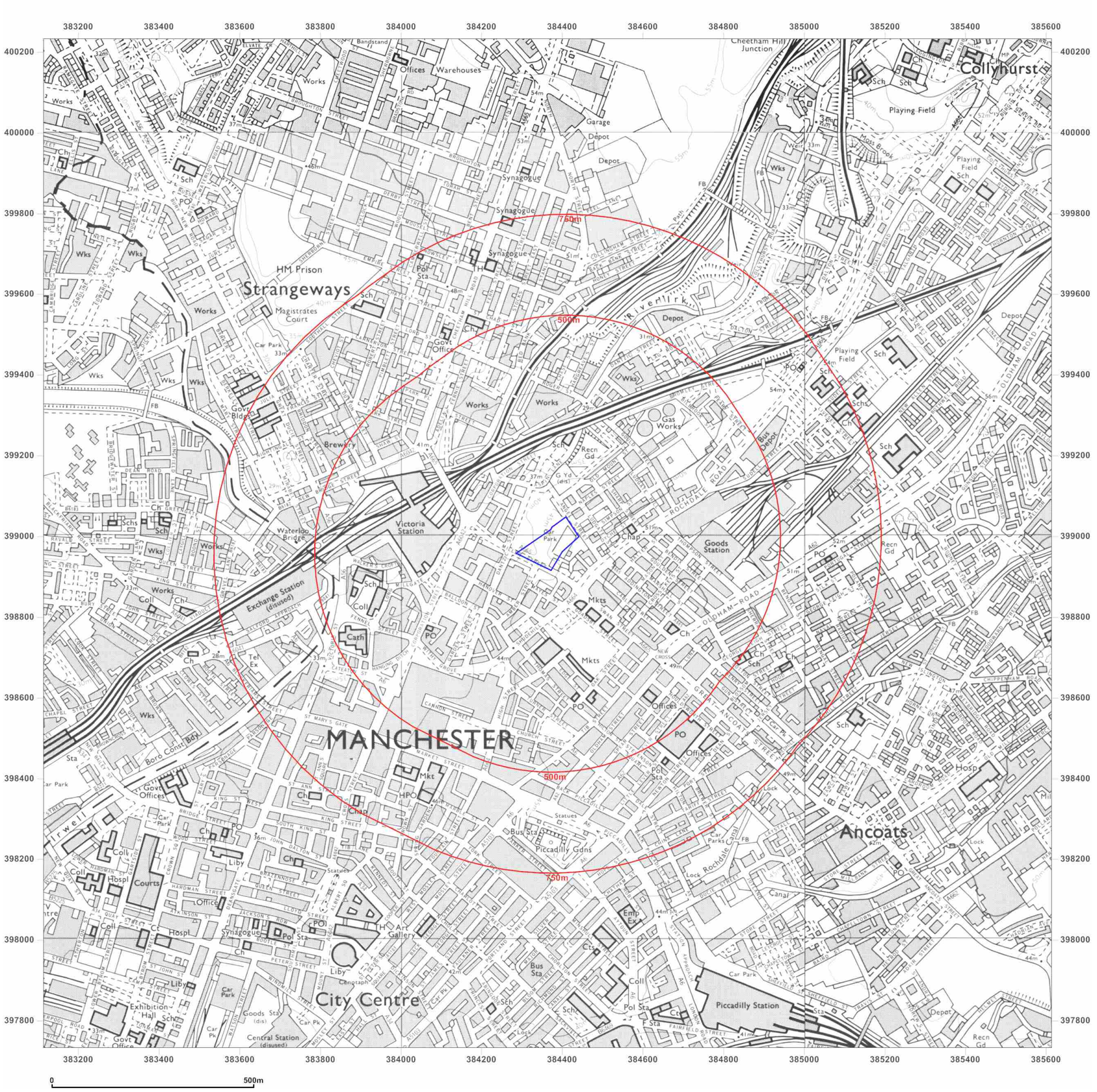
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Production date: 06 August 2019

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1980-1985**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1985
Revised 1985
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1980
Revised 1980
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1976
Revised 1980
Edition N/A
Copyright 1980
Levelled 1976

Surveyed 1976
Revised 1980
Edition N/A
Copyright 1981
Levelled 1976

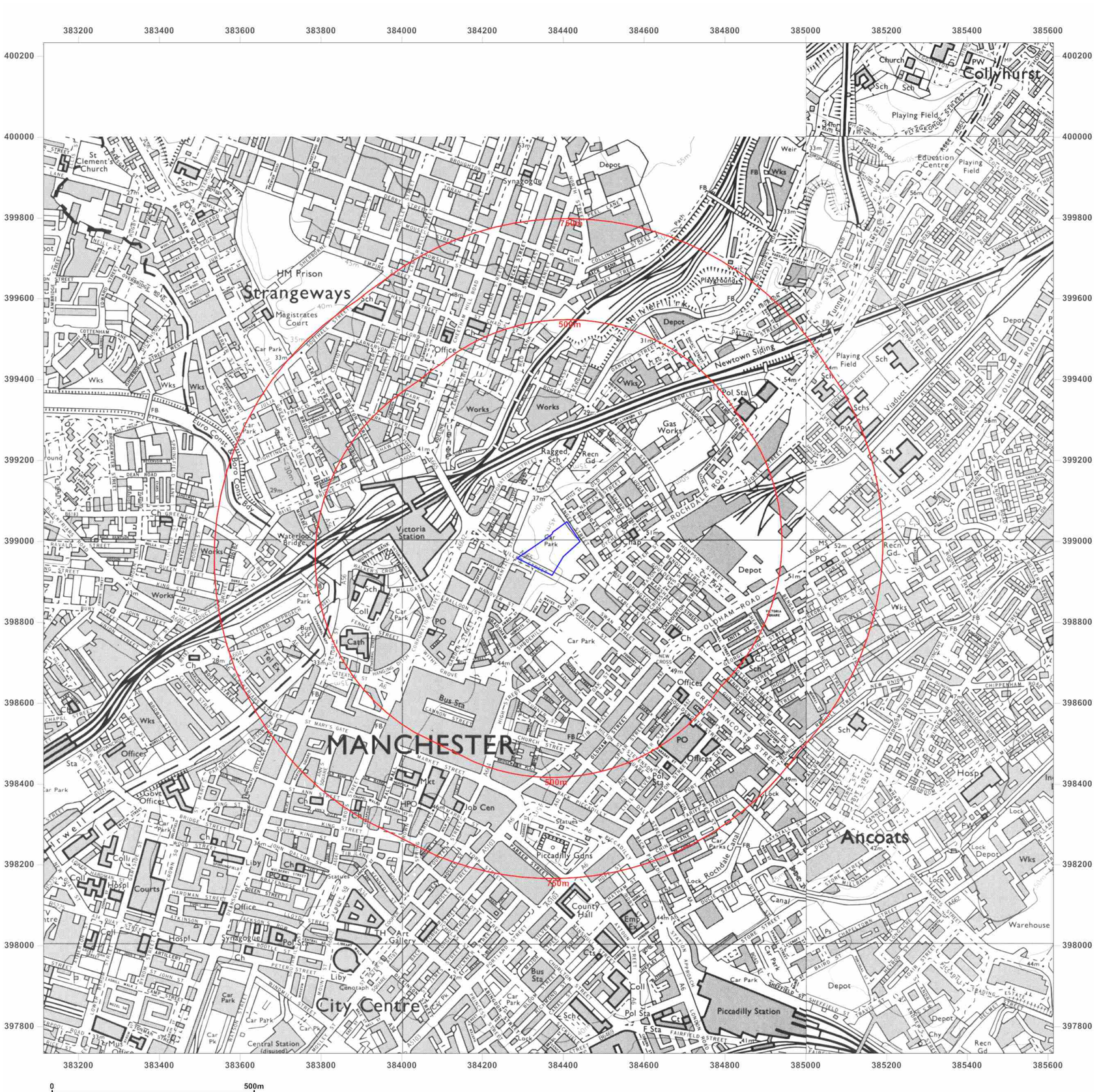
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1985-1988**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1987
Revised 1988
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1983
Revised 1985
Edition N/A
Copyright 1985
Levelled 1981

Surveyed 1985
Revised 1985
Edition N/A
Copyright 1985
Levelled 1981

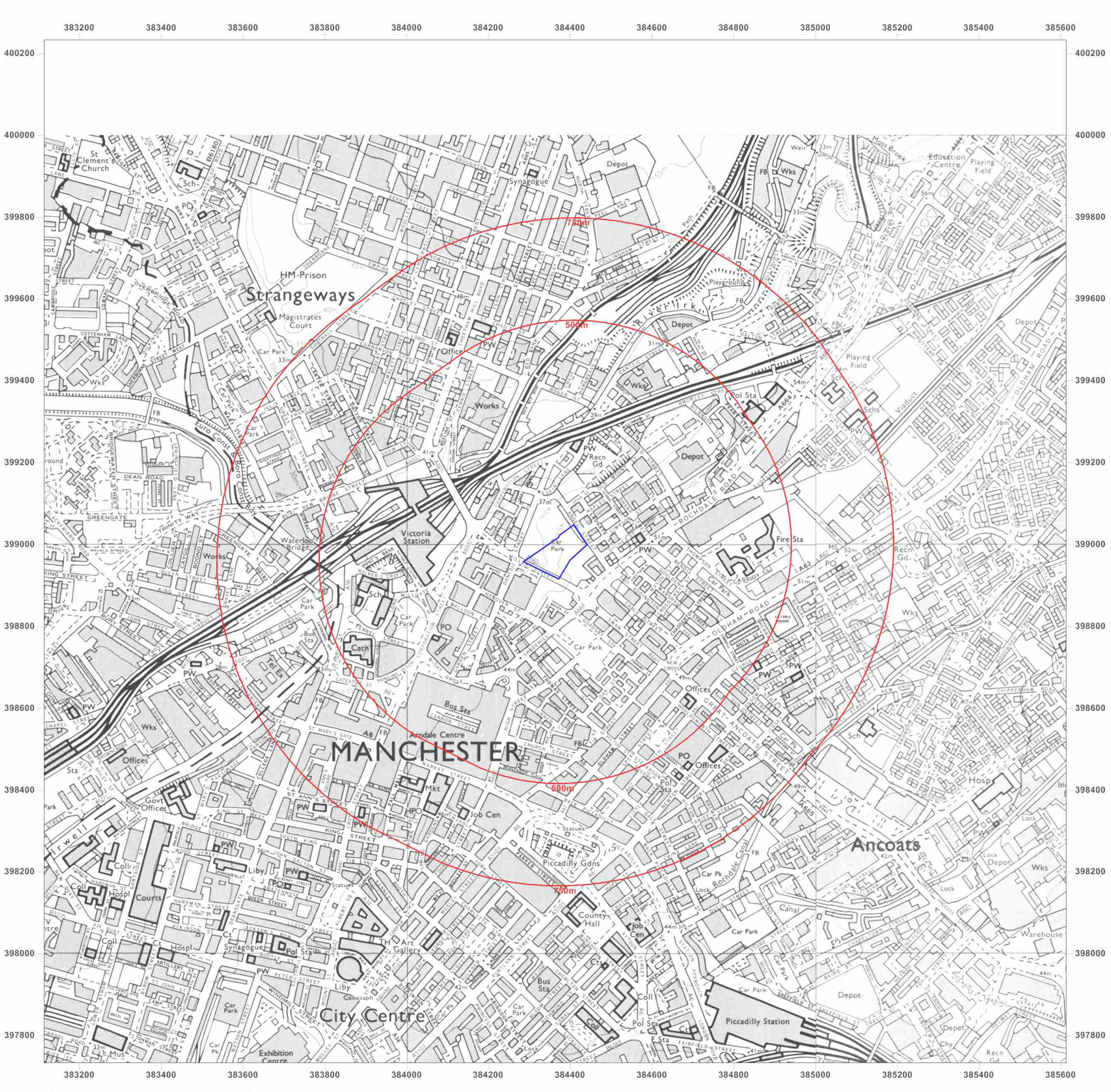
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

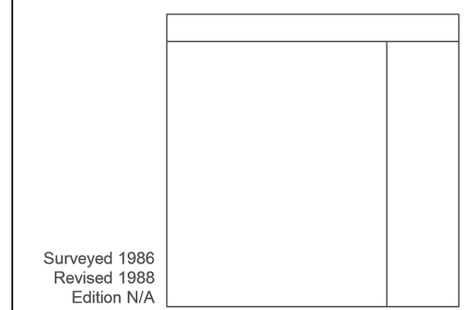
Map Name: National Grid

Map date: **1988-1991**

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1986
Revised 1988
Edition N/A
Copyright 1988
Levelled 1981

Surveyed 1985
Revised 1991
Edition N/A
Copyright 1991
Levelled 1981

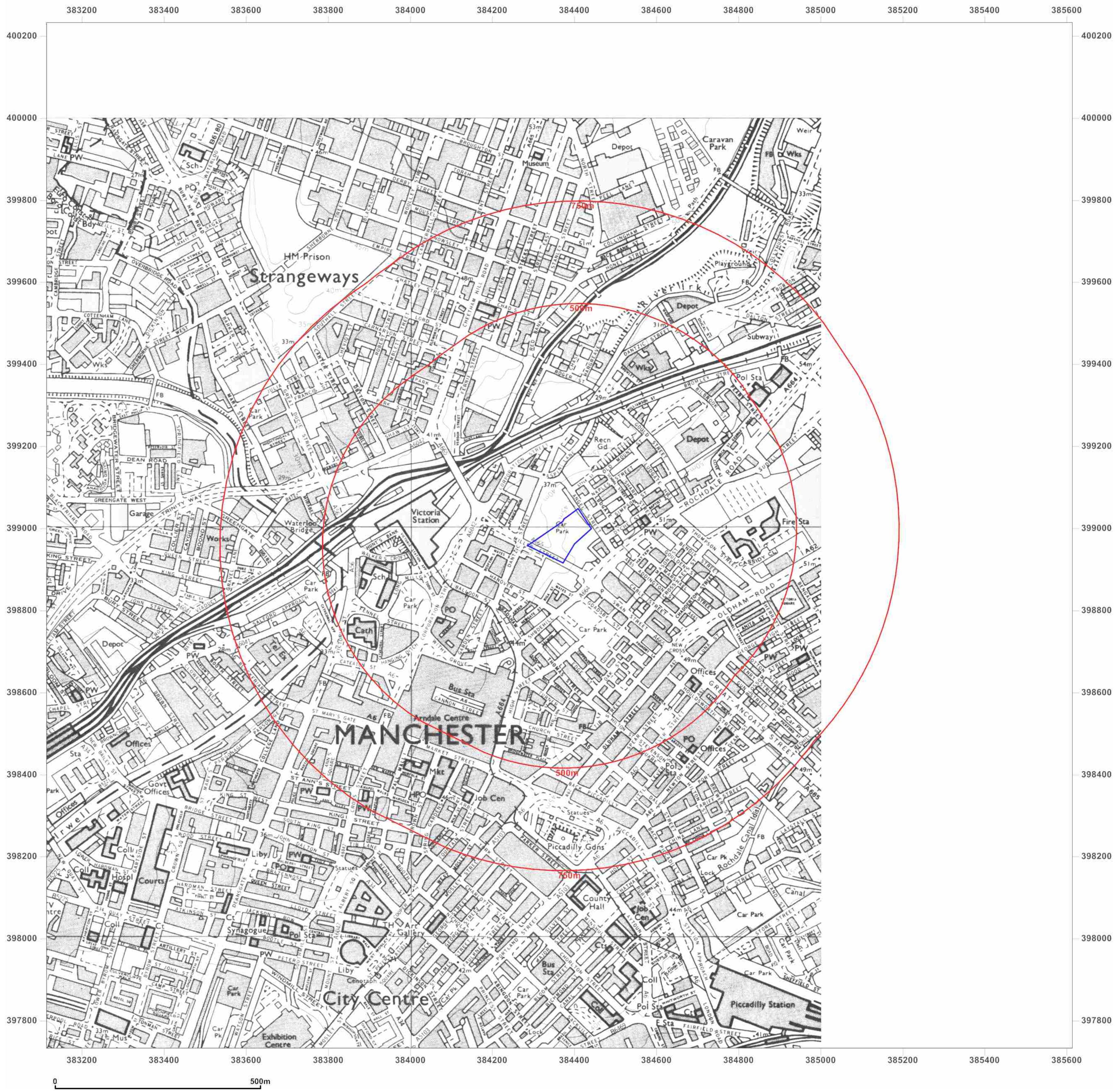
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Groundsure
INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **1994**

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1986
Revised 1994
Edition N/A
Copyright 1994
Levelled 1981

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

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2002

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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

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2010

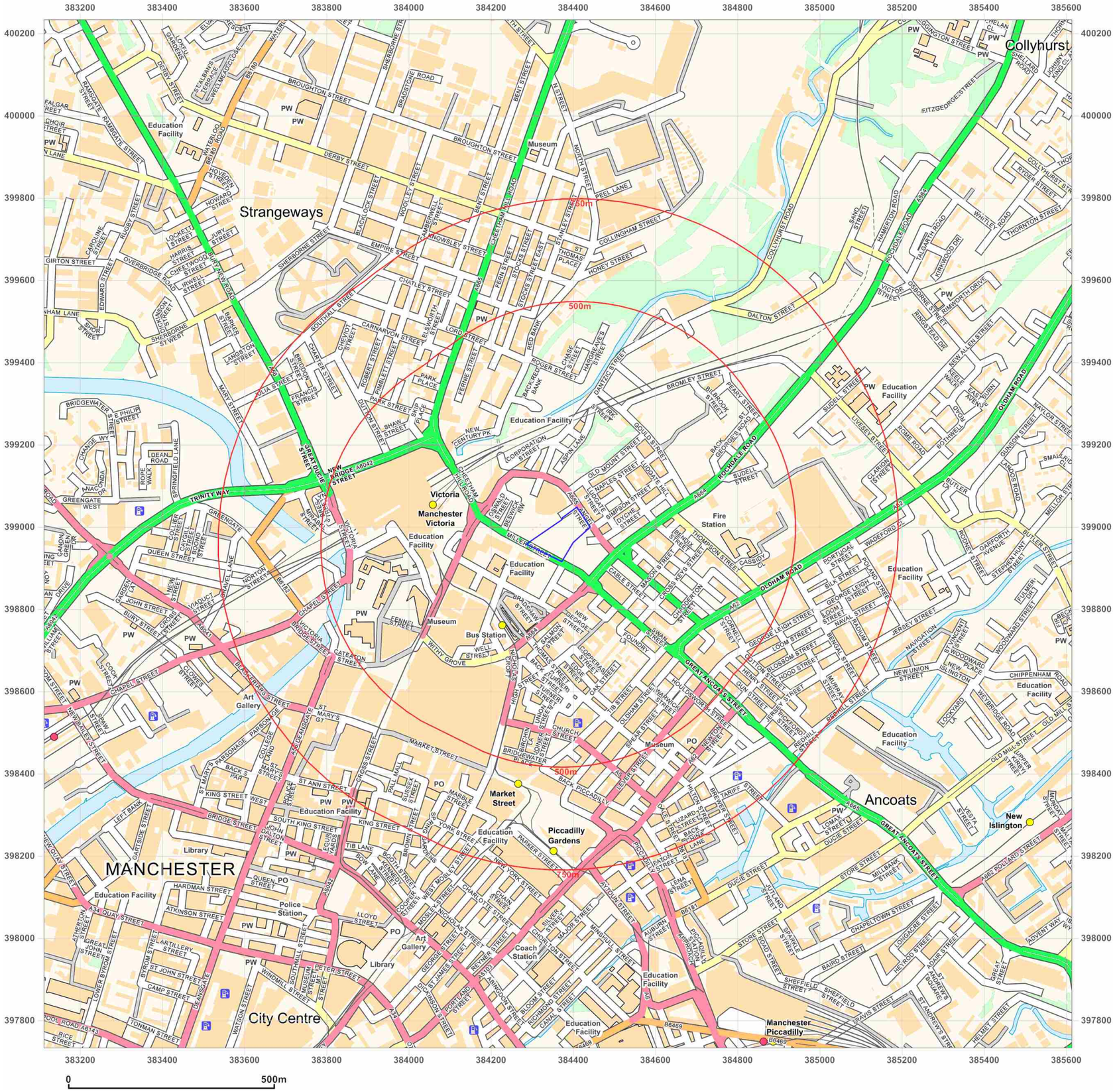
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Groundsure INSIGHTS

Site Details:

2 & 3 Angel Square, M4 4DY

Client Ref: NOMA_2_and_3_Angel_Sq
Report Ref: GS-6225240
Grid Ref: 384363, 398982

Map Name: National Grid

Map date: **2014**

Scale: 1:10,000

Printed at: 1:10,000

N W E S

2014

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Production date: 06 August 2019

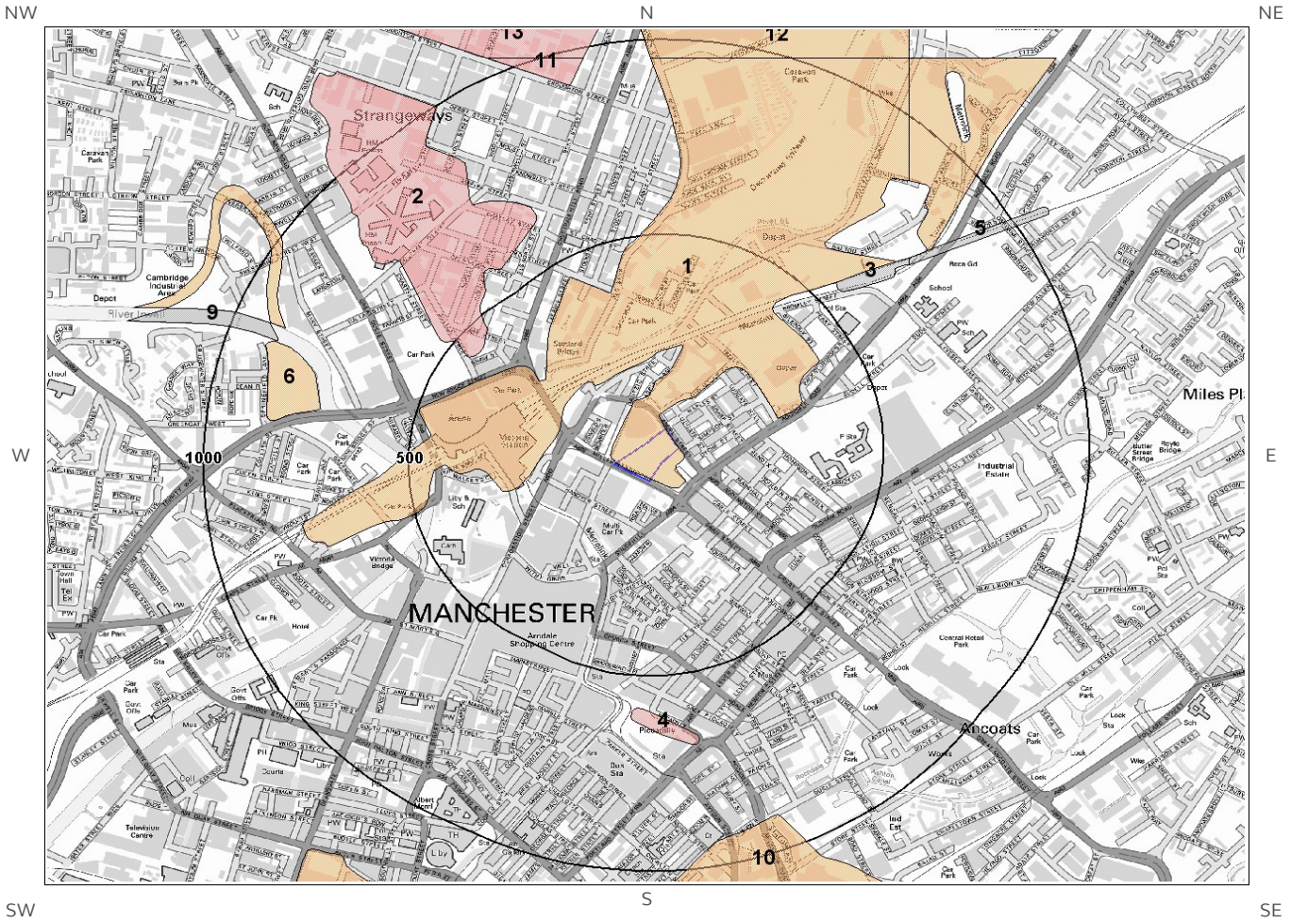
Map legend available at:
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Appendix E Geological Maps, Historical & Recent Borehole Logs

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1 Geology (1:10,000 scale).

1.1 Artificial Ground map (1:10,000 scale)



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Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

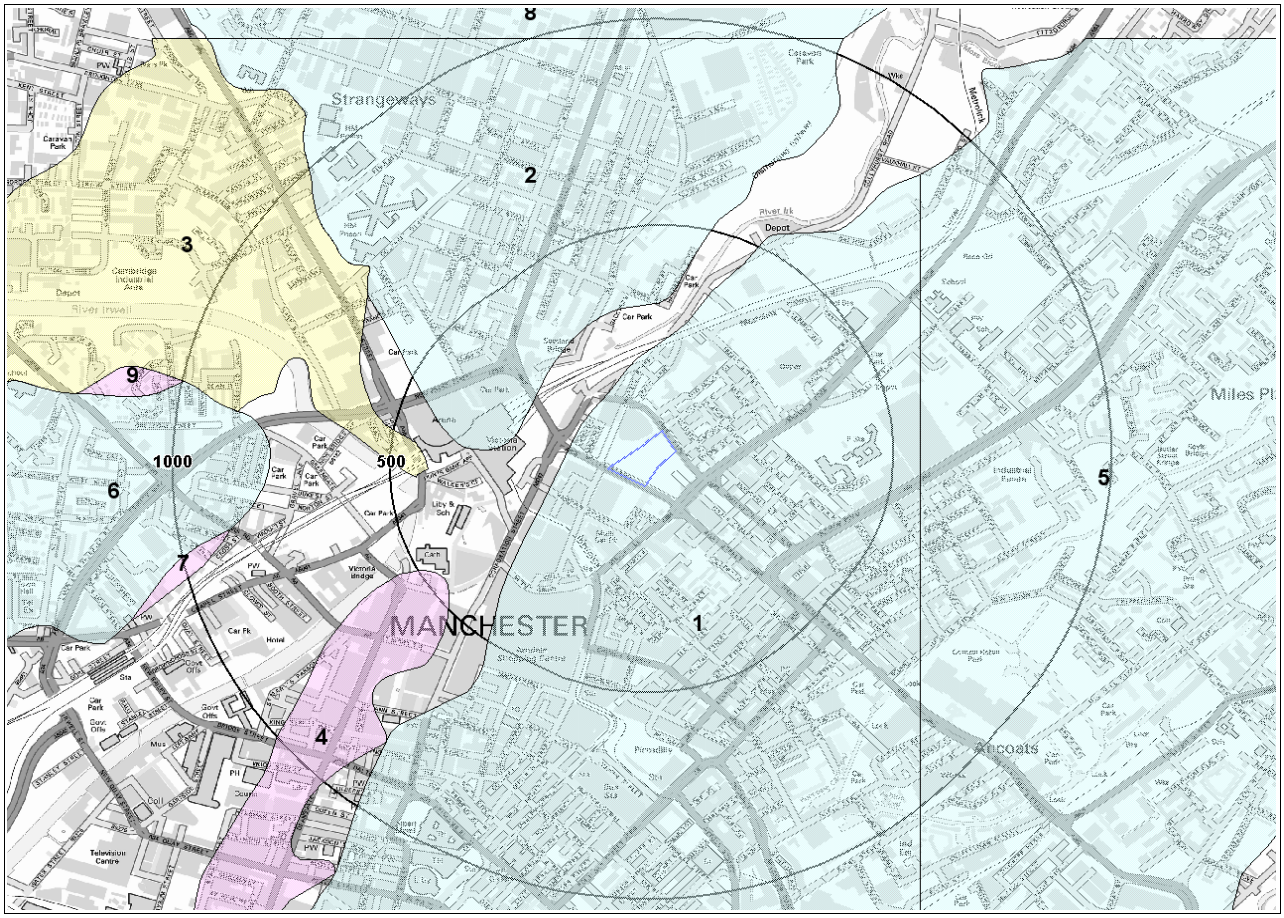
Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

1.2 Superficial Deposits and Landslips map (1:10,000 scale)

NW N NE



W E

SW S SE

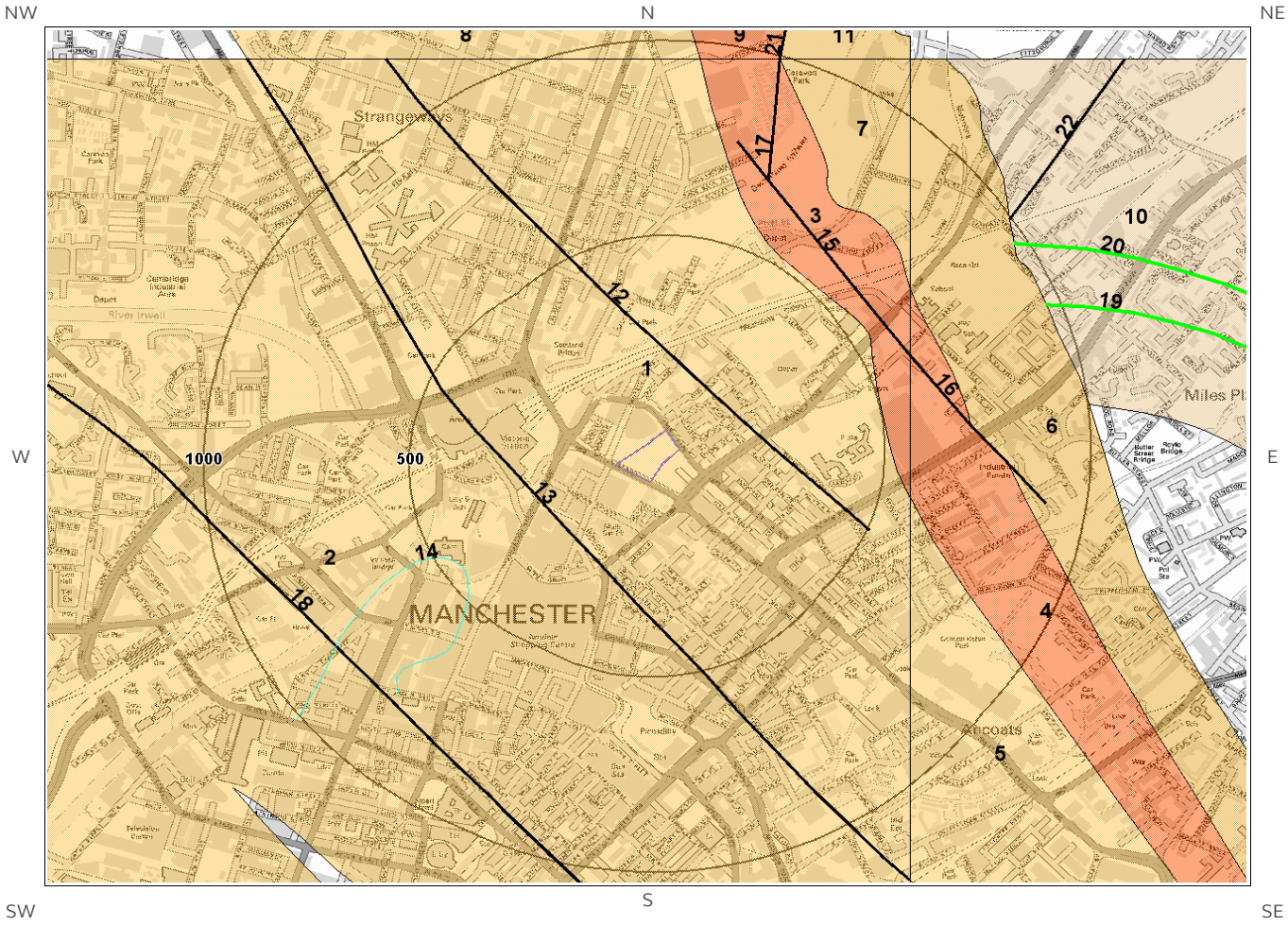
Artificial Ground Legend

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Site Outline

500
1000
Search Buffers (m)

1.3 Bedrock and linear features map (1:10,000 scale)



Bedrock and linear features Legend

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Site Outline

500
1000
Search Buffers (m)

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

SJ 89 NW/[redacted]

Location: MANCHESTER (Miller St) | Task: I.R.O. Schedule 'E' Centre

843 990.

BOREHOLE LOG

Borehole No. A
Ground Level 150·10
Date 9th. – 22nd. June 1968

Note: Slow seepage of ground water at 2'6" cased off at 3'6" borehole dry to 96'0"

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			Metres		
MADE GROUND: Clay, ashes and brick rubble		S269	GL – 150 1'0" 0·31		MADE GROUND
CLAY: soft/firm, silty grey/brown with occasional small stones		S270 S272	1'6" 4'0"		BOULDER CLAY
CLAY: very stiff, silty, grey/brown with small stones and fragments of coal		S273 S275 S277	6'6" 9'0" 11'6"		
SANDY CLAY: brown and gravelly		S279	14'0"		
SAND; Medium/fine, very dense, gravelly, brown		S280	15'0" – 4·57 15'9"		14/28/57 – SC
GRAVEL; Medium/coarse, sandy, poorly graded, very dense, brown		S281	19'0" 5·79 19'9"		17/24/60 – SC
SAND; Medium/fine, variably gravelly, very dense, brown		S282 S283 S285	24'0" 7·32 24'9" 29'3" 33'6" 34'0"		11/30/58 – SC 17/30/61 – SC 8/24/39/50 – SC
SAND; Medium/fine, silty or clayey with occasional stones red/brown		S286	37'0" 11·28 40'0" – 12·19		U4 attempted no recovery

Note: Description of strata is in accordance with B.S. C.P.2001.

Legend:
Disturbed Sample
Undisturbed Sample
Ground Water Level

Standard Penetration Test
Blows per 3" penetration
SC solid cone
OS open spoon

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. 6900 Appendix A Sheet No. 3644

SJ 89 NW/[redacted]

Location MANCHESTER (Miller St.) Task I. R. O. Schedule 'E' Centre [redacted]

BOREHOLE LOG

Borehole No. A (continued)

Ground Level

Date 9th - 22nd June 1968

Note: Percussion borehole to 45'0"
'H' size Rotary bore to 96'0"

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			Metres		
		8287	40'0"		
GRAVEL; Medium / fine sandy		8288			
SAND; fine, silty, grey / brown, very dense, containing pebbles		8289			24/54/24 for 1" = 0S
			45'0"		Core recovery 3'3" (65%)
			48'0"		No core recovered
			53'0"	16.15	
SANDSTONE; Very soft, red / brown medium / fine grained		6912			Core recovery - 3'0" (100 %)
			56'0"		
		6913			Core recovery - 5'0" (100 %)
			61'0"		
		6914			Core recovery - 3'2" (63 %)
			66'0"		
		6915			Core recovery - 3'11" (78 %)
			71'0"		
SANDSTONE; Soft to medium hard coarse grained occasional pebbles many lenses of red marl		6916			Core recovery - 4'0" (82 %)
			76'0"		
		6917			Core recovery - 5'0" (100 %)
			80'0"	24.38	

Note:
Description of strata is in accordance with B.S. C.P.2001.

Legend:
Disturbed Sample
Undisturbed Sample
Ground Water Level

Standard Penetration Test
Blows per 3" penetration
SC Solid cone
OS Open shoe

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. 40[illegible] Appendix A
Sheet No. 3

SJ 89 NW/[illegible]644

Location MANCHESTER (Miller St.)

Task I. R. O. Schadule 'E' Centre

BOREHOLE LOG

Borehole No. A (continued)

Ground Level

Date 9th. - 22 nd June 1968

Note:

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
Many marly laminations and pellets of red marl cement bedding dip 2 - 5°		G918	80'0"	24.38	Core recovery - 5'0" (100%)
		G919	86'0"		Core recovery - 5'0" (100%)
		G920	91'0"		Core recovery - 5'0" (100%)
Borehole completed at 96 ft.			96'0"	29.26	

Note:
Description of strata is in accordance with B.S. C.P.2001.

Legend:
Disturbed Sample
Undisturbed Sample
Ground Water Level

Standard Penetration Test
Blows per 3" penetration
S.C Solid Cone

...ISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. 5/4084 | Appendix A, Sheet No. 4

Location: MANCHESTER (Miller St.) | Task: I. R. O. Schedule 'E' Centre

BOREHOLE LOG

SJ 89 NW [redacted]3645

Borehole No. B
Ground Level 148 · 75
Date 17th – 21st June 1968

Note: No ground water encountered to maximum depth of borehole 45'0"

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			GL	149	
MADE GROUND; Mixture of large rubble and timber		B286			
			11'6"		
SAND; Fine, silty with small stones		B287	12'0"		
			14'0"		
GRAVEL; Large, sandy, brown			14'6"		11/23/61 – SC
		B288			
			19'0"		
			20'0"		16/28/57 – SC
		B301			
			23'0"		
SAND; Medium/fine, gravelly, brown		B302			
			24'6		14/32/61 – SC
GRAVEL; Sandy, well graded, brown		B303			
			29'0"		
			30'0"		18/31/59 – SC
		B304			
			32'6"		33/74 – OS
SAND; Fine, silty and clayey, very dense, red / brown and grey with stones		B305			
		B306			
			40'0"		

Note: Description of strata is in accordance with B.S. C.P. 2001

Legend: Disturbed Sample; Undisturbed Sample; Ground Water Level

Standard Penetration Test: Blows per 3" penetration; SC Solid Cone; OS Open Shoe

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. S/4084 | Appendix A, Sheet No. 5

Location: MANCHESTER (Miller St) | Task: I.R.O. Schedule 'E' Centre

BOREHOLE LOG

SJ89NW 3645 [redacted]

Borehole No. B (continued)

Ground Level

Date

Note:

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
SAND; Fine, silty and clayey, with small stones, grey/brown		B307	40'0"		31/68 - 05
		B308	40'6"		
		B309	44'6"		43/67 - 05
Bore completed at 45'0"					

Note: Description of strata is in accordance with B.S. C.P 2001

Legend: Disturbed Sample; Undisturbed Sample; Ground Water Level

Standard Penetration Test: Blows per 3" penetration; SC Solid cone

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. S/4084 | Appendix A, Sheet No. 8

Location: MANCHESTER (Miller St) | Task: I.R.O. Schedule 'E' Centre

BOREHOLE LOG

3647 SJ 89 NW [redacted]

Borehole No. E
Ground Level 150·48
Date 3rd – 14th July 1968

Note: Seepage of water at 1'0" probably due to recent rain Otherwise borehole dry

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			GL	150	
MADE GROUND: ASHES: LOOSE			1' 0"		
CLAY; silty, grey/brown with fragments of coal and small stones. Firm to stiff becoming very stiff		8208	2' 0"		
			3' 6"		
		8209	4' 6"		
		8210	7' 0"		
			8' 6"		
		8212			
		8213	11' 0"		
			12' 6"		
		8215	13' 6"		
			14' 6"		
SAND; clayey, fine, brown with some stones		8216			9/13/28/31/50 – SC
		8217	16' 0"		
			17' 0"		3/11/23/44 – SC
SAND; fine, silty and gravelly, brown		8218			
			21' 6"		
			22' 0"		2/9/17/53 – SC
GRAVEL; medium/coarse, sandy brown		8219			
			27' 0"		7/7/16/28/39 – SC
		8220			
			32' 0"		3/5/11/25/29/30 – OS
SAND; medium/coarse, gravelly Lt brown		8221			
GRAVEL; medium, sandy, brown		8222			
			36' 6"		28/57/70 – OS
SAND; clayey, brown with some stones		8223			
		8225			

Note: Description of strata is in accordance with B.S. C.P 2001

Legend: Disturbed Sample; Undisturbed Sample; Ground Water Level

Standard Penetration Test: Blows per 3" penetration; SC Solid cone

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. S/4084 Appendix A Sheet No. 16

Location MANCHESTER (Miller St) Task I.R.O. Schedule E Centre

BOREHOLE LOG

3652 SJ 89 NW [redacted]

Borehole No. 1

Ground Level 154·20

Date 8th – 10th July 1968

Note: Borehole dry

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			GL	154	
MADE GROUND: Loose Ash and Brick Fill			5'0"		
CLAY: Silty, variably firm to very stiff, grey/brown with occasional large boulders at depth		8342	6'6"		
		8343			
		8344	10'0"		
			11'6"		
		8346			
		8347	15'0"		U4 sample stopped by Boulder
SAND: Clayey, Stiff, brown containing small stones		8350	16'6"		
SAND: Medium/fine, silty and gravelly, brown, containing occasional bands of coarse sand		7148	18'6"		
		7149	20'0"		28/58 – 05
		7150	24'0"		32/65 – 05
		8250			
Bore completed at 28'6"					

Note: Description of strata is in accordance with B.S. C.P.2001.

Legend: Disturbed Sample; Undisturbed Sample; Ground Water Level

Standard Penetration Test: Blows per 3" penetration; SC Solid cone

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. [redacted] Appendix A
Sheet No. 17

SJ 89 NW/[redacted] 3653

Location: MANCHESTER (Miller St)

Task: I. R. O. Schedule 'E' Centre

BOREHOLE LOG

Borehole No. M
Ground Level 159·25
Date 25th. May to 15th. June 1968

Note: Ground water seepage at 5'0"
Percussion bore to 50'0"
cased to 47'0"

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			GL	159	
MADE GROUND; Large RUBBLE and ASHES with slabs of sandstone at 4 ft.		7991			
		W8254	5' 0"	154	
CLAY; Silty, Firm, grey/brown, containing occasional small pebbles and fragments of coal		7992	6' 0"		
		7994	8' 0"		
		7995	11' 0"		
		7997	13' 0"		
		7998	16' 0"		
		8000	18' 0"		
CLAY; Silty, Very stiff, grey/brown, with small stones and fragments of coal		8251	21' 0"		
		8252	22' 0"		
		8255	24' 0"		
			25' 0"	134	
SAND; Fine, silty, Lt. brown		8256	26' 3"		
		8257	27' 0"		
SAND; Medium / Fine silty and gravelly, dk. brown		8258	31' 0"		
		8259			
			32' 0"	9·91	
SAND; Gravelly, brown		8260	35' 0"		
			36' 0"		
			37' 0"		
SAND; Medium, gravelly brown		8261	40' 0"	12·19	

Note:
Description of strata is in accordance with B.S. C.P.2001.

Legend:
Disturbed Sample
Undisturbed Sample
Ground Water Level
Ground Water Sample W

Standard Penetration Test
Blows per 3" penetration
OS Open Spoon
SC Solid cone

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[SJ89NW BJ 3653 .]

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. SJ 89 NW/3 [redacted] 3653 | Appendix A Sheet No. 18

Location: MANCHESTER (Miller St) | Task: I.R.O. Schedule 'E' Centre

BOREHOLE LOG

Borehole No. M (continued)

Ground Level

Date 25th. May to 6th. June 1968

Note: 'H' size Rotary borehole from 50' 0" to 100' cased to 63' 6"

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			40' 0"	12.19	
SAND; Medium, gravelly, brown with some large cobbles		B202			37/65 - 0S
			42' 6"		
		B203			
			45' 6"	-13.72	
SAND; Medium, Uniform, brown		B204	46' 0"		8/11/14/14/23/29 - 0S
		B206	47' 6"	14.48	
SAND; Medium/fine, silty, red/brown		B207	48' 0"		27/100 - 0S
			50' 0"	15.24	
SAND; Fine silty with pebbles, partially cemented		0901			Core recovery 3' 1" (62%)
			55' 0"		
		0902			Core recovery 3' 0" (60%)
			60' 0"		
			61' 0	18.59	
Band of red Marl			62' 0"	18.90	
		0903			Core recovery 4' 6" (87%)
SANDSTONE; Soft, medium/fine, red/brown with marl pellets and small pebbles			65' 0"		
		0904			Core recovery 4' 0" (80%)
			70' 0"		
		0905			Core recovery 5' 0" (100%)
			75' 0"		
		0906			Core recovery 3' 3" (65%)
			80' 0"	24.38	

Note:
Description of strata is in accordance with B.S. C.P.2001.

Legend:
Disturbed Sample
Undisturbed Sample
Ground Water Level

Standard Penetration Test
Blows per 3" penetration
OS Open spoon
SC Solid cone

W.2037

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MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. [illegible] Appendix A
Part No.

SJ 89 NW/[redacted]

Location: MANCHESTER (Miller St) Task: I.R.O. Schedule 'E' Centre . 3653

BOREHOLE LOG

Borehole No. M (concluded)
Ground Level
Date

Note:

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			80'0"	24·30	
SANDSTONE: Medium hard, coarse, red/brown with occasional laminations and pellets of marl		6907			Core recovery 3'0" (60%)
			85'0"		
		6908			Core recovery 4'0" (80%)
			90'0"		
		6909			Core recovery 5'0" (100%)
			95'0"		
		6910			Core recovery 3'8" (73%)
			100'0"	30·50	
Bore completed at 100'0"					

Note:
Description of strata is in accordance with B.S. C.P.2001.

Legend:
Disturbed Sample
Undisturbed Sample
Ground Water Level

Standard Penetration Test
Blows per 3" penetration
OS Open spoon
SC Solid cone

W.2037

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[SJ89NW BJ 3653 .]

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**01.05.09** End: **13.05.09**	**40.8**	**E:384360.0 N:399101.2**	**1** of **5**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thick ness)	Legend
											MADE GROUND: Dark grey black and reddish brown slightly silty fine to coarse SAND and very angular to subangular fine to coarse GRAVEL of ash, clinker, brick, sandstone, ceramic fragments and coal with frequent angular to subangular cobbles of brick.	(0.70)	
0.40	1	ES	Tubx2+J+VL									0.70	
0.50-1.00	4	B											
0.80	2	ES	Tubx2+J+VL								Brick wall in north face extending from 0.20m to 1.00m depth.	1.00	
1.10	5	ES	Tubx2+J+VL								MADE GROUND: Stiff brown slightly gravelly CLAY with occasional grey mottling and occasional subrounded cobbles up to 150mm diameter. Gravel is subangular to subrounded fine to coarse sandstone, limestone, quartzite and ironstone.	1.20	
1.20	3	D											
1.20-1.70	6	B											
1.70	7	ES	Tubx2+J+VL								Very stiff brown very sandy slightly gravelly CLAY. Gravel is subrounded to rounded fine to coarse quartzite, limestone, sandstone, and ironstone.	(1.50)	
2.20-2.70	8	B									Brown very clayey slightly gravelly fine to medium SAND. Gravel is subrounded to rounded fine to coarse quartzite, limestone, sandstone and ironstone.	2.70	
2.70-3.20	10	B									Pinkish brown fine to coarse SAND and subangular to rounded fine to coarse GRAVEL of quartzite, limestone and sandstone with frequent subrounded to rounded cobbles.		
2.70	9	D											
3.20	11	D										(1.80)	
3.70-4.20	12	B											
4.20	13	D										4.50	
4.50-4.95	1	SPT	N=50								Very dense reddish brown clayey to very clayey fine to medium SAND and subangular to rounded fine to coarse GRAVEL of various lithologies including sandstone, limestone, quartzite, glacial coal and granite.		
	2	B											

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
01/05/09		4.50	4.50	250	Dry
11/05/09	09:45	4.50	4.50	250	Dry
11/05/09	17:30	11.80	11.80	200	Dry
13/05/09	10:30	11.80	11.80	200	Dry
13/05/09	14:30	21.00	11.80	121	21.00
13/05/09	15:40	24.80	11.80	121	15.80
13/05/09	16:00	24.80	11.80	121	16.80
13/05/09	16:20	24.80	11.80	121	15.15

Chiselling

From	To	Duration (hh:mm)
4.50	11.80	07:00

General Remarks

1. Hand dug pit excavated to 1.20m depth on 14.04.09.
2. All faces similar.
3. All faces generally stable. Slightly unstable below 2.70m depth.
4. No groundwater encountered during excavation of trial pit.

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**01.05.09** End: **13.05.09**	**40.8**	**E:384360.0 N:399101.2**	**2** of **5**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thickness)	Legend
6.00	3	D									Very dense reddish brown clayey to very clayey fine to medium SAND and subangular to rounded fine to coarse GRAVEL of various lithologies including sandstone, limestone, quartzite, glacial coal and granite. *(stratum text copied from layer at 4.50m depth from previous sheet)*		
6.00-6.35	4	SPT	N=75*										
	5	B											
												(5.80)	
7.50	6	D											
7.50-7.83	7	SPT	N=83*										
	8	B											
8.00	9	D											
8.00-8.34	10	SPT	N=79*										
	11	B											
9.00	12	D									Below 9.00m, slightly gravelly.		
9.00-9.41	13	SPT	N=57*										
	14	B											
10.00	15	D											
10.00-10.37	16	SPT	N=68*										
	17	B										10.30	
											Orangish brown locally clayey fine to medium SAND.	(0.70)	
												11.00	

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
14/05/09	08:30	24.80	11.80	121	15.10

Chiselling

From	To	Duration (hh:mm)

General Remarks

5. Excavation easy. Moderate below 1.20m depth. Difficult below 2.70m depth.
6. Trial pit terminated at 4.50m depth.
7. 255mm diameter plastic casing installed on completion to enable borehole to be continued at this location.
8. Exploratory hole continued by cable percussive

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler**	AGS

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**01.05.09** End: **13.05.09**	**40.8**	**E:384360.0 N:399101.2**	**3** of **5**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Legend
11.00	18	D									Extremely weak red brown locally purplish brown fine to medium grained SANDSTONE.		
11.00-11.43	19	SPT	N=54*									(0.80)	
	20	B										11.80	
11.80-12.80											Very weak locally extremely weak locally weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, highly weathered locally completely weathered to red brown slightly gravelly fine to medium sand. Subhorizontal to horizontal bedding fractures very closely to closely spaced planar smooth tight locally partially open locally weakened with sand infill.		
11.80	21	D									11.80-12.01m : Assumed zone of core loss.		
11.80-11.91	22	SPT	N=429*								12.01-12.10m : Non intact.		
12.33-12.45	23	C		79	69	58							
12.80-14.30							NI						
13.03-13.13	24	C					60						
							119						
				99	95	61		100% return Foam					
14.30-15.80											14.30-14.35m : Non intact. Below 14.30m, bedding fractures closely to medium spaced locally extremely closley to very closely spaced.		
14.92-15.11	25	C		100	97	83							
							NI						
							130						
							290						
15.80-17.30												(8.39)	
				97	91	65							

Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	techniques from 4.50m depth. 9. Cable percussive borehole terminated at 11.80m depth. 10. Exploratory hole continued by rotary drilling techniques from 11.80m depth. 11. Falling head permeability tests conducted at 24.80m depth on 12.05.09 and 13.05.09.

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**01.05.09** End: **13.05.09**	**40.8**	**E:384360.0 N:399101.2**	**4** of **5**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Legend
											Very weak locally extremely weak locally weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, highly weathered locally completely weathered to red brown slightly gravelly fine to medium sand. Subhorizontal to horizontal bedding fractures very closely to closely spaced planar smooth tight locally partially open locally weakened with sand infill.		
16.98-17.06	26	C		97	91	65					11.80-12.01m : Assumed zone of core loss. *(stratum text copied from layer at 11.80m depth from previous sheet)*		
17.30-18.80				98	96	85	NI 130 290				16.93-16.98m : Non intact. 17.65-17.70m : Very narrow orangish brown staining up to 3mm thick.		
18.80-20.30													
19.04-19.15	27	C		95	91	79		100% return Foam			19.21-19.23m : Very narrow orangish brown staining up to 3mm thick.		
												20.19	
20.30-21.80							NI 35 60				20.16-20.19m : Band of orangish yellow brown fine to coarse sand. Extremely weak to very weak thinly laminated red brown MUDSTONE, completely to highly weathered. Subhorizontal to horizontal bedding fractures intersecting and interlocking with subvertical to vertical fractures extremely closely to very closely spaced planar smooth tight and clean. 20.21-20.68m : Assumed zone of core loss. 20.70-20.78m : Non intact.	(0.69)	
												20.88	
21.02-21.14	28	C		75	69	45	NI 200 420				*Description on next sheet*		
21.80-23.30				95	85	73					21.80-21.95m : Predominantly non intact.		

Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**01.05.09** End: **13.05.09**	**40.8**	**E:384360.0 N:399101.2**	**5** of **5**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thick ness)	Legend
				95	85	73					Very weak locally extremely weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, highly weathered. Subhorizontal to horizontal bedding fractures closely to medium locally very closely spaced planar smooth tight. *(stratum text copied from layer at 20.88m depth from previous sheet)*	(3.92)	
22.88-22.95	29	C									22.70-22.80m : Vertical fracture.		
23.30-24.80							NI 200 420	100% return Foam			23.20-23.30m : Subvertical fracture.		
				100	98	79							
24.69-24.80	30	C										24.80	
											Borehole terminated at 24.80m depth.		

Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**02.05.09** End: **15.05.09**	**42.9**	**E:384344.2 N:399048.0**	**1** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thickness)	Legend
											MADE GROUND: Tarmac.	0.05	
											MADE GROUND: Dark grey fine to coarse SAND and angular to subrounded fine to medium GRAVEL of limestone and sandstone.	0.20	
0.20	1	ES	Tubx2+J+VL										
0.50	3	ES	Tubx2+J+VL								MADE GROUND: Stiff friable sandy gravelly CLAY. Gravel is very angular to subrounded fine to coarse brick, sandstone, mudstone, ceramic and possible clinker. Locally very clayey gravelly sand. 0.70m, Abandoned cast iron drainage pipe.	(0.90)	
0.50-1.00	5	B											
0.60-1.10	2	ES	Tubx2+J+VL										
1.00	4	ES	Tubx2+J+VL									1.10	
1.10-1.40	8	B									MADE GROUND: Very stiff brown sandy locally very sandy slightly gravelly to gravelly CLAY. Gravel is subangular to rounded fine to medium sandstone, mudstone, coal and quartzite. Locally very clayey slightly gravelly sand. 1.10m, Abandoned cast iron drainage pipe.	(0.40)	
1.20	6	D											
1.30	7	ES	Tubx2+J+VL									1.50	
2.00-2.50	11	B									MADE GROUND: Light brown slightly gravelly fine to medium SAND. Gravel is subrounded to rounded fine to coarse sandstone. Clay strata above continues from 1.10 to 2.50m in south east side of trial pit. Below 1.50m, 2 No. vertical clay drainage pipes in both north and south faces of trial pit.	(2.50)	
2.00	9	ES	Tubx2+J+VL										
2.50	10	ES	Tubx2+J+VL										
3.50-4.00	12	B									3.70m, Horizontal clay drainage pipe in south face.	4.00	
4.00	13	ES	Tubx2+J+VL								Very stiff brown sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse sandstone, mudstone and coal.	4.30	
4.50-4.92	1	SPT	N=57*								Very dense reddish brown clayey to very clayey gravelly to gravelly fine to medium SAND. Gravel is subangular to rounded fine to coarse various lithologies including sandstone, quartzite, limestone and glacial coal.		
	14	D											
	15	B											
	2	B											

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
02/05/09		1.00	None	N/R	1.00
02/05/09		4.50	4.50	255	Dry
12/05/09	09:00	4.50	4.50	200	Dry
12/05/09	12:30	10.50	10.50	200	Dry
14/05/09	14:00	10.50	10.50	121	Dry
14/05/09	17:45	17.50	10.50	121	17.50
14/05/09	18:45	20.50	10.50	121	18.10
15/05/09	08:30	20.50	10.50	121	16.30

Chiselling

From	To	Duration (hh:mm)
4.50	10.50	00:00

General Remarks

1. Hand dug pit excavated to 1.20m depth on 15.04.09.
2. All faces similar, save where noted.
3. All faces slightly unstable.
4. Slight groundwater seepage at 1.00m depth.
5. Excavation easy. Moderate below 4.30m depth.
6. Trial pit terminated at 4.50m depth.

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler + RLaw**	AGS

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**02.05.09** End: **15.05.09**	**42.9**	**E:384344.2 N:399048.0**	**2** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thickness)	Legend
5.50-5.73	4 17 5	SPT D B	N=130*								Very dense reddish brown clayey to very clayey gravelly to gravelly fine to medium SAND. Gravel is subangular to rounded fine to coarse various lithologies including sandstone, quartzite, limestone and glacial coal. *(stratum text copied from layer at 4.30m depth from previous sheet)*		
6.50-6.69	7 7 8	SPT D B	N=143*									(5.90)	
7.50	9	D											
9.00	10	D											
9.10-9.15	11 12	SPT B	N=300*										
10.10	13	D										10.20	
10.20-10.35	14 15	SPT B	N=214*								Extremely weak red brown fine to medium grained SANDSTONE.	10.50	
10.50-12.00											*Description on next sheet*		
10.50-10.68	17 17	SPT D	N=150*	40	27	0	NI 20 90						

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
15/05/09	11:00	24.50	10.50	121	20.30
15/05/09	12:20	24.50	10.50	121	20.40
15/05/09	12:40	24.50	10.50	121	19.20
15/05/09	14:10	24.50	10.50	121	15.51
15/05/09	14:40	24.50	10.50	121	15.98

Chiselling

From	To	Duration (hh:mm)

General Remarks

7. 255mm diameter plastic casing installed on completion to enable borehole to be continued at this location.
8. Exploratory hole continuted by cable percussive techniques from 4.50m depth.
9. Cable percussive borehole terminated at 10.50m depth.

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler + RLaw**	AGS

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	End: **15.05.09**	**42.9**	**E:384344.2 N:399048.0**	**3** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thick ness)	Legend
				40	27	0					Extremely weak, locally very weak, indistinctly thinly laminated orangish red brown fine to medium locally coarse grained SANDSTONE, completely locally highly weathered to orangish red brown very gravelly fine to medium sand. Gravel is very angular to angular fine to coarse lithorelicts. Subhorizontal to horizontal bedding fractures locally intersected by subvertical fractures extremely closely to very closely spaced planar smooth.		
11.61-11.66	19	C											
11.94-11.98	20	C										(3.00)	
12.00-13.50							NI 20 90				10.50-11.40m : Assumed zone of core loss. *(stratum text copied from layer at 10.50m depth from previous sheet)* 11.40-11.60m : Predominantly non intact. 12.00-12.62m : Assumed zone of core loss.		
				59	12	0					12.62-13.00m : Predominantly non intact.		
13.20	18	D									13.12-13.44m : Predominantly non intact. 13.20m, Narrow band of soft red brown clay (residual mudstone).	13.50	
13.50-14.50								100% return Foam			Extremely weak to very weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, completely to highly weathered. Subhorizontal to horizontal bedding fractures very closely to closely spaced planar smooth tight locally intersected by subvertical to vertical fractures.		
13.62-13.70	21	C											
				100	100	36							
14.50-16.00											14.50-14.68m : Assumed zone of core loss.		
							NI 60 230				15.00-15.33m : Extremely closely spaced intersecting and interlocking subhorizontal and subvertical fractures.		
				88	57	34							
15.40-15.51	22	C									15.68-16.76m : Non intact and completely weathered.	(4.90)	
16.00-17.50													
				97	86	45					16.18-16.25m : Band of extremely weak thinly laminated red brown mudstone.		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling

From	To	Duration (hh:mm)

General Remarks

10. Exploratory hole continued by rotary drilling techniques from 10.50m depth.
11. Falling head permeability test conducted at 24.50m depth on 15.05.09.

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler + RLaw**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	End: **15.05.09**	**42.9**	**E:384344.2 N:399048.0**	**4** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instru-mentation	Water	Description of Strata	Depth (Thick ness)	Legend
16.97-17.06	23	C		97	86	45	NI 60	100% return Foam			Extremely weak to very weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, completely to highly weathered. Subhorizontal to horizontal bedding fractures very closely to closely spaced planar smooth tight locally intersected by subvertical to vertical fractures. *(stratum text copied from layer at 13.50m depth from previous sheet)*		
17.50-19.00							230				16.77m, Very narrow band of extremely weak thinly laminated red brown mudstone.		
17.86-17.95	24	C		73	65	15						18.40	
19.00-20.50				33	13	7	NI NI 100				Extremely weak orangish red brown fine to medium grained SANDSTONE, completely weathered to orangish red brown very gravelly fine to medium sand. Gravel is very angular to angular fine to coarse lithorelicts. 18.40-18.60m : Non intact. 18.60-20.00m : Assumed zone of core loss. 20.00-20.15m : Non intact. 20.32-20.42m : Non intact.	(2.40)	
20.40-20.50	25	C											
20.50-21.50				92	66	48					20.50-20.80m : Non intact.	20.80	
21.25-21.37	26	C					NI 100	100% return Foam			Extremely weak to very weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, highly locally completely weathered. Subhorizontal to horizontal bedding fractures closely locally very closely spaced planar smooth light locally with orangish red brown surface staining. 21.38-21.50m : Subvertical fracture. 21.50-21.60m : Assumed zone of core loss. 21.60-21.68m : Non intact.		
21.50-22.50				90	82	57	350						

Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler + RLaw**	AGS

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	End: **15.05.09**	**42.9**	**E:384344.2 N:399048.0**	**5** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Legend
				90	82	57					Extremely weak to very weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, highly locally completely weathered. Subhorizontal to horizontal bedding fractures closely locally very closely spaced planar smooth light locally with orangish red brown surface staining. *(stratum text copied from layer at 20.80m depth from previous sheet)*		
22.50-23.50													
22.99-23.06	27	C		63	57	43					23.13-23.50m : Assumed zone of core loss.		
23.50-24.50							NI 100 350				23.62-23.97m : Assumed zone of core loss.		
24.12-24.20	28	C		65	36	0					24.04-24.13m : Non intact and completely weathered. 24.20-24.36m : Non intact and completely weathered.		
24.50-25.50								100% return Foam			24.50-24.60m : Assumed zone of core loss. 24.60-24.80m : Non intact.		
25.08-25.17	29	C		90	65	27					24.90-25.00m : Subvertical fracture.		
25.50-26.50											Below 25.50m, fractures closely to medium spaced.	(9.70)	
26.50-27.50				72	72	50	NI 150 430				26.00-26.20m : Subvertical fracture. 26.20-27.02m : Assumed zone of core loss.		
27.07-27.20	30	C		48	43	43					27.02-27.05m : Band of firm red brown clay (residual mudstone).		

Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler + RLaw**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
The co-operative Head Office, Manchester	**The co-operative**	**TPBH 02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
761072	**02.05.09** End: **15.05.09**	**42.9**	**E:384344.2 N:399048.0**	**6** of **6**

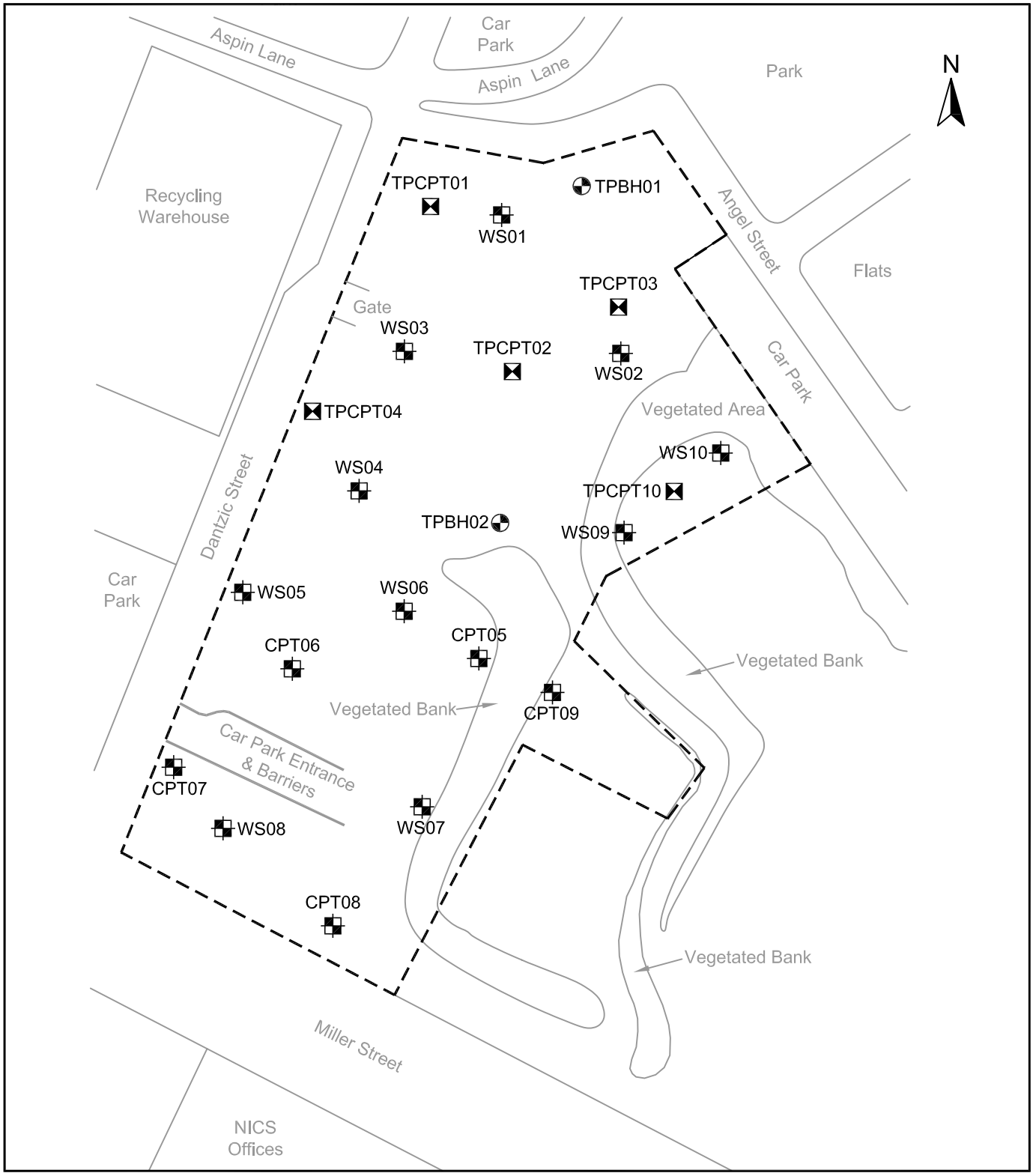
Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Flush Returns & Details	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Legend
27.50-28.50				76	45	30		100% return Foam			Extremely weak to very weak indistinctly thinly laminated red brown fine to medium locally coarse grained SANDSTONE, highly locally completely weathered. Subhorizontal to horizontal bedding fractures closely locally very closely spaced planar smooth light locally with orangish red brown surface staining. *(stratum text copied from layer at 20.80m depth from previous sheet)* 27.50-27.74m : Assumed zone of core loss. 27.74-27.90m : Completely weathered. 28.00-28.10m : Completely weathered. 28.54-28.74m : Completely weathered.		
28.50-29.50				100	76	60	NI 150 430						
29.10-29.20	31	C											
29.50-30.50				100	98	88							
												30.50	
											Borehole terminated at 30.50m depth.		

Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:31**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored + Trial Pit/trench	**Dando 2000 + Massenza M-I-2 + Wheeled 360° excavator**	**JH & RF + SH**	**NFowler + RLaw**	

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LEGEND: TPBH Borehole Location; CPT WS Hand Dug Trial Pit Location; TPCPT Trial Pit Location; Site Boundary

STRUCTURAL SOILS LIMITED

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CLIENT: Buro Happold Limited

PROJECT: The co-operative Head Office, Manchester

TITLE: EXPLORATORY HOLE LOCATION PLAN

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
00	15.06.2009	-	CPM	NF	-

JOB NO.	DRAWING FILE	DRAWING STATUS	FIGURE
761072	-	-	Figure 2

DIMENSION	SCALE	ORIGIN SIZE
m	Not to Scale	A4

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**02.09.13** End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**1** of **8**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.10-0.30	1	B								MADE GROUND : Cobbles. (MADE GROUND)	0.30	
0.30	2	ES								MADE GROUND : Stiff locally closely fissured grey brown and grey slightly sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse coal, sandstone quartzite, brick, clinker. Rare organic material. Localised grey gleying on fissure surfaces. (MADE GROUND)	(1.70)	
0.40	3	D										
0.50-0.80	4	B										
0.90	5	D										
0.90-1.20	6	B										
1.30	7	ES										
1.50-1.95	8	U	50 blows								2.00	
2.00	9	D								Firm brown sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse sandstone, quartzite and mudstone. (GLACIAL TILL)	(1.80)	
2.30	10	ES										
2.50-2.95	11	SPT	N=11									
2.50-2.95	12	B										
3.30	13	ES										
3.50-3.95	14	U	60 blows								3.80	
4.00	15	D								Medium dense brown slightly silty slightly gravelly fine to medium SAND. Gravel is rounded to sub angular fine to coarse sandstone, quartzite and mudstone. (GLACIAL SAND AND GRAVEL)	(0.60)	
4.10	16	D									4.40	
4.10-4.30	17	B								Medium dense orange brown slightly silty fine to coarse SAND and rounded to sub rounded fine to coarse GRAVEL of quartzite, sandstone and siltstone. Low cobble content. (GLACIAL SAND AND GRAVEL)		
4.40	18	D										
4.50-4.95	19	SPT	N=29									
4.50-4.95	20	B										
5.50-5.95	21	SPT(c)	N=31									
6.50	22	D									(4.40)	
7.00-7.21	23	SPT(c)	N=165*									
8.00	24	D									8.80	
										Description on next sheet		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
05/09/13	11:00	14.90	14.90	150	Dry
11/09/13	10:00	30.00	20.25	150	19.90

Chiselling / Slow Progress

From	To	Duration (hh:mm)
7.30	7.60	00:45
8.20	8.40	00:30
9.70	10.00	00:45
10.30	10.70	01:00
11.80	12.00	00:45
12.30	12.50	00:30
13.30	13.60	00:45
14.20	14.80	01:30

General Remarks

1. SPT hammer JB.11-2013 (E_r = 74.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**02.09.13** End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**2** of **8**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
										Medium dense orange brown slightly silty gravelly fine to coarse SAND. Gravel is rounded to sub rounded fine to coarse quartzite and sandstone. (GLACIAL SAND AND GRAVEL)	(0.80) 9.60	
9.50-9.95	25	SPT(c)	N=31							*(stratum copied from 8.80m from previous sheet)*		
9.50	26	D										
9.70	27	D										
10.00-10.27	28	SPT(c)	N=129*							Dense orange brown slightly silty fine to coarse SAND and rounded to sub rounded fine to coarse GRAVEL of quartzite, sandstone and siltstone. Low cobble content. (GLACIAL SAND AND GRAVEL)		
11.00	29	D										
11.50-11.78	30	SPT(c)	N=120*								(4.30)	
12.50	31	D										
13.00-13.18	32	SPT(c)	N=217*									
											13.90	
13.90	33	D								Red brown fine to medium grained SANDSTONE. Recovered as fine to medium sand with occasional gravel size fragments. (SHERWOOD SANDSTONE GROUP)	(0.90) 14.80	
14.80-15.30				20	8	0				Very weak to weak red brown fine to medium grained SANDSTONE. Discontinuities are horizontal to subhorizontal, closely spaced rough, locally undulating. (SHERWOOD SANDSTONE GROUP)		
14.80-14.89	35	SPT(c)	N=341*									
15.30-15.80				80	62	0				. . . 14.80m to 15.20m, AZCL.		
15.80-16.30				100	82	0	NI			. . . 15.30m to 15.80m, extremely weak.		
16.30-17.80				74	60	7	40 80			. . . 16.30m to 16.69m, AZCL.		
							NI 80 120			. . . 17.12m to 17.20m, non intact.		
17.80-18.30				100	70	28						

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**02.09.13** End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**3** of **8**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
18.30-18.80				100	70	28	NI 140 220		11/09 10:00	Very weak to weak red brown fine to medium grained SANDSTONE. Discontinuities are horizontal to subhorizontal, closely spaced rough, locally undulating. (SHERWOOD SANDSTONE GROUP)	(7.52)	
				94	94	94				. . . 14.80m to 15.20m, AZCL.*(stratum copied* from 14.80m from previous sheet)		
18.80-19.30				80	48	0				. . . below 18.15m, 1no. 30° fracture, stepped, rough.		
19.50-20.00				74	52	44				. . . 19.30 to 19.50m - open hole drilling, advancing casing.		
20.00-20.50				100	94	82				. . . 20.15m to 20.85m, weak fine to coarse sandstone with rounded gravel of sandstone, mudstone and quartzite.		
20.50-21.50				100	93	78						
21.50-23.00				90	84	49				. . . 21.50m to 21.65m, AZCL.	22.32	
23.00-24.50				75	67	27	NI 100 240			Weak red brown fine to coarse grained SANDSTONE with frequent fine to coarse gravel inclusions of quartzite, sandstone and mudstone. Discontinuities are horizontal, closely spaced, locally medium spaced, rough. (SHERWOOD SANDSTONE GROUP)		
24.50-26.00				100	80	57				. . . 23.82m to 24.00m, 1no. 75° fracture, planar, rough. Yellow brown discolouration penetrating up to 20mm. Possible signs of movement, striations/slikensides on fracture surface.		
26.00-27.50				100	88	44					(7.68)	

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDJ

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**02.09.13** End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**4** of **8**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
27.50-29.00				100	88	44				Weak red brown fine to coarse grained SANDSTONE with frequent fine to coarse gravel inclusions of quartzite, sandstone and mudstone. Discontinuities are horizontal, closely spaced, locally medium spaced, rough. (SHERWOOD SANDSTONE GROUP) *(stratum copied from 22.32m from previous sheet)*		
				100	99	62	NI 100 240					
29.00-30.00				98	93	74					30.00	
										Rotary borehole terminated at 30.00m depth.		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MD

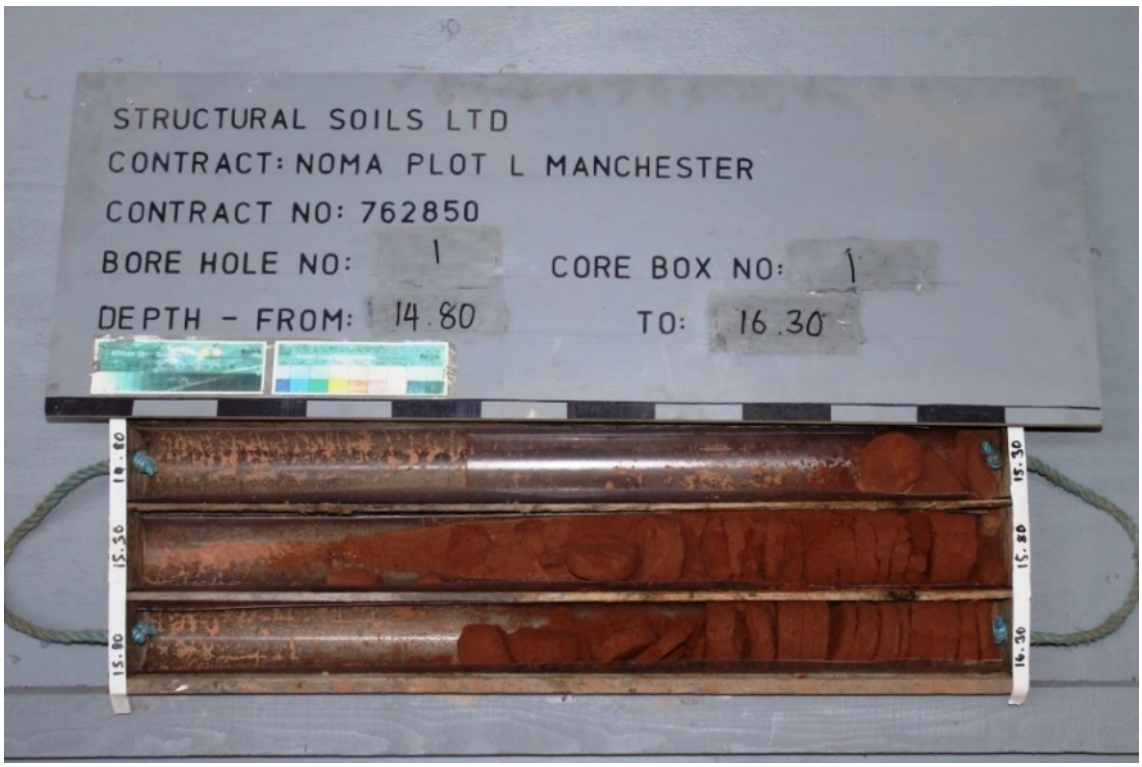
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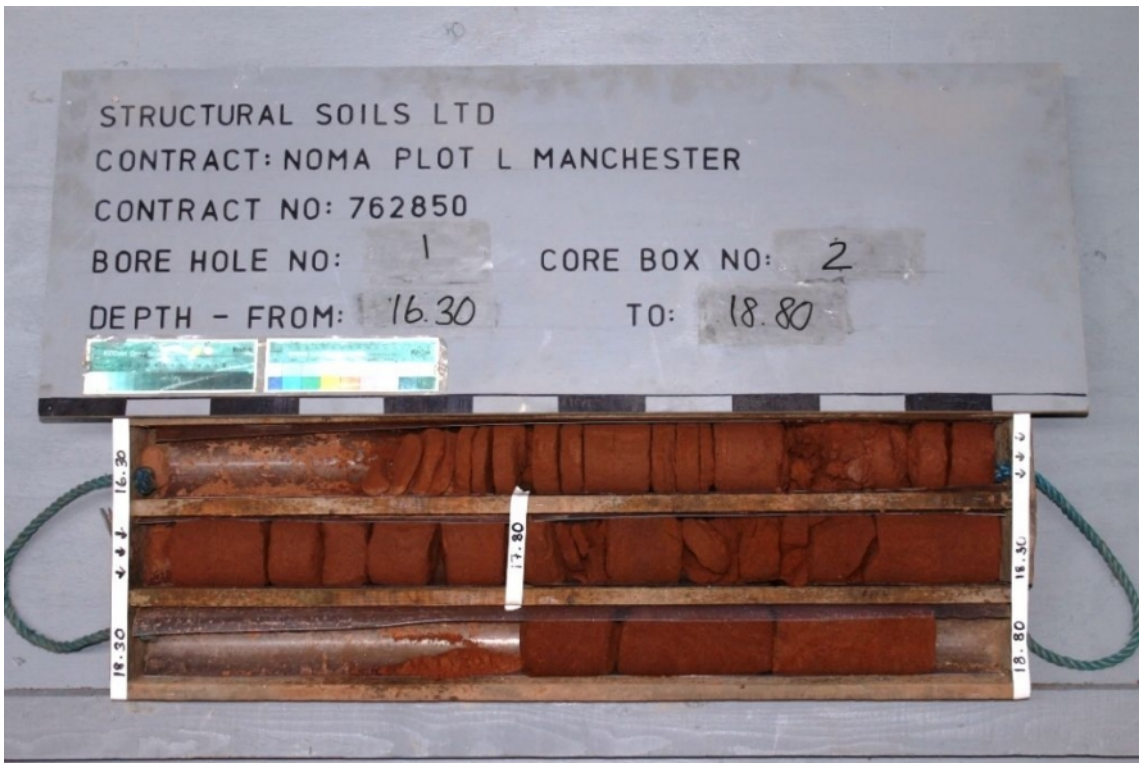
STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL01**
Contract Ref:	Start: **02.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**5** of **8**

BH1 Box 1 - 14.80m to 16.30m





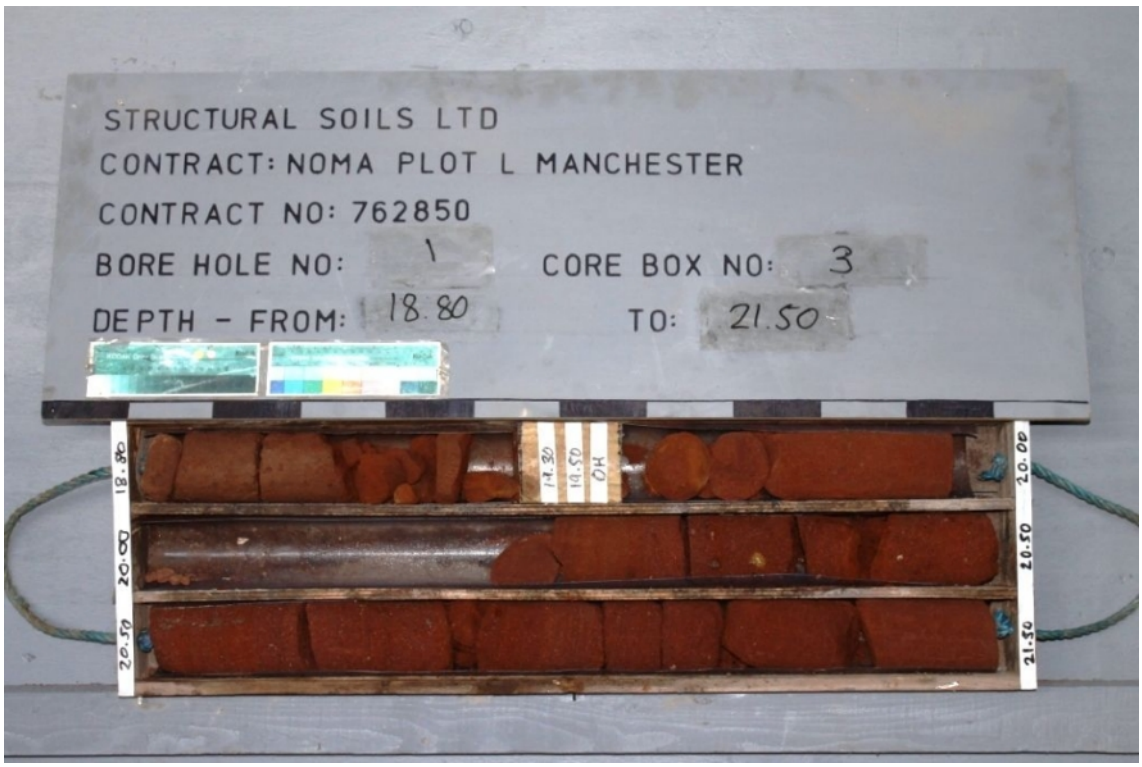
BHL01 Box 2 - 16.30m to 18.80m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

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Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL01**
Contract Ref:	Start: **02.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**6** of **8**

BHL01 Box 3 - 18.80m to 21.50m





BHL01 Box 4 - 21.50m to 24.50m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:40 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL01**
Contract Ref:	Start: **02.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**7** of **8**

BHL01 Box 5 - 24.50m to 27.50m





BHL01 Box 6 - 27.50m to 30.00m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:40 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL01**
Contract Ref:	Start: **02.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **10.09.13**	**45.47**	**E:384366.9 N:398957.8**	**8** of **8**

BH1 - 23.82m to 24.00m.





BH1 - 23.82 to 24.00m.

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL02**

Contract Ref:	Start: **05.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **05.09.13**	**48.72**	**E:384446.4 N:398924.5**	**1** of **2**

Depth (m)	Samples & Testing: No	Type	Results	Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
						MADE GROUND : Hardcore/roadstone (Foreman's description) (MADE GROUND)	0.25	
0.20	1	ES				MADE GROUND : Dense dark brown slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub rounded sandstone, quartzite, brick and concrete. Foreman reports full and half bricks, wood and glass. (MADE GROUND)	(2.55)	
0.30	2	D						
0.40-0.70	3	B						
0.80	4	D						
0.90-1.20	5	B						
1.30	6a	ES						
1.50-1.79	7	SPT(c)	N=111*					
1.50	7	B						
2.30	8	ES						
2.50	9	B					2.80	
2.80-3.11	9	SPT(c)	N=93*			MADE GROUND : Concrete basement (Foreman's description) (MADE GROUND)	3.00	
						MADE GROUND : Dense dark brown slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub rounded sandstone, quartzite, brick and concrete. (MADE GROUND)	(0.60)	
3.30	10	ES					3.60	
3.50-3.95	11	SPT(c)	N=14			MADE GROUND : Medium dense red brown clayey gravelly locally very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub rounded sandstone, quartzite, brick and concrete. (MADE GROUND)	4.00	
3.50	11	B				Borehole terminated at 4.00m depth as the drill casing was off vertical due to obstructions.		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress

From	To	Duration (hh:mm)
1.80	2.10	00:45
2.80	3.00	01:30

General Remarks

1. Inspection pit to 1.20m
2. Magnetometer survey to 3.00m.
3. Cable percussion boring to 4.00m using 150mm casing and tools.
4. Hole terminated due to off vertical casing caused by obstructions.
5. Borehole backfilled with arisings.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion	**Dando 2000**	**GB**	**RH**	MD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**05.09.13** End: **05.09.13**	**48.72**	**E:384446.4 N:398924.5**	**2** of **2**

Depth (m)	Samples & Testing: No	Type	Results	Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend

Boring Progress and Water Observations						Chiselling / Slow Progress		
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)

General Remarks

6. SPT hammer JB.11-2013 (E_r = 74.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion	**Dando 2000**	**GB**	**RH**	MD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL02A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**06.09.13** End: **13.09.13**	**48.77**	**E:384447.4 N:398926.6**	**1** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
										MADE GROUND : Hardcore stone (Foreman's description) (MADE GROUND)	0.25	
										MADE GROUND : Brick rubble with ash fill, full and halfbricks, concrete and wood. (Foreman's description) (MADE GROUND)	(2.55)	
											2.80	
										MADE GROUND : Concrete basement (Foreman's description) (MADE GROUND)	3.00	
										MADE GROUND : Brick and ash rubble fill (Foreman's description) (MADE GROUND)	(0.70)	
											3.70	
3.80	1	D								Firm to stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular to sub angular sandstone and mudstone. (GLACIAL TILL)		
3.90	2	ES										
4.00-4.45	3	U	55 blows									
4.50	4	D								. . . 3.80 - soil sampling commences. (see BHL02 for 0.00 to 3.80m)		
5.00	5	ES										
5.00-5.45	6	SPT	N=17									
5.00-5.45	7	B										
6.00	8	D									(5.00)	
6.50-6.95	9	U	55 blows									
7.00	10	D										
7.60	11	D								. . . Below 7.60m - foreman reports sand bands.		
8.00-8.24	12	SPT	N=167*							. . . below 8.00m becoming stiff to very stiff.		
8.00-8.30	13	B										
											8.70	
8.70	14	D								*Description on next sheet*		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
12/09/13	16:00	19.70	19.70	150	Dry
13/09/13	13:00	30.00	19.70	150	23.10

Chiselling / Slow Progress

From	To	Duration (hh:mm)
1.50	1.80	00:30
2.20	2.40	00:30
2.80	3.00	01:15
8.30	8.50	00:45
9.30	9.50	00:30
10.90	11.00	00:30
11.20	11.40	00:45
14.90	15.20	00:45

General Remarks

1. Hand dug inspection pit to 1.20m
2. Magnetometer surevey to 3.00m
3. Cable tool boring using 150mm casing and tools to 19.60m
4. Rotary core drilling using PWF core barrel and air mist flush from 1.60m to 30.00m.
5. Dual installation (both 50mm diameter)

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:40 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL02A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**06.09.13** End: **13.09.13**	**48.77**	**E:384447.4 N:398926.6**	**2** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
9.00-9.26	15	SPT(c)	N=135*							Dense orange brown slightly gravelly fine to medium SAND. Gravel is sub angular to sub rounded fine to coarse sandstone and mudstone. (GLACIAL SAND AND GRAVEL) *(stratum copied from 8.70m from previous sheet)*	(1.10)	
9.00-9.30	15	B									9.80	
10.00	16	D								Dense orange brown fine to medium SAND. (GLACIAL SAND AND GRAVEL)	(1.20)	
10.50-10.79	17	SPT	N=105*								11.00	
10.50-10.80	18	B										
11.00	19	D								Dense orange brown slightly silty fine to coarse SAND and sub angular to rounded fine to coarse GRAVEL of sandstone, mudstone and quartzite. Foreman reports cobbles and boulders. (GLACIAL SAND AND GRAVEL)	(4.00)	
11.50-11.80	20	SPT(c)	N=103*									
11.50-11.80	20	B										
12.50	21	D										
13.00-13.20	22	SPT(c)	N=147*									
13.00-13.30	22	B										
14.00	23	D										
14.50-14.78	24	SPT(c)	N=115*									
14.50-14.80	24	B									15.00	
15.50	25	D								Very stiff red brown slightly sandy slightly gravelly CLAY. Gravel is angular to sub angular sandstone and mudstone. (GLACIAL TILL)	(3.50)	
16.00-16.11	26	SPT(c)	N=208*									
16.00-16.30	26	B										
17.00	27	D										
17.50-17.70	28	SPT(c)	N=156*									
17.50-17.80	28	B										

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress

From	To	Duration (hh:mm)
17.80	18.00	00:45
19.30	19.60	01:00

General Remarks

installed on completion.
6. SPT hammer JB.11-2013 (E_r = 74.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL02A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**06.09.13** End: **13.09.13**	**48.77**	**E:384447.4 N:398926.6**	**3** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
											18.50	
18.70	29	D								Red brown fine to medium grained SANDSTONE. Recovered as fine to medium sand with occasional gravel size fragments. (SHERWOOD SANDSTONE GROUP)	(1.10)	
19.00-19.14	30	SPT	N=238*								19.60	
19.60-20.60										Weak red brown fine to coarse grained SANDSTONE with frequent fine to coarse gravel inclusions of quartzite, sandstone and mudstone. Discontinuities are horizontal, closely spaced, locally medium spaced, rough. (SHERWOOD SANDSTONE GROUP)		
19.60-19.72	31	SPT	N=283*									
				80	64	12						
20.60-22.10										. . . 19.60m to 19.80m, AZCL. . . . 20.14m to 20.17m, Light orange in colour. . . . 20.60m to 20.90m, AZCL.		
				80	63	31	NI 120 200					
22.10-23.60										. . . 22.37m to 22.42m, non intact.		
				93	83	31			13/09 13:00			
23.60-25.10										. . . below 23.90m, closely to medium spaced with rare fine to medium gravel inclusion of sandstone.		
				92	84	65	NI 200 340				(10.40)	
25.10-26.60												
				88	83	64	NI 100 150					
26.60-28.10				92	75	25						

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:40 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL02A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**06.09.13** End: **13.09.13**	**48.77**	**E:384447.4 N:398926.6**	**4** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
28.10-29.60				92 97	75 90	25 63	NI 100 150 25 120			Weak red brown fine to coarse grained SANDSTONE with frequent fine to coarse gravel inclusions of quartzite, sandstone and mudstone. Discontinuities are horizontal, closely spaced, locally medium spaced, rough. (SHERWOOD SANDSTONE GROUP) . . . 19.60m to 19.80m, AZCL.*(stratum copied* from 19.60m from previous sheet)		
29.60-30.00				100	100	88	280				30.00	
										Borehole terminated at 30.00m.		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MD

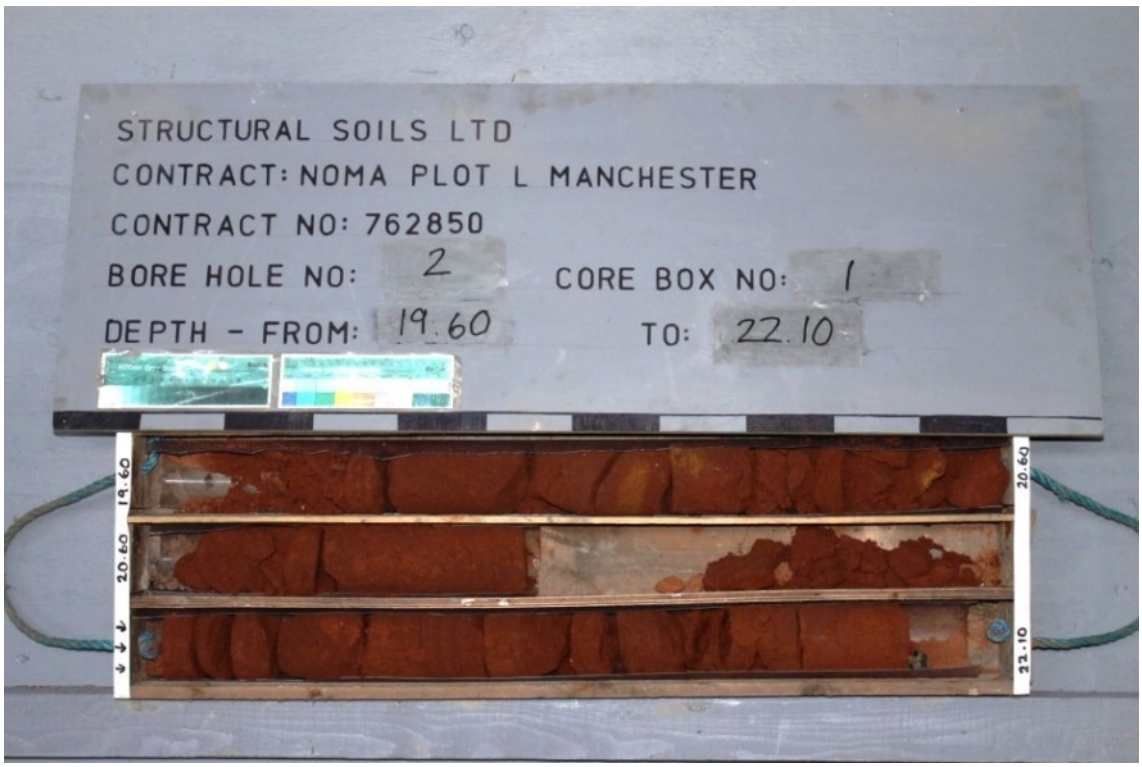
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL02A**
Contract Ref:	Start: **06.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **13.09.13**	**48.77**	**E:384447.4 N:398926.6**	**5** of **6**

BHL02a Box 1 - 19.60m to 22.10m





BHL02a Box 2 - 22.10m to 25.10m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

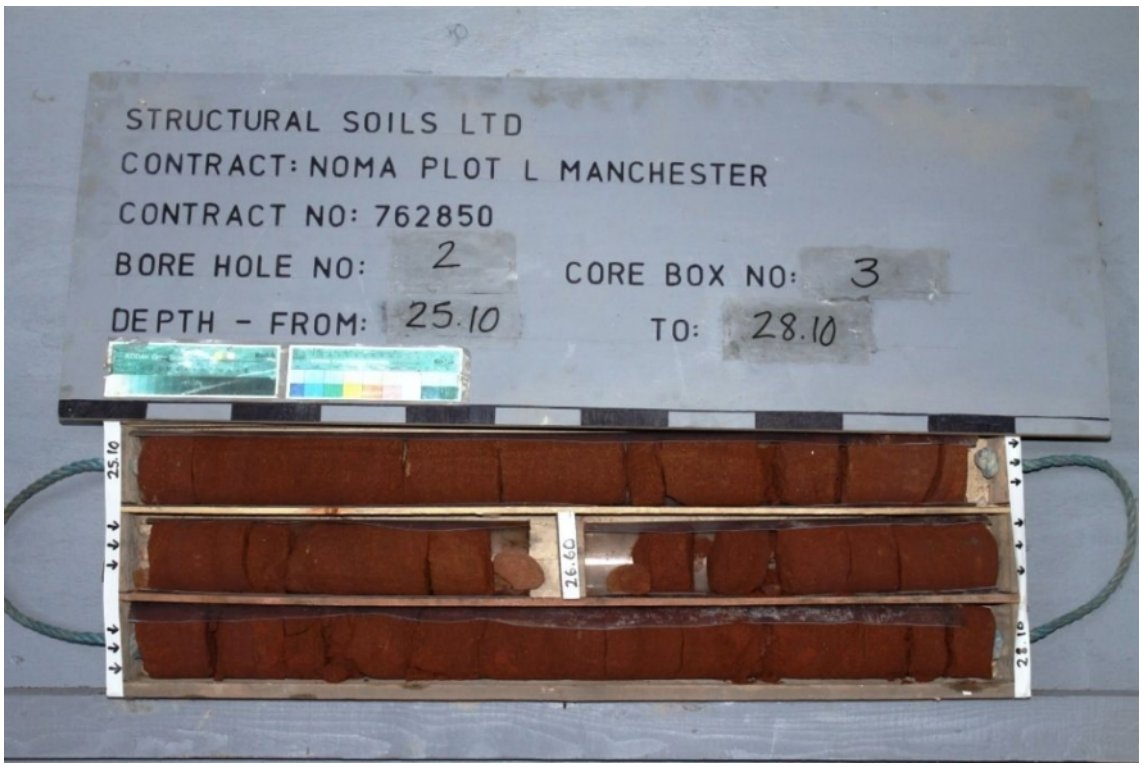
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL02A**
Contract Ref:	Start: **06.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **13.09.13**	**48.77**	**E:384447.4 N:398926.6**	**6** of **6**

BHL02a Box 3 - 25.10m to 28.10m





BHL02 Box 4 - 28.10m to 30.00m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:40 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**13.09.13** End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**1** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
										MADE GROUND : Hardcore (Foreman's description) (MADE GROUND)	0.10	
0.20	1	ES										
0.30	2	D										
0.30-0.60	3	B								MADE GROUND : Medium dense dark grey brown clayey gravelly fine to coarse SAND. Gravel is a angular to sub angular fine to coarse limestone and mudstone. Foreman reports fragments of glass, wood and bone. (MADE GROUND)		
0.80	4	D										
0.90-1.20	5	B										
1.30	6	ES										
1.50-1.95	7	SPT	N=13							. . . Below 0.80m becoming sandy gravelly clay.	(3.30)	
2.30	8	ES										
2.50-2.95	9	SPT(c)	N=18									
3.30	10	ES									3.40	
3.50	11	ES								Firm to stiff slightly sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse sandstone and mudstone. Occasional closely spaced silt partings. (GLACIAL TILL)		
3.50-3.95	12	$U_{(100)}$	70 blows 80% recovery									
4.00	13	D										
4.30	14	ES									(2.10)	
4.50-4.95	15	SPT	N=19									
4.50-4.95	16	D										
											5.50	
5.50-5.80	17	SPT(c)	N=102*							Dense brown slightly silty fine to coarse SAND and sub angular to rounded fine to coarse GRAVEL of sandstone mudstone and quartzite. (GLACIAL SAND AND GRAVEL)		
6.50	18	D									(2.30)	
7.00-7.35	19	SPT(c)	N=75*									
											7.80	
8.00	20	D								Dense orange brown slightly gravelly fine to medium SAND. Gravel is sub angular to sub rounded fine to coarse sandstone and mudstone. (GLACIAL SAND AND GRAVEL)		
8.50-8.86	21	SPT(c)	N=70*							. . . Below 8.50m foreman reports with silt bands.		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
16/09/13	13:00	14.00	14.00	150	Dry
18/09/13	11:00	29.80	14.30	150	21.10

Chiselling / Slow Progress

From	To	Duration (hh:mm)
5.80	6.00	00:30
8.80	9.10	00:45
9.80	10.00	00:30
10.30	10.70	00:45
11.10	11.30	00:30
13.60	13.80	00:45

General Remarks

1. Hand dug inspection pit to 1.20m
2. Magnetometer survey to 3.00m
3. Cable tool boring using 150mm casing and tools to 14.00m
4. Rotary core drilling using PWF core barrel and air mist flush from 14.00m to 29.80m.
5. Dual installation (both 50mm diameter)

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**13.09.13** End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**2** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
9.50	22	D								Dense orange brown slightly gravelly fine to medium SAND. Gravel is sub angular to sub rounded fine to coarse sandstone and mudstone. (GLACIAL SAND AND GRAVEL) *(stratum copied from 7.80m from previous sheet)*		
10.00-10.18	23	SPT(c)	N=238*							. . . Below 10.00m foreman reports sands and gravels with very stiff clay bands.	(6.20)	
11.00	24	D										
11.50-11.68	25	SPT	N=246*									
11.50-11.70	26	B										
12.50	27	D										
13.00-13.17	28	SPT(c)	N=146*								14.00	
14.30-15.30				0	0	0				Foreman reports sand, gravel and clay. (GLACIAL SAND AND GRAVEL) 14.00m - foreman reports boulder, unable to progress casing.	(2.00)	
15.30-16.30				40	0	0				. . . 15.30m-15.90m AZCL. . . . 15.90m-16.00m recovered as medium to coarse sub rounded gravel of limestone, sandstone and quartzite.	16.00	
16.30-17.30				40	22	0	NI 50 100			Very weak red brown fine to medium grained SANDSTONE. Discontinutities are horizontal, very closely spaced becoming closely spaced, planar, rough, occassionally undulating. (SHERWOOD SANDSTONE GROUP) . . . 16.30m-16.90m AZCL. . . . 16.90m-17.00m recovered as fine to medium sand. . . . 17.30m-17.68m AZCL.		
17.30-17.80				24	0	0						
17.80-18.30				92	56	0						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

installed on completion.
6. SPT hammer JB.11-2013 (E_r = 74.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MD

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**13.09.13** End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**3** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
18.30-19.30				92 75	56 53	0 10	NI 50 100			Very weak red brown fine to medium grained SANDSTONE. Discontinutities are horizontal, very closely spaced becoming closely spaced, planar, rough, occassionally undulating. (SHERWOOD SANDSTONE GROUP) *(stratum copied from 16.00m from previous sheet)* . . . 18.00m-18.13m extremely closly spaced, randomly orientated, intersecting, interlocking fractures. . . . 18.30m-18.55m AZCL. . . . 18.70m-19.02m Extremely weak sandstone. Extremely close to very closely spaced, randomly orientated, intersecting, interlocking and some horizontal fractures. Bands of clay 1mm-2mm and pockets of clayey sand 2mm-4mm. . . . 19.07m-19.12m 45° fracture. . . . 19.20m-19.27m 45° fracture. . . . 19.97m Sub horizontal fracture with 3-4mm band of clay. . . . 20.30m-20.44m AZCL. . . . 20.54m-20.58m Very close interseting 45° fractures. . . . 20.80m-20.92m Very closely spaced, randomly orientated, intersecting and interlocking fractures. . . . 20.92m-20.98m Sub vertical fracture. . . . 21.14m-21.19m Very closely spaced fracture. . . . 22.30m-22.60m AZCL.		
19.30-20.80				89	77	52			18/09 11:00			
20.80-22.30				92	79	64	NI 120 270					
22.30-23.80				75	46	14					(13.80)	
23.80-25.30				95	82	43	NI 110 160			. . . 23.40m-23.64m Extremely weak sandstone with 2-4mm pockets and bands of clay in very closely spaced horizontal and 45 degree intersecting and interlocking fractures. . . . 24.11m-24.13m extremely closely spaced horizontal fracture. . . . 24.60m band of clay 2-3mm		
25.30-26.80				87	80	63	90 320 360					
26.80-28.30				97	80	54						

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDJ

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
NOMA Plot L Manchester	**Co-operative Group Limited**	**BHL03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**13.09.13** End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**4** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
				97	80	54				Very weak red brown fine to medium grained SANDSTONE. Discontinutities are horizontal, very closely spaced becoming closely spaced, planar, rough, occassionally undulating. (SHERWOOD SANDSTONE GROUP) *(stratum copied from 16.00m from previous sheet)*		
28.30-29.80							NI 120 260			. . . 28.42m-28.75m occasional sub angular to rounded fine and medium gravel size inclusions of quartz and sandstone.		
				88	73	56				. . . 29.43m-29.62m Weak sandstone, extremely closely spaced fractures. Frequent rounded fine to coarse inclusions of red brown mudstone.	29.80	
										Borehole terminated at 29.80m.		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Cable Percussion + Rotary Cored	**Dando 2000 + Comacchio MC300**	**GB + LW**	**MDolby**	MDJ

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL03**
Contract Ref:	Start: **13.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**5** of **7**

BHL03 Box 1 - 15.30m to 18.30m





BHL03 Box 2 - 18.30m to 20.80m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:41 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL03**
Contract Ref:	Start: **13.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**6** of **7**

BHL03 Box 3 - 20.80m to 23.80m





BHL03 Box 4 - 23.80m to 26.80m

Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDJ

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:41 | MD.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
NOMA Plot L Manchester		**Co-operative Group Limited**		**BHL03**
Contract Ref:	Start: **13.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **18.09.13**	**46.81**	**E:384407.2 N:399027.1**	**7** of **7**

BHL03 Box 5 - 26.80m to 29.80m



Method Used:	**Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2000 + Comacchio MC300**	Drilled By:	**GB + LW**	Logged By:	**MDolby**	Checked By:	MDD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log COMPOSITE LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:41 | MD.
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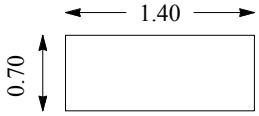
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
NOMA Plot L Manchester	**Co-operative Group Limited**	**TP1**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**03.09.13** End: **03.09.13**	**44.68**	**E:384370.4 N:398934.4**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Dark grey angular coarse GRAVEL of limestone..	0.05	
						MADE GROUND: Cobbles.	0.15	
0.20	1	ES				MADE GROUND: Dark brown gravelly fine to coarse SAND. Gravel is angular to subangular medium to coarse brick, sandstone, slag, ash, slate and clay pipe. . . . below 0.50m, drain pipe dissused.	(0.75)	
							0.90	
1.10	2	ES				Firm orangey brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse mudstone, sandstone and coal.	(1.10)	
							2.00	
						Trial pit terminated at 2.00m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation easy using JCB 3CX.
2. Stability - slight spalling during excavation.
3. All faces similar.
4. No groundwater encountered during excavation.
5. Trial pit backfilled using compacted arisings on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP1**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**44.68**	**E:384370.4 N:398934.4**	**2** of **3**

TP01 Face A





TP01 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP1**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**44.68**	**E:384370.4 N:398934.4**	**3** of **3**

TP01 Base



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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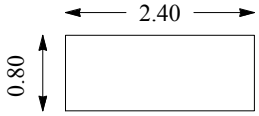
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
NOMA Plot L Manchester	**Co-operative Group Limited**	**TP2**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**03.09.13**	**48.66**	**E:384444.0 N:398910.1**	**1** of **3**
	End: **03.09.13**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Tarmac.	0.20	
0.30	1	ES				MADE GROUND: Yellow brown medium to coarse SAND with some gravel. Gravel is angular to subangular.	0.40	
						MADE GROUND: Hardcore stone.	0.60	
						MADE GROUND: Dark brown sandy gravelly COBBLES. Sand is angular to subangular medium to coarse. Gravel is angular medium to coarse. Cobbles are full and half bricks along with concrete and paving slabs, glass and slate.	(1.50)	
							2.10	
						Firm brown grey slightly gravelly CLAY. Gravel is subangular to rounded fine to medium including various lithologies of mudstone, coal and organic materials (roots).	(0.80)	
2.80	4	D					2.90	
						Trial pit terminated at 2.90m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation easy using JCB 3CX, breaker used on the tarmac.
2. Sides unstable during excavation, some face collapse.
3. Similarity - brickwork basement structure in two long faces.
4. No groundwater encountered during excavation.
5. Trial pit backfilled using compacted arisings on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP2**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**48.66**	**E:384444.0 N:398910.1**	**2** of **3**

TP02 face A





TP02 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP2**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**48.66**	**E:384444.0 N:398910.1**	**3** of **3**

TP02 spoil



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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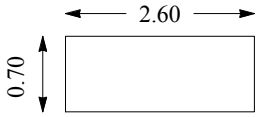
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
NOMA Plot L Manchester	**Co-operative Group Limited**	**TP3**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**03.09.13** End: **03.09.13**	**49.51**	**E:384465.1 N:398953.5**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Tarmac.	0.10	
						MADE GROUND: Hardcore stone.	(1.40)	
0.50	1	ES					1.50	
						MADE GROUND: Brown grey sandy gravelly BOULDERS. Sand is angular to subangular fine to coarse. Gravel is angular to subangular medium to coarse.	(1.90)	
1.70	2	ES					3.40	
						Firm brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of various lithologies of coal, sandstone and mudstone.	3.60	
3.50	3	ES						
3.50	4	B						
						Trial pit terminated at 3.60m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation easy using JCB 3CX.
2. Stability : sides spalling during excavation
3. All faces similar - clay pipe located at 0.60m.
4. No groundwater encountered during excavation.
5. Trial pit backfilled using compacted arisings on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP3**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**49.51**	**E:384465.1 N:398953.5**	**2** of **3**

TP03 Face A





TP03 Base

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP3**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**49.51**	**E:384465.1 N:398953.5**	**3** of **3**

TP03 spoil



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

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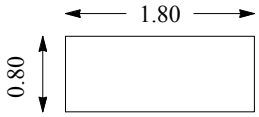
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
NOMA Plot L Manchester	**Co-operative Group Limited**	**TP4**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**03.09.13** End: **03.09.13**	**48.82**	**E:384451.7 N:398976.4**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: TARMAC.	0.20	
						MADE GROUND: Hardcore stone.	0.30	
0.50	1	ES				MADE GROUND : Dark brown SAND and GRAVEL of angular to subangular medium to coarse of various lithologies of brick, coal, glass, slate, sandstone and clay pipe.	(0.80)	
1.00	2	ES					1.10	
1.00	4	B				Firm brown slightly sandy slightly gravelly CLAY. Sand is subangular to subrounded fine. Gravel is subangular to subrounded fine to coarse of mudstone, coal and sandstone.	1.30	
						Trial pit terminated at 1.30m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation easy using JCB 3CX.
2. Stability - faces spalling during excavation.
3. All faces similar.
4. No groundwater encountered during excavation.
5. Trial pit backfilled using compacted arisings on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP4**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**48.82**	**E:384451.7 N:398976.4**	**2** of **3**

TP04 Face A





TP04 base

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP4**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**48.82**	**E:384451.7 N:398976.4**	**3** of **3**

TP04 Face C



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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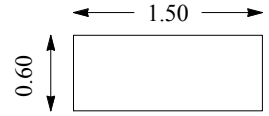
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
NOMA Plot L Manchester	**Co-operative Group Limited**	**TP5**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**03.09.13** End: **03.09.13**	**47.00**	**E:384404.6 N:399007.4**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Hardcore stone, ash, brick, sandstone, coal, slate and slag ash.	(0.30)	
							0.30	
0.30	1	ES				Firm brown slightly sandy gravelly CLAY. Gravel is angular to subangular medium to coarse of mudstone, sandstone and coal.		
0.80	2	ES					(1.50)	
							1.80	
						Trial pit terminated at 1.80m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation easy using JCB 3CX.
2. Stability : All sides spalling during excavation.
3. All faces similar.
4. No groundwater encountered during excavation.
5. Trial pit backfilled using compacted arisings on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP5**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**47.00**	**E:384404.6 N:399007.4**	**2** of **3**

TP05 Face A





TP05 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP5**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**47.00**	**E:384404.6 N:399007.4**	**3** of **3**

TP05 Spoil



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER.GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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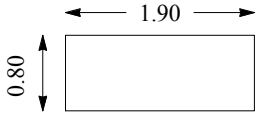
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
NOMA Plot L Manchester	**Co-operative Group Limited**	**TP6**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	**03.09.13** End: **03.09.13**	**48.16**	**E:384426.2 N:398950.0**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Gravelly sandy TOPSOIL with rootlets.	(0.50) 0.50	
0.70	1	ES				MADE GROUND: Brown sandy gravelly COBBLES. Sand is angular to subangular fine to coarse. Gravel is angular to subangular medium to coarse of brick, sandstone, ash, slate, glass and clay pipe.	(0.60) 1.10	
1.80	2	ES				Firm friable brown grey sandy gravelly CLAY. Sand is subangular to subrounded fine to medium. Gravel is suabngular to subrounded fine to coarse of mudstone, sandstone and coal.	(0.90) 2.00	
						Trial pit terminated at 2.00m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation easy using JCB 3CX.
2. All sides stable during excavation.
3. All faces similar - disused electric cable located in the pit.
4. No groundwater encountered during excavation.
5. Trial pit backfilled using compacted arisings on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:58 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP6**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**48.16**	**E:384426.2 N:398950.0**	**2** of **3**

TP06 Face A





TP06 cable

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:59 | MD.
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STRUCTURAL SOILS

TRIAL PIT LOG

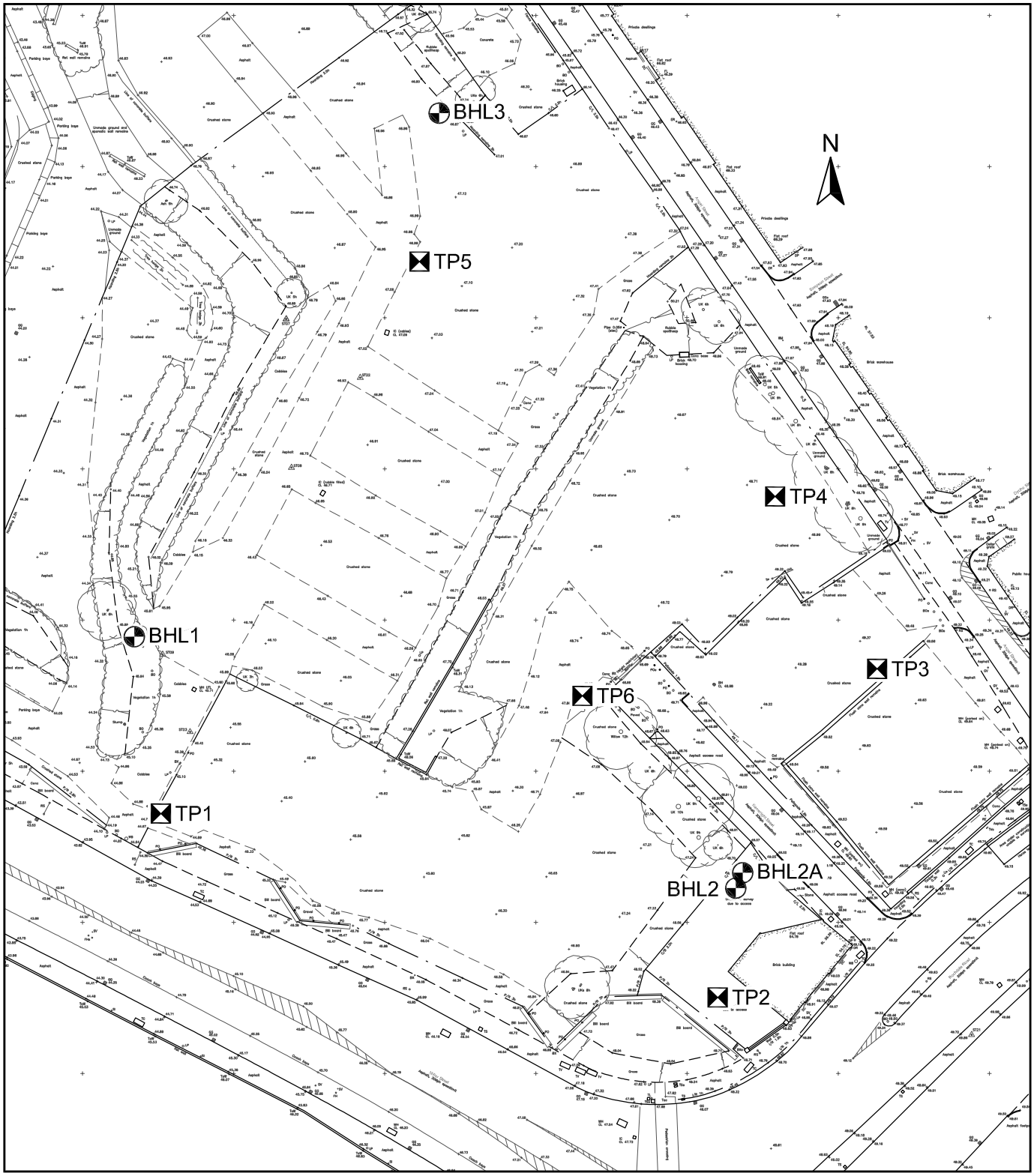
Contract:		Client:		Trial Pit:
NOMA Plot L Manchester		**Co-operative Group Limited**		**TP6**
Contract Ref:	Start: **03.09.13**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
762850	End: **03.09.13**	**48.16**	**E:384426.2 N:398950.0**	**3** of **3**

TP06 spoil



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**DRoberts**	MJD

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0002 | Log TRIAL PIT LOG | 762850 - NOMA MANCHESTER GPJ - v8_05 | 16/01/14 - 16:59 | MD.
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LEGEND	
	Borehole Location
	Trial Pit Location

STRUCTURAL SOILS LIMITED

The Potteries
Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Tel: 01977 552255
Fax: 01977 552299
ask@soils.co.uk
www.soils.co.uk

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
00	23.10.2013	-	JAH	MD	-

DIMENSION	SCALE	DRAWING STATUS
m	1:750	-

CLIENT: The Co-operative

PROJECT: NOMA PLOT L Manchester

TITLE: EXPLORATORY HOLE LOCATION PLAN

JOB NO.	SCALE BAR	ORIGIN SIZE	FIGURE
762850	0 10 20 30 40m	A4	2

STRUCTURAL SOILS

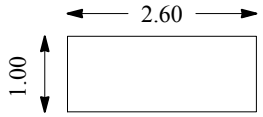
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP1**

Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**45.66**	**E:384409.8 N:399020.8**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
0.00-0.55	1	B				MADE GROUND: Black brown clayey slightly sandy subangular to subrounded fine to coarse GRAVEL of brick and ash with high cobble and medium boulder content.			
0.30	1	ES	Tx2, Jx2, Vx2					(0.80)	
0.70	2	ES	Tx2, Jx2, Vx2				44.86	0.80	
						Stiff brown silty CLAY with pockets of grey silt and rare gravel of coal.			
1.00-1.50	2	B		≈				(0.70)	
							44.16	1.50	
						Trial pit terminated at 1.50m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trial pit clear.
2. Slight groundwater seepage at 1.10m.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:13 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP1**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**45.66**	**E:384409.8 N:399020.8**	**2** of **3**

TP1 Face A





TP1 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:13 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP1**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**45.66**	**E:384409.8 N:399020.8**	**3** of **3**

TP1 Face C





TP1 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:14 | GR.
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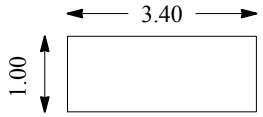
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP2**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**26.01.15**	**46.23**	**E:384389.9 N:398987.7**	**1** of **3**
	End: **26.01.15**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: BRICKWORK.	46.15	0.08	
						MADE GROUND: Black brown slightly clayey slightly sandy angular to subangular fine to coarse GRAVEL of brick and sandstone with medium cobble content.	46.08	0.15	
0.30	1	ES	Tx2, Jx2, Vx2			Stiff brown mottled light blue silty slightly sandy CLAY with rare fine gravel of sandstone and coal.		(0.85)	
0.90	2	ES	Tx2, Jx2, Vx2				45.23	1.00	
0.90-1.00	3	B				Trial pit terminated at 1.00m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:14 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP2**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**46.23**	**E:384389.9 N:398987.7**	**2** of **3**

TP2 Face A





TP2 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:14 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP2**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**46.23**	**E:384389.9 N:398987.7**	**3** of **3**

TP2 Face C





TP2 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:15 | GR.
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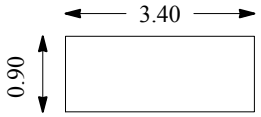
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP3**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**26.01.15**	**45.86**	**E:384375.3 N:398958.6**	**1** of **3**
	End: **26.01.15**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
0.30	1	ES	Tx2, Jx2, Vx2			Stiff light brown mottled blue silty slightly sandy CLAY with rare fine to medium gravel of sandstone and coal.		(1.00)	
0.90	2	ES	Tx2, Jx2, Vx2				44.86	1.00	
						Trial pit terminated at 1.00m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:17 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP3**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**45.86**	**E:384375.3 N:398958.6**	**2** of **3**

TP3 Face A





TP3 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:18 | GR.
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FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP3**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**45.86**	**E:384375.3 N:398958.6**	**3** of **3**

TP3 Face C





TP3 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:19 | GR.
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STRUCTURAL SOILS

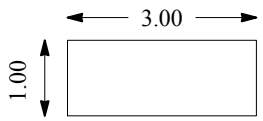
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP4**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**26.01.15**	**45.48**	**E:384386.4 N:398932.6**	**1** of **2**
	End: **26.01.15**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
0.00-0.20	1	B				MADE GROUND: Black slightly sandy locally slightly clayey angular to subangular fine to coarse GRAVEL of ash, brick and metals with high cobble and medium boulder content.		(0.80)	
0.40	1	ES	Tx2, Jx2, Vx2				44.68	0.80	
						MADE GROUND: BRICK foundations.		(0.50)	
							44.18	1.30	
						Trial pit terminated at 1.30m depth due to foundations in absence of archaeologist.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:19 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP4**
Contract Ref:	Start: **26.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **26.01.15**	**45.48**	**E:384386.4 N:398932.6**	**2** of **2**

TP4 Face A





TP4 Face C

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:19 | GR.
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STRUCTURAL SOILS

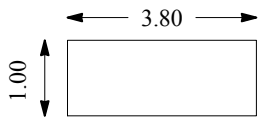
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP4a**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**27.01.15** End: **27.01.15**	**45.47**	**E:384382.2 N:398938.8**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
0.50	1	ES	Tx2, Jx2, Vx2			MADE GROUND: Black slightly sandy locally slightly clayey angular to subangular fine to coarse GRAVEL of ash, brick and metals with high cobble and medium boulder content.			
1.00	2	ES	Tx2, Jx2, Vx2			. . . below 0.10m, wire rope.		(2.40)	
2.00	3	ES	Tx2, Jx2, Vx2				43.07	2.40	
						Trial pit terminated at 2.40m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:20 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP4a**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**45.47**	**E:384382.2 N:398938.8**	**2** of **3**

TP4a Face A





TP4a Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:20 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP4a**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**45.47**	**E:384382.2 N:398938.8**	**3** of **3**

TP4a Face C





TP4a Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:21 | GR.
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STRUCTURAL SOILS

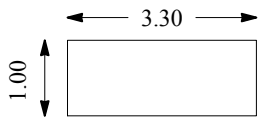
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP5**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**27.01.15** End: **27.01.15**	**47.37**	**E:384423.5 N:398991.3**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Light brown mottled light grey orange sandy angular to subangular fine to coarse GRAVEL of brick, glass and coal with high cobble content and brickwork present.			
0.50	1	ES				. . . below 0.65m, orange brown medium sand.			
						. . . below 0.80m, redundant water drain (100mm diameter) damaged.		(1.80)	
1.40	2	ES							
				≈			45.57	1.80	
1.80	3	EW				MADE GROUND: Black sandy angular to subangular fine to coarse GRAVEL in clayey matrix with pottery and snail shells.			
1.80	3	ES						(0.40)	
							45.17	2.20	
						Stiff to very stiff light brown mottled light blue silty locally slightly sandy CLAY.		(0.30)	
2.40	4	ES					44.87	2.50	
						Trial pit terminated at 2.50m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - water pipe detected.
2. Slight seepage of water at 1.80m.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:21 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP5**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**47.37**	**E:384423.5 N:398991.3**	**2** of **3**

TP5 Face A





TP5 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:22 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP5**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**47.37**	**E:384423.5 N:398991.3**	**3** of **3**

TP5 Face C





TP5 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:22 | GR.
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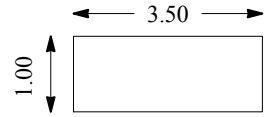
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP6**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**27.01.15** End: **27.01.15**	**46.02**	**E:384392.4 N:398952.1**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Black sandy angular to subangular fine to coarse GRAVEL of ash, brick and glass with high cobble and low boulder content.		(0.50)	
0.40	1	ES	Tx2, Jx2, Vx2				45.52	0.50	
						Stiff to very stiff light brown mottled light blue silty locally sandy CLAY.			
0.70	2	ES	Tx2, Jx2, Vx2						
								(1.50)	
1.50	3	ES	Tx2, Jx2, Vx2						
							44.02	2.00	
						Trial pit terminated at 2.00m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trila pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:22 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP6**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**46.02**	**E:384392.4 N:398952.1**	**2** of **3**

TP6 Face A





TP6 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:23 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP6**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**46.02**	**E:384392.4 N:398952.1**	**3** of **3**

TP6 Face C





TP6 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:24 | GR.
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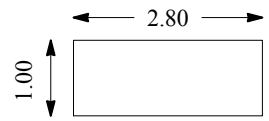
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP7**

Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.74**	**E:384379.3 N:399001.1**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: ASPHALT.	44.64	0.10	
						Light grey dark grey angular medium to coarse GRAVEL of limestone.	44.44	0.30	
0.40	1	ES	Tx2, Jx2, Vx2	≈		Black dark grey sandy angular to subrounded fine to coarse GRAVEL of ash, brick and sandstone.	44.24	0.50	
0.80	2	ES	Tx2, Jx2, Vx2			Very stiff light brown mottled light blue slightly sandy silty CLAY.		(1.00)	
							43.24	1.50	
						Trial pit terminated at 1.50m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - trial pit clear.
2. Slight seepage of water at 0.50m.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:24 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP7**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.74**	**E:384379.3 N:399001.1**	**2** of **3**

TP7 Face A





TP7 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:25 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP7**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.74**	**E:384379.3 N:399001.1**	**3** of **3**

TP7 Face C





TP7 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:26 | GR.
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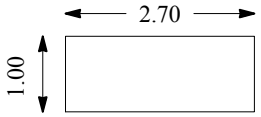
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP8**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**28.01.15**	**44.62**	**E:384368.9 N:398979.4**	**1** of **3**
	End: **28.01.15**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: ASPHALT.	44.52	0.10	
						Light grey dark grey angular medium to coarse GRAVEL of limestone.	44.42	0.20	
0.30	1	ES	Tx2, Jx2, Vx2			Black slightly clayey sandy angular to subangular fine to coarse GRAVEL of brick, ash and sandstone with low cobble content.		(0.50)	
						. . . below 0.65m, redundant water drain (100mm diameter) damaged.	43.92	0.70	
0.80	2	ES	Tx2, Jx2, Vx2			Stiff to very stiff light brown mottled light blue silty slightly sandy CLAY		(1.00)	
						Trial pit terminated at 1.70m depth.	42.92	1.70	

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's - water pipe detected.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:29 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP8**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.62**	**E:384368.9 N:398979.4**	**2** of **3**

TP8 Face A





TP8 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:29 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP8**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.62**	**E:384368.9 N:398979.4**	**3** of **3**

TP8 Face C





TP8 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:30 | GR.
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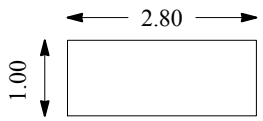
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP9**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**28.01.15** End: **28.01.15**	**44.48**	**E:384343.7 N:398972.7**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: ASPHALT.	44.38	0.10	
						MADE GROUND: Light grey dark grey angular medium to coarse GRAVEL of limestone.	44.18	0.30	
0.25	1	ES	Tx2, Jx2, Vx2			MADE GROUND: Black sandy angular to subangular fine to coarse GRAVEL of ash, brick and sandstone.	44.03	0.45	
						Very stiff light brown mottled light blue silty slightly sandy CLAY.		(0.85)	
1.00	2	ES	Tx2, Jx2, Vx2				43.18	1.30	
						Trial pit terminated at 1.30m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's- trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:30 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP9**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.48**	**E:384343.7 N:398972.7**	**2** of **3**

TP9 Face A





TP9 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:31 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP9**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**44.48**	**E:384343.7 N:398972.7**	**3** of **3**

TP9 Face C





TP9 Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:31 | GR.
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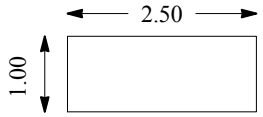
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP10**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**27.01.15** End: **27.01.15**	**41.67**	**E:384318.6 N:398969.9**	**1** of **2**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Light grey angular coarse GRAVEL.	41.57	0.10	
						MADE GROUND: Light brown gravelly fine to medium SAND. Gravel is angular medium to coarse limestone and brick.	41.37	0.30	
						Trial pit terminated at 0.30m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's- trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit terminated at 0.30m due to hard standing asphalt, unable to penetrate.
4. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:32 | GR.
Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk.

STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP10**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**41.67**	**E:384318.6 N:398969.9**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:32 | GR.
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STRUCTURAL SOILS

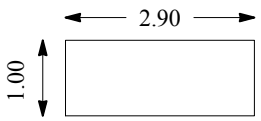
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP10a**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**27.01.15** End: **27.01.15**	**42.35**	**E:384326.9 N:398965.4**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Light grey dark grey clayey slightly sandy angular to subangular fine to coarse GRAVEL of limestone.	42.05	(0.30) 0.30	
0.40	1	ES	Tx2, Jx2, Vx2			MADE GROUND: Black dark grey angular to subrounded fine to coarse sandy GRAVEL of ash, brick and sandstone, including brickwork. . . . below 0.50m, waste materials including old shoes, plastic ties, fabrics.			
1.00	2	ES	Tx2, Jx2, Vx2					(2.50)	
2.00	3	ES	Tx2, Jx2, Vx2						
2.60	4	ES	Tx2, Jx2, Vx2			. . . below 2.50m, no waste materials.	39.55	2.80	
						Trial pit terminated at 2.80m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried servoces and UXO's - trial pit clear.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:32 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP10a**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**42.35**	**E:384326.9 N:398965.4**	**2** of **3**

TP10a Face A





TP10a Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:33 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP10a**
Contract Ref:	Start: **27.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **27.01.15**	**42.35**	**E:384326.9 N:398965.4**	**3** of **3**

TP10a Face C





TP10a Face D

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:33 | GR.
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STRUCTURAL SOILS

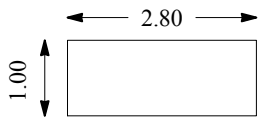
FINAL TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2&3 Angel Square	**Buro Happold**	**TP11**

Contract Ref:	Start:	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	**28.01.15** End: **28.01.15**	**43.81**	**E:384353.7 N:398950.7**	**1** of **3**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Black slightly clayey sandy angular to subrounded fine to coarse GRAVEL of brick and ash.		(0.60)	
0.30	1	ES	Tx2, Jx2, Vx2				43.21	0.60	
						MADE GROUND: Orange brown fine to medium SAND.			
						. . . at 0.70m, electric cables, no signals detected.	43.01	0.80	
						MADE GROUND: Black dark grey slightly clayey sandy angular to subangular fine to coarse GRAVEL of brick and ash.		(0.70)	
0.90	2	ES	Tx2, Jx2, Vx2						
						. . . below 1.30m, brown sandy clayey angular to subrounded fine to coarse gravel of ash and sandstone.			
1.40	3	ES	Tx2, Jx2, Vx2				42.31	1.50	
						Trial pit terminated at 1.50m depth.			

Plan (Not to Scale)



General Remarks

1. Trial pit scanned every 0.30m to detect both buried services and UXO's.
2. No groundwater encountered whilst excavating.
3. Trial pit backfilled on completion.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:34 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP11**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**43.81**	**E:384353.7 N:398950.7**	**2** of **3**

TP11 Face A





TP11 Face B

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:34 | GR.
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STRUCTURAL SOILS

FINAL TRIAL PIT LOG

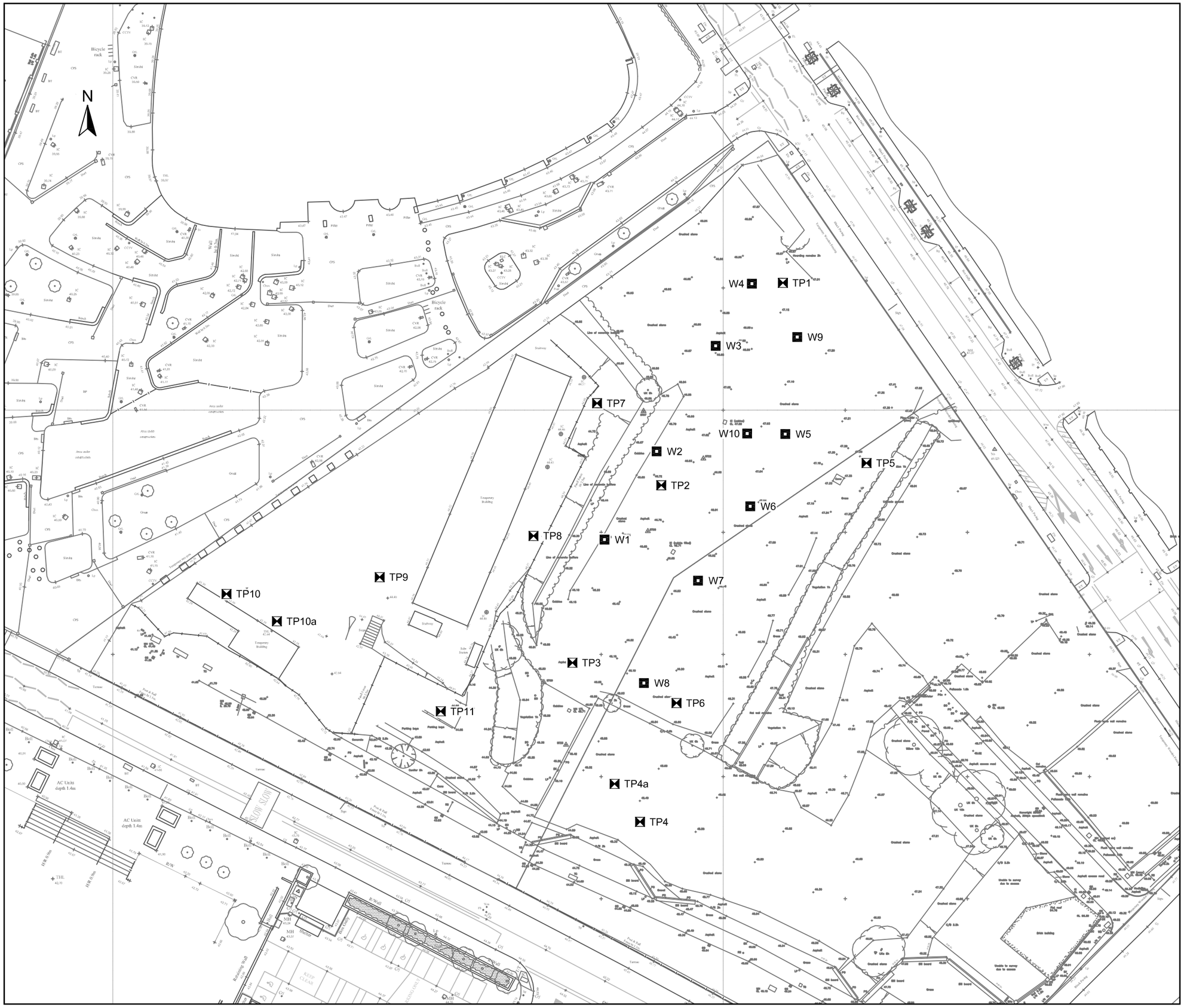
Contract:		Client:		Trial Pit:
2&3 Angel Square		**Buro Happold**		**TP11**
Contract Ref:	Start: **28.01.15**	Ground Level (m):	National Grid Co-ordinate:	Sheet:
763315	End: **28.01.15**	**43.81**	**E:384353.7 N:398950.7**	**3** of **3**

TP11 Face C



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**GRushton**	CAH

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 763315 ANGEL SQUARE.GPJ - v8_05 | 10/04/15 - 16:35 | GR.
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LEGEND

- Trial Pit Location
- WAC Stockpile Locations

REV	DATE	DESCRIPTION	BY	CHD	APR
01	18.02.2015	-	MW	GR	-

DIMENSION	SCALE	ORIGIN SIZE
m	1:600	A3

STRUCTURAL SOILS

The Potteries
Pottery Street
Castleford
WF10 1NJ

Tel: 01977 552255
Fax: 01977 552299
ask@soils.co.uk
www.soils.co.uk

CLIENT

NOMA (GP) Ltd

PROJECT

2&3 Angel Square, Manchester

TITLE

EXPLORATORY HOLE LOCATION PLAN

JOB NO	FIGURE
763315	2

DRAWING STATUS	REV
-	01

SCALE BAR

0 5 10 15 20 25 30m

KEY TO EXPLORATORY HOLE LOGS - SUMMARY OF ABBREVIATIONS

SAMPLING

Sample type codes

B	=	Bulk disturbed sample.
C	=	Core sample.
D	=	Small disturbed sample.
D-NR	=	Small disturbed sample - no recovery.
DSPT	=	Small disturbed sample originating from SPT test.
ES	=	Soil sample for environmental testing.
LB	=	Large bulk disturbed sample.
UT	=	Undisturbed thin wall sample.
UT100	=	Undisturbed sample UT100.

IN-SITU TESTING

$SPT_{(c)}$	=	Standard Penetration Test using a solid 60 degree cone.
SPT	=	Standard Penetration Test using split spoon sampler. ($_{(NR)}$ indicates 'No Sample Recovery').
	=	* denotes extrapolated N value. NP denotes 'No Penetration'.
V	=	Field Vane Test. Peak value (c_u) & Residual value (c_r), given as shear strength in kPa.

ROTARY DRILLING INFORMATION

W	=	Water flush returns (%)
TCR	=	Total core recovery (%)
SCR	=	Solid core recovery (%)
RQD	=	Rock quality designations (%)
If	=	Fracture spacing (mm). Where variable the minimum - mode - maximum spacing may be quoted.

In fracture column (i) denotes discontinuity is infilled (refer to Fracture Table for details).
'NI' denotes non-intact core. 'NA' denotes not applicable.

- All lengths used to determine rock core mechanical properties taken along the centre line of the core.
- Obvious induced fractures have been ignored.
- The assessment of solid core is based on lengths that show a full diameter and not necessarily a full circumference.

AZCL = Assessed zone of core loss.

ADDITIONAL NOTES

1. All soil and rock descriptions and legends in general accordance with BS EN ISO 14688-1, 14688-2, 14689-1, and BS5930:2015.
2. Material types divided by a broken line (- - -) indicates an unclear boundary.
3. Fracture spacings (If) quoted in the Description of Strata for specific strata or specific fracture sets are also quoted in mm, e.g. (25/80/230) referring to (Min/Avg/Max).
4. The data on any sheet within the report showing the AGS icon is available in the AGS format.

GINT_LIBRARY_V10_01.GLB|GrfcText G - LEGEND - 1 OF 2 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01 | 29/09/21 - 20:31 | JM2.
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STRUCTURAL SOILS

Contract Reference: **765325**

KEY TO EXPLORATORY HOLE LOGS - SUMMARY OF GRAPHIC SYMBOLS

WATER COLUMN SYMBOLS



First water strike, second water strike etc.



Standing water level following first strike, standing water level following second strike etc.


Seepage.


Standing water level recorded at documented date.

MATERIAL GRAPHIC LEGENDS


CLAY


Clayey gravelly SAND with COBBLES


GRAVEL


GRAVEL with COBBLES


Gravelly CLAY


Gravelly SAND


MADE GROUND


Possible MADE GROUND


SAND


Sandstone


Sandy CLAY


Sandy silty CLAY


Gravelly sandy CLAY


Sandy gravelly CLAY


Gravelly sandy CLAY with COBBLES


Gravelly silty SAND

INSTRUMENTATION SYMBOLS


Backfill


Bentonite seal


Concrete


Gravel filter


Plain pipe


Slotted pipe

GINT_LIBRARY_V10_01.GLB|GrfcText G - LEGEND - 2 OF 2 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01 | 29/09/21 - 20:32 | JM2.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH101**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**28.07.21** End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**1** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.20-0.50	1	B								MADE GROUND: Blackish brown gravelly fine to coarse SAND. Gravel is angular to subangular of brick, concrete, hardcore and sandstone. Low cobble content of brick.	(1.90)	
0.90-1.20	2	B										
1.50-1.95		SPT	N=13									
1.50-1.95	4	B										
											2.10	
2.10-2.50	5	B								Stiff brown slightly gravelly CLAY. Gravel is fine to coarse of sandstone, quartzite and mudstone.		
2.50-2.95	6	UT100	100 blows 89% recovery									
2.95-3.10	7	D										
3.50-3.95		SPT	N=23									
3.50-3.95	10	B										
3.50-3.95	9	D										
3.50-3.95	9	DSPT									(4.15)	
4.50-4.95	11	UT100	100 blows 100% recovery									
4.95-5.10	12	D										
5.50	13	D										
6.00-6.30		SPT	N=100*									
6.00-6.30	15	DSPT										
6.00-6.25	16	B										
6.25-6.50	17	B								Very dense light brown sandy fine to coarse subrounded to rounded GRAVEL of quartzite and sandstone. Sand is fine to coarse. Medium cobble content of sandstone and quartzite.	(1.35)	
7.00	18	D										
											7.60	
7.50-7.72		SPT(c)	N=125*									
7.50-8.00	20	B								Very dense orangish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of quartzite, sandstone and mudstone.		
8.50	21	D										

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
28/07/21	17:44	1.20	None	200	Dry
29/07/21	08:00	1.20	None	200	
29/07/21	18:00	12.22	12.00	150	11.70
30/07/21	08:00	12.22	12.00	150	-
30/07/21	15:00	16.50	16.50	150	13.10
02/08/21	08:00	16.50	16.50	150	-
02/08/21	12:00	18.00	18.00	150	14.50

Chiselling / Slow Progress

From	To	Duration (hh:mm)
6.25	7.60	03:00
9.50	11.00	02:00
16.64	18.00	01:30

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.20m.
3. Cable percussion drilling to 18.00m with 200mm and 150mm diameter casing and tools.
4. Stainless steel casing (3m lead lengths) used to allow UXO scan to be carried out as borehole is

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log COMPOSITE LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH101**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**28.07.21** End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**2** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
9.00-9.33		SPT	N=83*							Very dense orangish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of quartzite, sandstone and mudstone. *(stratum copied from 7.60m from previous sheet)*	(4.30)	
9.00-9.33	23	DSPT										
9.00-9.50	24	B										
10.00	25	D										
10.50-10.80		SPT	N=100*									
10.50-10.80	27	DSPT										
10.50-11.00	28	B										
11.50	29	D									11.90	
12.00-12.22		SPT	N=214*							Stiff brown slightly gravelly very sandy CLAY.	(3.10)	
12.00-12.22	31	DSPT										
12.00-12.50	32	B										
13.00	33	D										
13.50-13.80	34	UT100	150 blows 67% recovery									
14.00	35	D										
14.50	36	D									15.00	
15.00-15.16		SPT	N=250*							Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of quartzite and sandstone.	(1.60)	
15.00-15.50	39	B										
16.00	40	D									16.60	
16.50-16.64		SPT	N=214*							Extremely to very weak red brown medium grained SANDSTONE.	(1.40)	
16.50-17.00	43	B										
17.50	44	D									18.00	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

drilled.
5. Rotary coring from 18.00m to 29.00m using water flush.
6. Installation as shown.
7. Cable percussion rig re-erected to complete installation and pull casing.
8. SPT hammer AR1862-2021 (E_r = 95.00%)

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log COMPOSITE LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH101**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**28.07.21** End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**3** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
18.00-18.50										Very weak laminated red brown medium grained SANDSTONE. Very closely to closely spaced horizontal discontinuities.		
18.00-18.07		SPT	N=375*	36	0	0						
18.50-19.00				100	74	0				. . . 18.00 to 18.50m core run mainly medium sand, bottom 180 mm extremely weak sandstone.		
19.00-19.50				100	62	20	NI			. . . 18.00 to 18.95m 45° rough planar discontinuity.		
19.50-20.50				80	55	10	50 100			. . . 19.00 to 19.10m 60° smooth planar discontinuity. . . . 19.00 to 19.57m extremely weak, recovered as sand with medium gravel sized fragments of sandstone.	(3.50)	
20.50-21.50										. . . 19.45 to 19.46m redbrown mudstone / clay . . . 19.70 to 19.80m extremely weak, recovered as sand with medium gravel sized fragments of sandstone.		
20.50		C		90	80	37	NI 50 180			. . . 20.30 to 20.50m 50° rough planar discontinuity. . . . 20.33 to 20.53m 50° rough planar discontinuity. . . . below 20.60m thinly bedded.		
21.50-23.00				100	93	70	NI 280			Very weak to weak red brown medium to coarse grained SANDSTONE. Closely to medium spaced horizontal discontinuities.	21.50 (3.10)	
23.00-24.50												
23.00		C		87	67	20				. . . 23.55 to 23.70 m medium grained sandstone. . . . 23.70 to 24.10 m medium to coarse, mainly coarse grained sandstone. . . . 24.10 to 24.50 m exremely to weak weak core non intact.	24.60	
24.50-26.00							NI NI NI			Extremely weak red brown fine and medium grained SANDSTONE. Frequent high angled rough planar discontinuities.	24.90	
										Very weak red brown medium grained SANDSTONE. . . . 24.93 to 25.10m 80°smooth planar discontinuity. . . . 25.10 to 25.17m 80°smooth planar discontinuity, terminates against underlying discontinuity. . . . 25.15 to 25.20m 50°smooth planar discontinuity. . . . 25.30m high angled rough planar discontinuity at 90° to overlying discontinuities.	25.20	
25.50		C		98	80	73						
26.00-27.50							50 200 380					
26.60		C		92	92	81				*Description on next sheet.*		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH101**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**28.07.21** End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**4** of **7**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
				92	92	81				Very weak to weak red brown medium to coarse SANDSTONE. Closely to medium spaced sub horizontal discontinuities.	(3.80)	
27.50-29.00												
27.65		C					50			. . . 25.20 to 25.35m 50°smooth planar discontinuity.*(stratum copied from 25.20m from* previous sheet)		
				84	84	73	200					
28.30		C					380					
											29.00	
29.00		C								Borehole terminated at 29.00 m		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH101**
Contract Ref:	Start: **28.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**5** of **7**

BH101 18.00-19.50m





BH101 19.50-21.50m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH101**
Contract Ref:	Start: **28.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**6** of **7**

BH101 21.50-24.50m





BH101 24.50-27.50m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH101**
Contract Ref:	Start: **28.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **03.08.21**	**47.52**	**E:384428.0 N:399004.2**	**7** of **7**

BH101 27.50-29.00m



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Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:	AGS

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH102**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **03.08.21**	**46.88**	**E:384393.0 N:399004.2**	**1** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
										MADE GROUND: Tarmac	0.10	
0.30-0.50	1	B								MADE GROUND: Grey medium to coarse angular GRAVEL.	0.30	
0.30-0.50	2	D										
0.70-1.00	3	B								MADE GROUND: Blackish brown gravelly fine to coarse SAND. Gravel is angular to subangular of brick, concrete, hardcore, sandstone with low cobble content of brick.	0.70	
1.00-1.00	4	D										
1.20-1.35	5	UT	46 blows 300% recovery							Stiff brown slightly gravelly CLAY. Gravel is fine to coarse of sandstone, quartzite and mudstone.		
1.20-1.70	6	B										
1.70-1.70	7	D										
2.00-2.45		SPT	N=16									
2.00-2.45	8	DSPT										
2.00-2.50	9	B										
2.50	10	D										
3.00-3.45	11	UT	50 blows 89% recovery								(5.30)	
4.00-4.45		SPT	N=16							. . . 4.00 to 4.50m thin bed of stiff lminated brown CLAY		
4.00-4.45	12	DSPT										
4.00	13	B										
4.50	14	D								. . . below 4.50m becomes dark brown.		
5.00-5.45	15	UT	68 blows 0% recovery									
5.45	16	D										
5.50-6.00	17	B									6.00	
6.00	18	D								Very dense orangish brown slightly gravelly fine to coarse SAND. Gravel is subangular too rounded fine of sandstone, mudstone and quartzite.		
6.50-6.77		SPT	N=97*									
6.50	19	DSPT										
6.50-7.00	20	B										
7.00	21	D									(2.60)	
8.00-8.21		SPT	N=117*									
8.00-8.45	22	DSPT								. . . 8.00 to 8.60 m thin bed of stiff slightly gravelly very sandy CLAY.		
8.00-8.50	23	B										
8.50	24	D									8.60	
8.60-9.00	25	B								*Description on next sheet*		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
29/07/21	17:30	9.00	8.00	200	Dry
30/07/21	08:00	9.00	8.00	200	Dry
30/07/21	17:30	12.00	11.00	150	Dry
02/08/21	08:00	12.00	11.00	150	Dry
02/08/21	17:30	18.00	17.00	150	Dry

Chiselling / Slow Progress

From	To	Duration (hh:mm)
10.00	10.30	00:30
11.10	11.30	00:30
16.00	16.30	00:45
18.00	18.10	01:00
18.10	18.20	01:00

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.20m.
3. Cable percussion drilling to 18.20m with 200mm and 150mm diameter casing and tools.
4. Stainless steel casing (3m lead lengths) used to allow UXO scan to be carried out as borehole is

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH102**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**29.07.21** End: **03.08.21**	**46.88**	**E:384393.0 N:399004.2**	**2** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
9.00	26	D								Very dense light brown sandy fine to coarse subrounded to rounded GRAVEL of quartzite and sandstone. Sand is fine to coarse. Medium cobble content of quartzite. *(stratum copied from 8.60m from previous sheet)*	(2.40)	
9.50-9.88		SPT	N=65*									
9.50-10.00	28	B										
9.55-9.95	27	DSPT										
10.00	29	D									11.00	
11.00-11.26		SPT	N=143*							Medium dense orangish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of quartzite, sandstone and mudstone.		
11.00	30	DSPT										
11.00-11.50	31	B										
11.50	32	D									(2.00)	
										. . . At 12.00m becomes slightly clayey.		
12.50-12.95		SPT	N=13									
12.50-13.00	34	B									13.00	
13.00	35	D-NR								Medium dense reddish brown brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of quartzite and sandstone. and occasional black mudstone.		
14.00-14.45		SPT	N=23									
14.00-14.50	37	B									(2.50)	
14.50	38	D										
											15.50	
15.50-15.85		SPT	N=75*							Very dense reddish brown fine to medium SAND with occssional angular fine to medium gravel of extremely weak sandstone.		
15.50-15.50	40	B										
16.00	41	D									(2.70)	
17.00-17.12		SPT	N=259*									
17.00-17.50	43	B										
17.50	44	D										

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

drilled.
5. Rotary coring from 18.20m to 28.00m using water flush.
6. Installation as shown.
7. Cable percussion rig re-erected to complete installation and pull casing.
8. SPT hammer CD-1 2020 (E_r = 60.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH102**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**29.07.21** End: **03.08.21**	**46.88**	**E:384393.0 N:399004.2**	**3** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
18.00	45	D								. . . below 18.00 m gravel size fragments become medium to coarse and more frequent. Gravel is tabular, suggesting very thinly bedded sandstone.	18.20	
18.20-19.00				94	87	25				Very weak to weak red brown medium to coarse grained SANDSTONE. Very closely to closely spaced sub horizontal rough planar to undulating discontinuities.		
19.00-20.00												
19.00		C		100	88	43				. . . 19.30 to 19.34m extremely weak red brown mudstone.		
20.00-21.50				100	97	52						
21.50-23.00										. . . 21.43 to 21.45m extremely weak red brown mudstone dip 30°, 50 mm thick.		
21.50		C		97	93	38	NI 93 280					
23.00-24.50											(9.80)	
24.00		C		93	93	63						
24.50-26.00										. . . 24.55 to 25.15m some medium elongate gravel of mudstone, becomes more frequent with depth, shows some current bedding.		
26.00-27.50				100	100	38				. . . 25.95 to 26.00m extremely weak		
26.00		C										
26.50		C		93	73	43				. . . 26.35m 20mm lamination of extremely weak mudstone dip 80° . . . 26.52 to 26.64m 70° rough planar discontinuity		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH102**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**29.07.21** End: **03.08.21**	**46.88**	**E:384393.0 N:399004.2**	**4** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
27.50-28.00				93 / 86	73 / 86	43 / 86	NI 93 280			. . . 26.65 to 26.74m lamination of red brown clay / mudstone, dip 70°/80° estimated, over medium sand . . . Below 26.86m coarse sand more frequent. . . . 26.87 to 27.00m 70° rough planar discontinuity		
28.00		C								Very weak to weak red brown medium to coarse grained SANDSTONE. Very closely to closely spaced sub horizontal rough planar to undulating discontinuities. *(stratum copied from 18.20m from previous sheet)* . . . 27.20 to 27.40m 70° rough planar discontinuity	28.00	
										Borehole terminated at 28.00 m		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH102**
Contract Ref:	Start: **29.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **03.08.21**	**46.88**	**E:384393.0 N:399004.2**	**5** of **6**

BH102 18.20-20.00m





BH102 20.00-23.00m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH102**
Contract Ref:	Start: **29.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **03.08.21**	**46.88**	**E:384393.0 N:399004.2**	**6** of **6**

BH102 23.00-26.00m





BH102 26.00-28.00m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH103**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**21.07.21** End: **26.07.21**	**43.00**	**E:384345.0 N:398961.0**	**1** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.10-0.40	1	B								MADE GROUND: Brown sandy angular to subangular fine to coarse GRAVEL of concrete sandstone brick mudstone and hardcore. Sand is fine to coarse. Low cobble content of brick.	(1.10)	
0.10-0.95	101	ES									1.20	
0.90-1.20	2	B										
1.20-2.00	102	ES								MADE GROUND: Blackish brown slightly gravelly clayey fine to coarse SAND. Gravel is angular to subangular is fine to coarse of sandstone hardcore concrete and asphalt. Low cobble content of sandstone. Occasional rootlets present.	(1.75)	
1.50-1.95		SPT	N=17									
1.50-1.95	5	B									2.95	
2.00-2.95	103	ES										
2.50-2.95		SPT	N=27									
2.50-2.95	8	B										
3.50-3.95		SPT	N=12							MADE GROUND: Firm orangish brown gravelly CLAY. Gravel is angular to subangular fine to coarse of brick concrete quartzite and sandstone. Low cobble content of brick and concrete.	(2.05)	
3.50-4.00	104	ES										
3.50-3.95	11	B									5.00	
4.50-4.61		SPT	N=600*									
4.50-5.00	105	ES										
4.50-5.00	13	B										
5.00-5.50	14	B								Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine of sandstone quartz and mudstone.	(0.50)	
6.00-6.43		SPT	N=54*							Very dense reddish brown sandy subrounded to rounded fine to coarse GRAVEL of various lithologies including quartz and sandstone.	5.50	
6.00-6.43	17	B									(1.50)	
7.00-7.50	18	B									7.00	
7.50-7.95	19	UT100	150 blows 67% recovery							Stiff reddish brown slightly gravelly sandy CLAY. Gravel is sub rounded to rounded fine to coarse of quartz and sandstone. . . . 7.00m becomes slightly clayey	(1.00)	
8.00-8.50	20	B								Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to medium of sandstone, quartz and mudstone.	8.00	

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
21/07/21	17:09	6.45	6.20	200	5.70
22/07/21	08:15	6.45	6.20	200	Dry
22/07/21	16:29	12.00	12.00	150	6.00

Chiselling / Slow Progress

From	To	Duration (hh:mm)
4.00	5.00	01:30
11.30	12.00	01:00

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.20m.
3. Cable percussion drilling to 12.00m with 200mm and 150mm diameter casing and tools.
4. Stainless steel casing (3m lead lengths) used to allow UXO scan to be carried out as borehole is

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**CBailey**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH103**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**21.07.21** End: **26.07.21**	**43.00**	**E:384345.0 N:398961.0**	**2** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
9.00-9.21 9.00-9.50	23	SPT B	N=188*							Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to medium of sandstone, quartz and mudstone. *(stratum copied from 8.00m from previous sheet)*	(3.10)	
10.00	24	D									11.10	
10.50-10.67 10.50-11.00	27	SPT B	N=214*									
11.10-12.00	28	B								Extremely to very weak red brown medium grained SANDSTONE.	(0.90)	
12.00-13.50 12.00-12.08		SPT	N=375*	30	23	7	NI 60 100			Very weak to weak red brown medium to coarse grained SANDSTONE. Very closely to closely spaced sub horizontal rough planar and undulating discontinuities.	12.00	
13.50-14.50				96	96	66	20 120 170					
14.50-16.00 14.60		C		96	96	49	NI 80 140			. . . 14.50 to 14.70m with occasional angular flat fine to medium gravel of red brown mudstone.		
15.50		C								. . . Below 15.30m discontinuities mainly closely to medium spaced.		
16.00-17.50				98	98	83	NI 145 390					
16.80		C										
17.20		C										
17.50-19.00				100	98	92						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

drilled.
5. Rotary coring from 12.00m to 25.00m using water flush.
6. Installation as shown.
7. Cable percussion rig re-erected to complete installation and pull casing.
8. SPT hammer AR1862-2021 (E_r = 95.00%)

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**CBailey**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH103**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**21.07.21** End: **26.07.21**	**43.00**	**E:384345.0 N:398961.0**	**3** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
17.95		C								Very weak to weak red brown medium to coarse grained SANDSTONE. Very closely to closely spaced sub horizontal rough planar and undulating discontinuities. *(stratum copied from 12.00m from previous sheet)* . . . 18.35 to 18.30m core non intact recovered as coarse angular gravel sized fragments. . . . Below 19.00m more coarse sand size grains.	(13.00)	
19.00-20.50				100	98	92						
19.80		C										
20.50-22.00				100	100	77						
22.00-23.50				95	91	63	NI 145 390			. . . 20.95 to 21.00m with some medium sub rounded gravel of quartzite.		
22.40		C								. . . 22.10 to 22.20m 45° rough undulating discontinuity.		
23.50-25.00				100	97	70						
24.17		C										
25.00		C		100	100	90				Borehole terminated at 25.00 m	25.00	

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**CBailey**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH103**
Contract Ref:	Start: **21.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **26.07.21**	**43.00**	**E:384345.0 N:398961.0**	**4** of **6**

BH103 12.00-14.50m





BH103 14.50-17.50m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**CBailey**	Checked By:

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH103**
Contract Ref:	Start: **21.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **26.07.21**	**43.00**	**E:384345.0 N:398961.0**	**5** of **6**

BH103 17.50-20.50m





BH103 20.50-23.50m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**CBailey**	Checked By:

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BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH103**
Contract Ref:	Start: **21.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **26.07.21**	**43.00**	**E:384345.0 N:398961.0**	**6** of **6**

BH103 23.50-25.00m



Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**CBailey**	Checked By:

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH104**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **29.07.21**	**44.40**	**E:384349.3 N:398986.7**	**1** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.10-0.40	1	B								MADE GROUND: Blackish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of sandstone quartz concrete and hardcore.	0.45	
0.10-0.40	101	ES										
0.50-0.80	2	B								Firm orangish brown sandy CLAY. Sand is fine to medium.	(0.55) 1.00	
1.00-1.20	3	B								Firm brown CLAY mottled grey present on fissures and frequent root traces.	1.20	
1.50-1.65		SPT	N=200*							Firm orangish brown slightly gravelly sandy CLAY. Gravel is angular to subangular fine to coarse of sandstone and mudstone. Sand is fine to coarse. Low cobble content of sandstone.	(0.70) 1.90	
1.50-1.65	5	DSPT										
1.50-1.80	6	B										
2.00-2.50	7	B								Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine of sandstone quartz and mudstone.	(2.10) 4.00	
2.50-2.70		SPT	N=150*									
2.50-3.00	9	B										
3.50-3.83		SPT	N=83*									
3.50-3.83	11	DSPT										
3.50-4.00	12	B										
4.00-4.40	13	B								Very dense reddish brown sandy subrounded to rounded fine to coarse GRAVEL of various lithologies including quartzite sandstone.	(2.80) 6.80	
4.50-4.70		SPT	N=214*							. . . 4.50 to 4.60m driller records thin bed of slightly gravelly CLAY.		
4.50-4.70	15	DSPT										
4.50-5.00	16	B										
5.50	17	D										
6.00-6.21		SPT(c)	N=250*									
6.00-6.50	19	B										
6.80-7.30	20	B								Very dense orangish brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine of sandstone and quartz.	(1.70) 8.50	
7.50-7.85		SPT	N=75*									
7.50-7.85	22	DSPT										
7.50-8.00	23	B										
8.50-9.00	24	B								*Description on next sheet*		

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
22/07/21	18:08	1.20	None	200	Dry
23/07/21	08:05	1.20	None	200	Dry
23/07/21	14:00	5.30	5.30	200	5.20
26/07/21	09:59	5.30	5.30	200	Dry
26/07/21	17:33	13.80	13.50	150	10.50
27/07/21	08:05	13.80	13.50	150	13.10
27/07/21	17:57	22.58	22.50	150	14.10
28/07/21	08:00	22.50	22.50	150	15.10

Chiselling / Slow Progress

From	To	Duration (hh:mm)
4.50	5.30	03:00
5.30	6.00	01:00
6.00	6.80	01:00
14.20	15.00	01:00
15.00	16.50	01:30
21.90	22.50	01:15
22.58	24.00	01:30

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.20m.
3. Cable percussion drilling to 24.00m with 200mm and 150mm diameter casing and tools.
4. Stainless steel casing (3m lead lengths) used to allow UXO scan to be carried out as borehole is

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH104**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **29.07.21**	**44.40**	**E:384349.3 N:398986.7**	**2** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
9.00-9.30	25	UT100	150 blows 67% recovery							Very stiff brown slightly gravelly sandy CLAY. Gravel is subrounded to rounded fine of quartz, mudstone and sandstone. *(stratum copied from 8.50m from previous sheet)*	(3.00)	
9.50-10.00	26	B										
10.50-10.74		SPT	N=115*									
10.50-10.74	28	DSPT										
10.50-11.00	29	B										
											11.50	
11.50-12.00	30	B								Very dense reddish brown slightly gravelly fine to coarse SAND. Gravel is fine of quartz, sandstone and mudstone.		
12.00-12.15		SPT	N=200*									
12.00-12.15	32	DSPT										
12.00-12.50	33	B									(2.70)	
13.00	34	D										
13.50-13.80		SPT	N=100*									
13.50-13.80	36	DSPT										
13.50-14.00	37	B										
											14.20	
14.20-14.50	38	B								Very dense reddish brown fine to coarse SAND (driller records it as cemented sand)		
15.00-15.18		SPT	N=231*									
15.00-15.18	40	DSPT										
15.00-15.50	41	B										
16.00	42	D										
16.50-16.66		SPT	N=176*									
16.50-16.66	44	DSPT										
16.50-17.00	45	B										
17.50	46	D										

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
28/07/21	12:21	24.07	22.50	150	16.20

Chiselling / Slow Progress

From	To	Duration (hh:mm)

General Remarks

drilled.
5. Rotary coring from 24.00m to 31.00m using water flush.
6. Installation as shown.
7. Cable percussion rig re-erected to complete installation and pull casing.
8. SPT hammer AR1862-2021 (E_r = 95.00%)

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH104**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **29.07.21**	**44.40**	**E:384349.3 N:398986.7**	**3** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
18.00-18.14		SPT	N=200*							Very dense reddish brown fine to coarse SAND (driller records it as cemented sand) *(stratum copied from 14.20m from previous sheet)*	(7.70)	
18.00-18.14	48	DSPT										
18.00-18.50	49	B										
19.00	50	D										
19.50-19.65		SPT	N=200*									
19.50-19.65	52	DSPT										
19.50-20.00	53	B										
20.50	54	D										
21.00-21.25		SPT	N=150*									
21.00-21.25	56	DSPT										
21.00-21.50	57	B									21.90	
22.00-22.50	58	D								Extremely weak to very weak reddish brown medium grained SANDSTONE.	(2.10)	
22.50-22.58		SPT	N=375*									
22.50-22.58	60	DSPT										
22.50-23.50	61	B									24.00	
24.00-25.00				85	84	25	NI 77 130			Very weak to weak red brown medium to coarse grained SANDSTONE. Very closely to closely spaced sub horizontal rough planar and undulating discontinuities. . . . 24.55 to 24.70m with some angular fine gravel of quartzite and mudstone, occasional sub rounded coarse gravel of quartzite.		
24.00-24.07		SPT(c)	N=375*									
25.00-26.50				87	82	53	NI 130 370			. . . 25.55 to 26.50m ocassional angular fine and medium gravel of grey mudstone, sandstone and quartzite.		
25.40		C										
26.50-28.00				93	77	60						
26.80		C										

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
2 & 3 Angel Square	**MEPC Ltd**	**BH104**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **29.07.21**	**44.40**	**E:384349.3 N:398986.7**	**4** of **6**

Depth (m)	Samples & Testing: No	Type	Results	Mechanical Log: TCR (%)	SCR (%)	RQD (%)	If (mm)	Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
										. . . 26.90m single sub rounded coarse gravel of quartzite. Very weak to weak red brown medium to coarse grained SANDSTONE. Very closely to closely spaced sub horizontal rough planar and undulating discontinuities. *(stratum copied from 24.00m from previous sheet)* . . . 28.10 to 28.32m vertical, rough planar discontinuity.	(7.00)	
27.65		C		93	77	60						
28.00-29.50												
28.20		C										
				91	83	77	NI 130 370			. . . 29.20 to 29.60m some sub rounded fine gravel of quartzite, mainly more coarse sand.		
29.50-31.00												
29.90		C										
				100	96	72				. . . 30.65 to 30.70m extremely closley spaced sub vertical and sub horizontal rough discontinuities, core is non intact.	31.00	
31.00		C								. . . 30.85 to 31.00m 80° rough planar discontiniuty. Borehole terminated at 31.00 m		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable Percussion + Rotary Cored	**Dando 2500 + Massenza M-I-3**	**Robert Foster**	**IHayes**	

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH104**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **29.07.21**	**44.40**	**E:384349.3 N:398986.7**	**5** of **6**

BH104 24.00-26.50m





BH104 26.50-29.50m

Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:

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STRUCTURAL SOILS

BOREHOLE LOG

Contract:		Client:		Borehole:
2 & 3 Angel Square		**MEPC Ltd**		**BH104**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **29.07.21**	**44.40**	**E:384349.3 N:398986.7**	**6** of **6**

BH104 29.50-31.00m



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Method Used:	**Inspection pit + Cable Percussion + Rotary Cored**	Plant Used:	**Dando 2500 + Massenza M-I-3**	Drilled By:	**Robert Foster**	Logged By:	**IHayes**	Checked By:	

STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS101**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **21.07.21**	**46.90**	**E:384402.9 N:399024.2**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Weak to medium strong greyish black ASPHALT. Matrix is angular to subrounded fine to medium, 20-25% voids. (ROAD SURFACE)	0.10 (0.30)	
							MADE GROUND: Cream angular to subrounded fine to coarse sandy GRAVEL of limestone, occasional sandstone and quartz. (HARDCORE TYPE 1)	0.40	
							MADE GROUND: Light brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone and occasional concrete.	(0.75)	
	1.00	6	D					1.15	
	1.15	7	B				MADE GROUND: Dark brown mottled black gravelly clayey fine to coarse SAND of ash. Gravel is angular to subrounded of ash, brick.		
	1.20-1.65		SPT	N=9					
	1.20	1	DSPT						
1.00 - 2.00 (101mm dia) 90% rec	1.50	101	ES					(0.95)	
							. . . From 1.85m to 2.00m depth: Brick cobbles, angular to subrounded.		
	2.00-2.45		SPT	N=15				2.10	
	2.00	2	DSPT						
	2.10	8	B				MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to subrounded fine to coarse brick, occasional sandstone and mudstone.		
2.00 - 3.00 (89mm dia) 80% rec	2.50	102	ES						
	3.00-3.45		SPT	N=30				(1.85)	
	3.00	3	DSPT						
3.00 - 4.00 (79mm dia) 90% rec	3.40	9	B				. . . From 3.40m to 3.95m depth: Gravel content increases predominantly angular to subangular fine to medium of brick.		
	3.50	103	ES						
								3.95	
	3.95	10	D				Very stiff slightly sandy silty CLAY. (TILL)		
	4.00-4.45		SPT	N=39					
	4.00	4	DSPT						
4.00 - 4.75 (69mm dia)									

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)
21/07/21		2.30	-	89	

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.00m.
3. UXO scan carried out as hole drilled.
4. Water strike at 2.30 m depth
5. SPT refusal at 5.15 m depth.
6. Installed with 50mm standpipe - GL to 1.00m plain - 1.00m to 4.00m slotted.
7. SPT hammer DART384-2021 (E_r = 76.00%) used.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS101**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **21.07.21**	**46.90**	**E:384402.9 N:399024.2**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
4.00 - 4.75 (69mm dia)	4.95-5.28 4.95	5	SPT DSPT	N=86*			Very stiff slightly sandy silty CLAY. (TILL) *(stratum copied from 3.95m from previous sheet)*	(1.33)	
							Window sample hole terminated at 5.28m depth.	5.28	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS102**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **21.07.21**	**47.20**	**E:384401.8 N:398986.7**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	1.00-1.45		SPT	N=7			MADE GROUND: Brownish cream very gravelly slightly clayey fine to coarse SAND. Gravel is angular to subrounded of limestone, sandstone and occasional quartz. (HARDCORE TYPE 1)	(0.35)	
								0.35	
	1.00	1	DSPT				MADE GROUND: Brownish black gravelly slightly clayey fine to coarse SAND of predominantly ash. Gravel is angular to subrounded fine to coarse of brick, ash, occasional sandstone and rare mudstone. Low cobble content, angular to subangular of brick.	(1.00)	
	1.00-1.35	101	ES						
	1.00-1.35	6	D						
1.00 - 2.00 (101mm dia) 100% rec	1.35-4.00	7	B					1.35	
	2.00-2.45		SPT	N=17			Very stiff brown slightly sandy slightly gravelly indistinctly laminated CLAY. Gravel rare angular to rounded fine to coarse of sandstone. (TILL)		
	2.00	2	DSPT						
2.00 - 3.00 (89mm dia) 100% rec									
	3.00-3.45		SPT	N=19				(3.70)	
	3.00	3	DSPT						
3.00 - 4.00 (79mm dia) 100% rec									
	4.00-4.45		SPT	N=21					
	4.00	4	DSPT						
4.00 - 4.80 (69mm dia) 100% rec									

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.00m.
3. UXO scan carried out as hole drilled.
4. Installed with 50mm standpipe - slotted GL to 1.00m, bentonite backfill 1.00m to 5.05m.
5. SPT hammer DART384-2021 (E_r = 76.00%) used.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS102**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **21.07.21**	**47.20**	**E:384401.8 N:398986.7**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
4.00 - 4.80 (69mm dia) 100% rec	4.80-5.03 4.80	5	SPT DSPT	N=200*			Very stiff brown slightly sandy slightly gravelly indistinctly laminated CLAY. Gravel rare angular to rounded fine to coarse of sandstone. (TILL) *(stratum copied from 1.35m from previous sheet)*	5.05	
							Window sample hole refused at 5.05m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS103**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **22.07.21**	**44.55**	**E:384367.0 N:398992.4**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Grey and cream fine to coarse SAND and angular to subrounded fine to coarse GRAVEL of limestone, concrete and sandstone. (HARDCORE)	0.10	
	0.20	1	D				MADE GROUND: Black gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of ash and occasional sandstone and concrete.	0.35	
	0.20	101	ES						
	0.40	102	ES						
	0.40	2	D				Firm to stiff brown occasionally mottled dark brown slightly sandy silty CLAY with occasional pockets of silt. 20-50mm diameter. (TILL)		
	1.00-2.00	5	B						
1.20 - 2.00 (101mm dia) 100% rec	1.20-1.65		SPT	N=15			. . . From 1.00m to 2.40m depth: Firm to stiff slightly gravelly dark brown slightly sandy CLAY with indistinct laminations and closely spaced partings of silt. Gravel is angular to rounded fine to coarse of sandstone, occasional quartz and mudstone.	(2.10)	
	1.20	3	DSPT						
	2.00-2.45		SPT	N=51*					
	2.00	4	DSPT					2.45	
							Window sample hole terminated at 2.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.20m.
3. UXO scan carried out as hole drilled.
4. SPT refusal at 2.40 m depth.
5. Installed with 50mm standpipe - slotted GL to 1.00m, bentonite backfill 1.00m to 2.40m.
6. SPT hammer DART384-2021 (E_r = 76.00%) used.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS104**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **22.07.21**	**45.20**	**E:384367.0 N:398943.7**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.25-0.60	2	B				MADE GROUND: Cream and grey fine to coarse SAND and angular to subrounded fine to coarse GRAVEL of limestone and occasional concrete. (HARDCORE)	0.25	
	0.30	1	D				MADE GROUND: Black gravelly fine to coarse SAND of ash. Gravel is angular to subrounded fine to coarse of ash.	(0.35)	
	0.30	101	ES					0.60	
	0.60-1.20	4	B				Stiff to very stiff dark brown slightly sandy slightly gravelly indistinctly laminated CLAY. Gravel is angular to rounded fine to coarse of sandstone and mudstone. (TILL)		
	0.70	102	ES						
	0.70	3	D						
	1.00-1.45		SPT	N=12					
1.00 - 2.00 (101mm dia) 100% rec	1.00-2.00	8	B						
	2.00-2.45		SPT	N=12			. . . At 2.00m depth: Dark brown very stiff.	(2.80)	
2.00 - 3.00 (89mm dia) 100% rec	2.00-3.00	9	B						
	3.00-3.38		SPT	N=67*					
								3.40	
							Window sample hole terminated at 3.40m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.00m.
3. UXO scan carried out as hole drilled.
4. Installed with 50mm standpipe - slotted GL to 1.00m, bentonite backfill 1.00m to 3.40m.
5. SPT hammer DART384-2021 (E_r = 76.00%) used.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS105**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **22.07.21**	**41.70**	**E:384311.3 N:398964.5**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Grass over black gravelly fine to coarse SAND of ash. Gravel is angular to subrounded fine to coarse of ash, occasional concrete and brick. Low cobble content, angular to subangular of brick.		
1.00 - 2.00 (89mm dia) 100% rec	1.00-1.45 1.00 1.00-1.50 1.00-2.70	 1 101 8	SPT DSPT ES B	N=18				(2.80)	
2.00 - 2.70 (79mm dia) 100% rec	2.00-2.45 2.00	 2	SPT DSPT	N=39					
2.70 - 4.00 (69mm dia) 100% rec	2.70-3.15 2.70 2.80-3.50	 3 7	SPT DSPT D	N=33				2.80	
							MADE GROUND: Soft to firm brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of brick, sandstone, quartz and occasional concrete.	(0.70)	
	3.50-4.65	9	B				MADE GROUND: Orangish brown mottled yellow slightly gravelly fine to coarse SAND. Gravel is subangular to rounded of quartz, brick, sandstone and mudstone.	3.50	
4.00 - 5.00 (69mm dia) 100% rec	4.00-4.45 4.00-4.65 4.00	 102 4	SPT ES DSPT	N=22				(1.15)	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Scanned with CAT and Genny before breaking ground.
2. Hand dug pit to 1.20m.
3. UXO scan carried out as hole drilled.
4. Installed with 50mm standpipe - GL to 1.00m plain - 1.00m to 4.00m slotted, bentonite backfill 4.00m to 5.45m.
5. SPT hammer DART384-2021 (E_r = 76.00%) used.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
2 & 3 Angel Square	**MEPC Ltd**	**WS105**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**22.07.21** End: **22.07.21**	**41.70**	**E:384311.3 N:398964.5**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
4.00 - 5.00 (69mm dia) 100% rec								4.65	
	5.00-5.45 5.00	5	SPT DSPT	N=16			Orangish brown gravelly fine to coarse SAND. Gravel is subangular to rounded fine to coarse of sandstone, mudstone and quartz. (TILL)	(1.80)	
5.00 - 6.00 (59mm dia) 0% rec								6.45	
	6.00-6.45 6.00	6	SPT DSPT	N=35			Window sample hole terminated at 6.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Archway Dart 383**	**B Pine**	**IHayes**	

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STRUCTURAL SOILS

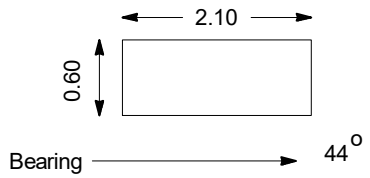
TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP101**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**47.00**	**E:384421.7 N:399019.0**	**1** of **2**

Description of strata by stratum code and associated diagrams

Stratum code	Stratum description
a	MADE GROUND: Light brown very sandy medium to coarse angular GRAVEL of limestone.
b	MADE GROUND: Dark grey very sandy fine to coarse angular to sub rounded GRAVEL with whole and half bricks. Gravel is mainly sandstone and brick fragments, with some fragments of glass, plastic and pottery. .....Bricks more frequent with depth. .....0.90 - 1.20 m earthenware drain pipe. Southern end .....0.10-0.90m: MADE GROUND: Mass concrete block, reinforcment bar protruding from top of block. .....25 mm diameter vertical pipe in south west corner. Central and northern end .....0.50-2.20m: MADE GROUND: Sandstone blocks, presumed masonary wall .....0.50-2.20 m masonry wall visible in west face of trial pit. .....0.50-1.30 m brick wall visible in east face of trial pit. .....1.30-2.20 m masonry wall visible in east face of trial pit.
c	MADE GROUND: Bricks, presumed to be a brick floor.
d	Firm to stiff brown slightly gravelly CLAY. Gravel is fine to medium sub rounded of quartzite. Fissures are closely spaced.

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 2.20m depth.

All dimensions in metres | Scale: **1:50**

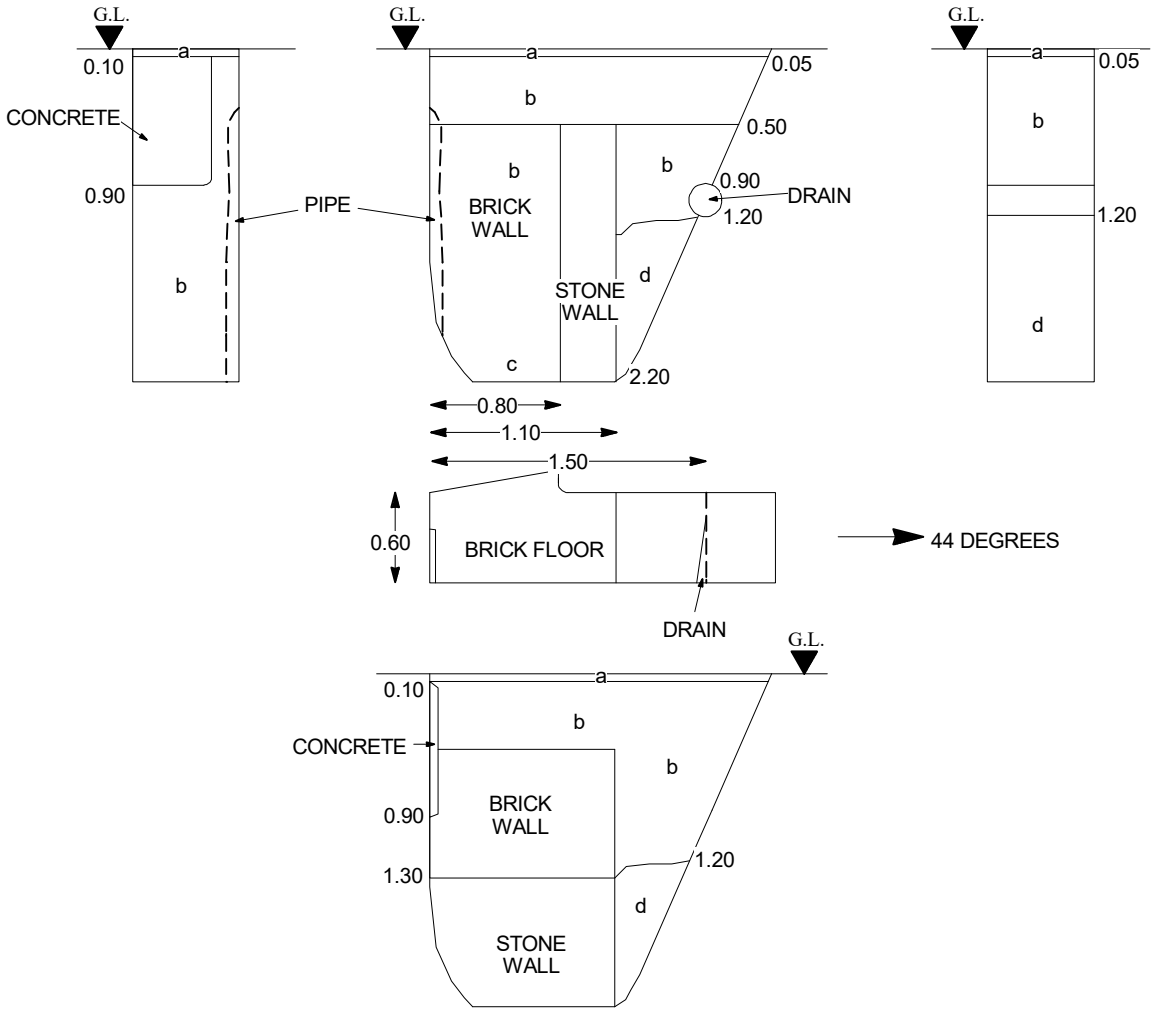
Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP101**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**47.00**	**E:384421.7 N:399019.0**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP102**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**47.10**	**E:384410.5 N:399004.2**	**1** of **2**

Description of strata by stratum code and associated diagrams

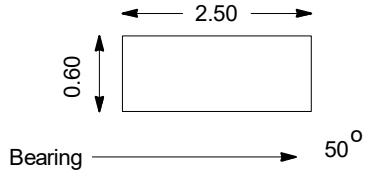
Stratum code	Stratum description
a	MADE GROUND: Brown slightly clayey very sandy fine to coarse angular GRAVEL of mainly sandstone and brick fragments.
b	MADE GROUND: Brown slightly clayey very sandy fine to coarse angular GRAVEL of mainly sandstone and brick fragments. Medium cobble content of mainly brick fragments (upto half bricks).
c	MADE GROUND: Angular blocks of sandstone 200mm x 200mm x 200mm. Presumed former road surface?

…..0.50-0.70 m line of blocks visible in east face of trial pit.

…..0.40-0.90 m brick wall visible in west face of trial pit.

d	MADE GROUND: Dark brown very sandy fine to coarse angular GRAVEL of mainly sandstone fragments. Some sand size ash.
e	POSSIBLE MADE GROUND: Very stiff brown occassinally mottled grey slightly gravelly CLAY. Gravel is fine to medium angular of brick fragments. Reworked material.
f	Very stiff fissured thinly bedded brown occasionally mottled grey along bedding and fissures slightly gravelly CLAY. Gravel is fine to medium sub rounded of quartzite. Fissures are closely spaced.

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 1.60m depth.

All dimensions in metres | Scale: **1:50**

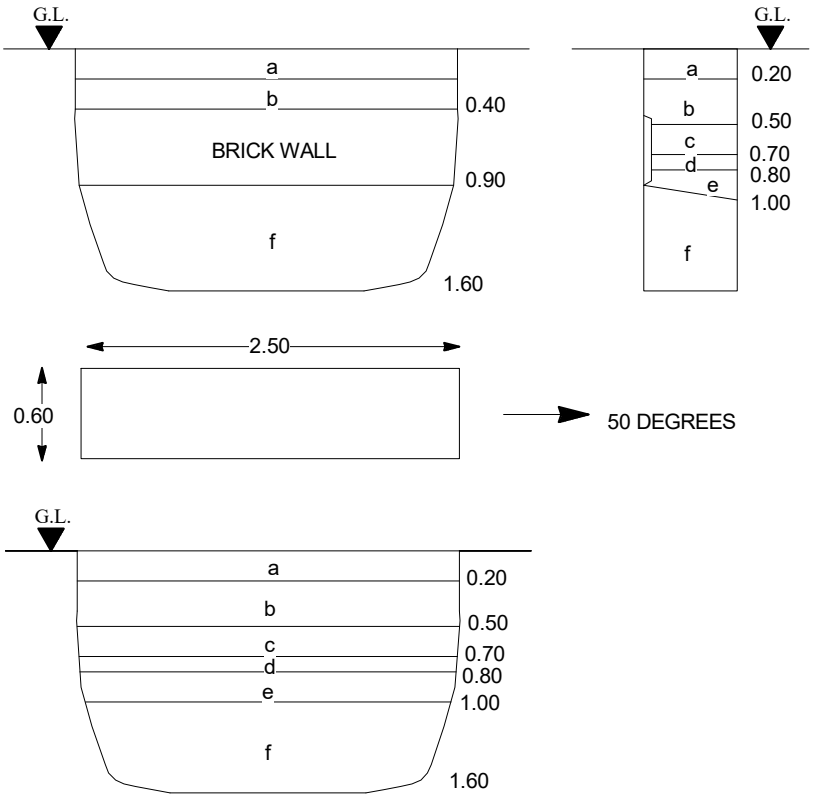
Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP102**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**47.10**	**E:384410.5 N:399004.2**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP103**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**46.70**	**E:384411.5 N:399026.5**	**1** of **2**

Description of strata by stratum code and associated diagrams

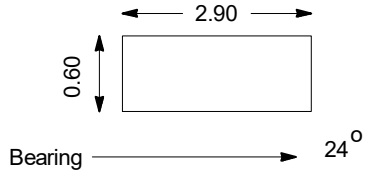
Stratum code	Stratum description
a	MADE GROUND: Light brown very sandy medium to coarse angular GRAVEL of limestone.
b	MADE GROUND: Brown very sandy fine to coarse angular GRAVEL of mainly sandstone and brick fragments. Medium cobble content of mainly brick fragments (upto half bricks).

…...gravel seen to extend down to 1.70 m in west side of pit.

c	MADE GROUND: Bricks, presumed to be a brick foundation.

…..1.05 - 1.70 m brick wall visible in west face of trial pit.

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 1.70m depth.

All dimensions in metres | Scale: **1:50**

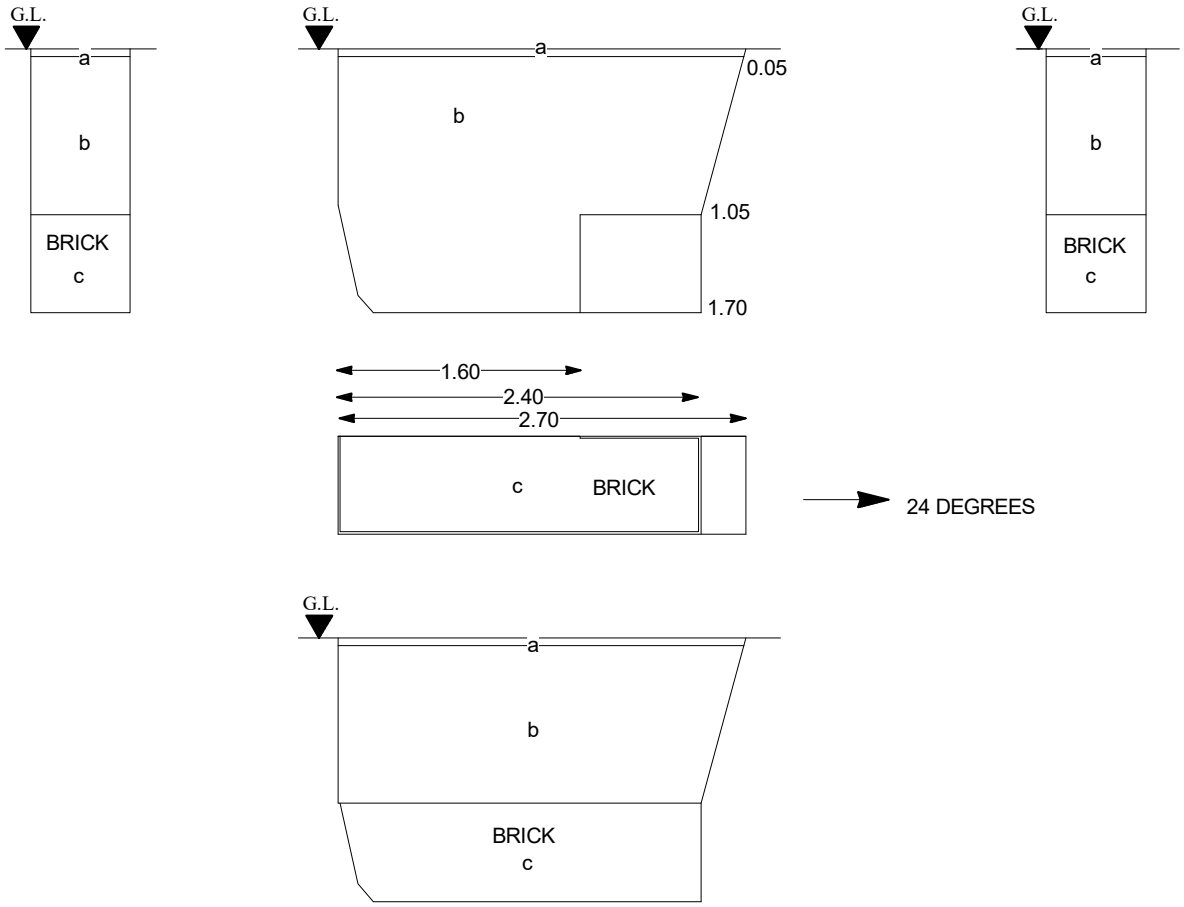
Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP103**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**46.70**	**E:384411.5 N:399026.5**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP104**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**46.85**	**E:384391.6 N:399013.5**	**1** of **2**

Description of strata by stratum code and associated diagrams

Stratum code	Stratum description
a	MADE GROUND: Light brown very sandy medium to coarse angular GRAVEL of limestone.
b	MADE GROUND: Dark brown brown slightly clayey very sandy fine to coarse angular GRAVEL of mainly sandstone and brick fragments. Whole and half bricks become more frequent with depth.

…...0.05m metal manhole cover.

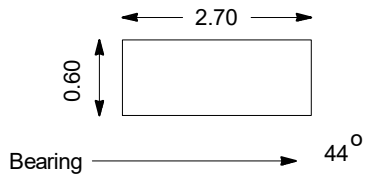
…...0.05-0.80m 2 x sandstone flags 70 mm x 200 x 300 m.

c	MADE GROUND Dark brown slightly clayey SAND and GRAVEL. Sand is firn to coarse, Gravel is fine to coarse angular to sub angular of mainly sandstone and brick fragments, some fragments of pottery and coal.
d	Very stiff fissured thinly bedded brown occasionally mottled grey along bedding and fissures slightly gravelly CLAY. Gravel is fine to medium sub rounded of quartzite. Fissures are closely spaced.

…...below 0.50 m brick wall visible in southern end of pit.

…...below 0.05 m light grey medium angular gravel exposed at northern end presumably surround to drain or duct. Pit dug between exposed gravel and wall.

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 2.10m depth.

All dimensions in metres | Scale: **1:50**

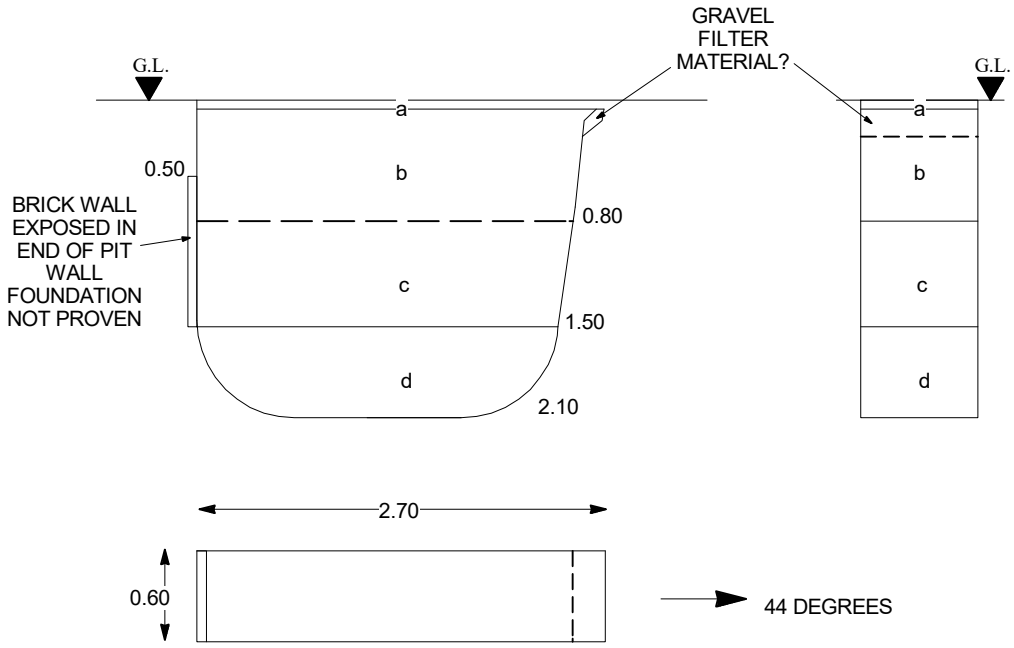
Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP104**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**46.85**	**E:384391.6 N:399013.5**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

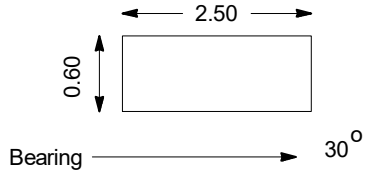
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP105**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**46.50**	**E:384381.1 N:398982.6**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.05	1	B				MADE GROUND: Light brown very sandy medium to coarse angular GRAVEL of limestone.	0.10	
0.05	101	ES				MADE GROUND: Dark brown slightly clayey very sandy fine to coarse angular GRAVEL of mainly sandstone and brick fragments. Medium cobble content of mainly brick fragments (whole and half bricks). . . . 0.10m: geotextile.	(0.80)	
0.30	102	ES						
0.30	2	B					0.90	
0.85	103	ES				Very stiff fissured very thinly to thinly bedded brown occasionally mottled grey along bedding and fissures slightly gravelly CLAY. Gravel is fine to medium sub rounded of quartzite, some angular gravel of coal. Fissures are very closely to closely spaced. Medium to coarse to sand on some bedding planes.	(0.60)	
0.85	3	B						
1.00		V	c_u=>130/>130					
1.20	104	ES						
1.20	4	B						
1.20	5	D					1.50	
1.50	6	B				Trial pit terminated at 1.50m depth.		
1.50	7	D						

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 1.50m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log TRIAL PIT LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

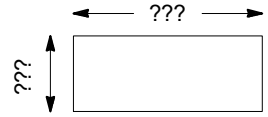
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP106**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**21.07.21** End: **21.07.21**	**44.45**	**E:384357.3 N:398996.4**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.20	1	D				MADE GROUND: Weak black ASPHALT. Matrix is angular to subrounded fine to medium. Voids of 25-30%	(0.62)	
							0.62	
0.70	4	D				MADE GROUND: Stiff brown slightly gravelly CLAY. Gravel is subangular to rounded fine to medium of mudstone, sandstone and quartz.	0.70	
						MADE GROUND: Light grey slightly sandy gravelly subangular to subrounded COBBLES of brick and sandstone. sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone, quartzite, brick and tarmacadam.	(0.92)	
							1.62	
1.70	6	D				Reddish brown slightly gravelly slightly clayey fine to medium SAND. Gravel is fine to medium subrounded to rounded of quartz. Low cobble content. Assessed as very dense sand.	(0.48)	
							2.10	
						Trial pit terminated at 2.10m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 2.10m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**CBailey**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log TRIAL PIT LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 15:09 | JM2 |

STRUCTURAL SOILS

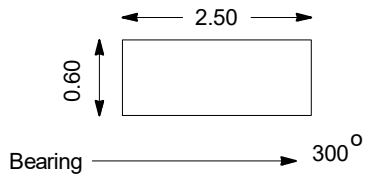
TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP107**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**44.20**	**E:384354.0 N:398930.2**	**1** of **2**

Description of strata by stratum code and associated diagrams

Stratum code	Stratum description
a	MADE GROUND: Tarmac
b	MADE GROUND: Brown very sandy fine to coarse angular GRAVEL of mainly sandstone. Medium cobble content of mainly brick fragments (whole and half bricks).
c	MADE GROUND: Tarmac
d	MADE GROUND: Light brown very sandy fine to coarse angular GRAVEL of mainly sandstone some brick fragments. Occasional whole and half bricks.
e	MADE GROUND: Angular cobbles and boulders, of sandstone and brick with fines. Fines comprise light brown very sandy fine to coarse angular gravel of sandstone and brick fragments.
f	MADE GROUND: Concrete, coarse gravel size aggregate including brick fragments up to half bricks.
g	MADE GROUND: Brick rubble, whole and half bricks.
…...base of the made ground becomes deeper in the central eastern end of pit, proved to 1.80 m on the north side and 2.00 m on the south side.	
…...below 0.95 m brick walls exposed in eastern end of pit in both the north and south faces and at the end.	
h	Stiff fissured very thinly to thinly bedded brown occasionally mottled grey along bedding and fissures slightly gravelly CLAY. Gravel is fine to medium sub rounded of quartzite. Fissures are very closely to closely spaced. Fine to medium sand on some bedding planes.

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 2.50m depth.

All dimensions in metres | Scale: **1:50**

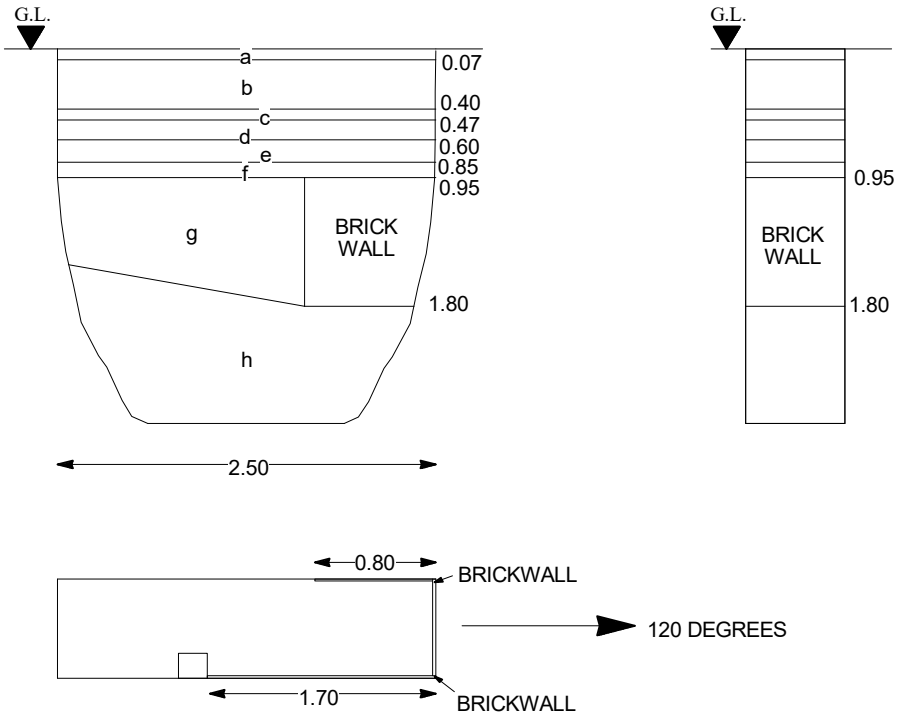
Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

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STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP107**
Contract Ref:	Start: **22.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**44.20**	**E:384354.0 N:398930.2**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

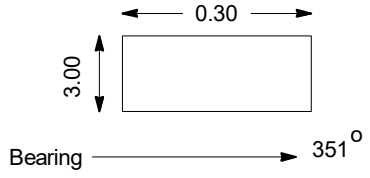
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP108**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **20.07.21**	**44.60**	**E:384358.0 N:398969.2**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.10	1	D				MADE GROUND: Grey sandy angular to subangular fine to coarse GRAVEL of limestone and concrete.	0.25	
0.25-0.55	3	B				MADE GROUND: Cream sandy gravelly angular to subrounded COBBLES of sandstone.	(0.30)	
0.30	2	D					0.55	
0.55-0.85	5	B				. . . Possible brick foundations encountetered in southern end of trial pit at 0.50m.		
0.60	101	ES				MADE GROUND: Black very gravelly fine to coarse SAND of ash. Gravel is angular to subrounded fine to coarse of ash, occasional brick and concrete.	(0.30)	
0.60	4	D					0.85	
0.85-1.25	7	B				Stiff very thinly bedded brown mottled grey on bedding CLAY with fine sand / silt on bedding. Very occasional fine angular gravel of coal.		
0.90	102	ES					(0.40)	
0.90	6	D					1.25	
1.25-1.85	9	B				Very stiff dark brown mottled grey slightly sandy CLAY with indistinct laminations, some grey mottling on laminations.		
1.30	103	ES						
1.30	8	D					(1.05)	
1.85-2.30	11	B				. . . 1.85m - 2.30m: slightly gravelly with low cobble content. Cobbles subrounded to rounded of mudstone. Gravel subrounded to rounded fine to coarse of mudstone and sandstone.		
2.00	10	D					2.30	
2.30-2.50	13	B				Orangish brown gravelly silty fine to medium SAND. Gravel is subangular to rounded fine to coarse of sandstone and occasional mudstone and quartz. Assessed as dense sand.	2.50	
2.35	12	D				Trial pit terminated at 2.50m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 2.50m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**IHayes**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log TRIAL PIT LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
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STRUCTURAL SOILS

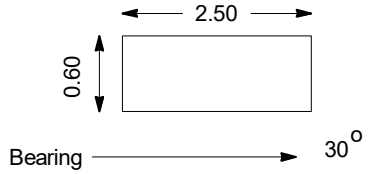
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP109**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **22.07.21**	**46.20**	**E:384375.5 N:398969.2**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Light brown very sandy medium to coarse angular GRAVEL of limestone.	0.25	
0.20	1	B						
0.20	101	ES						
0.30	102	ES				MADE GROUND: Brown slightly clayey very sandy fine to coarse angular GRAVEL of mainly sandstone and brick fragments. Medium cobble content of mainly brick fragments (up to half bricks).	0.40	
0.30	2	B						
0.50	103	ES				POSSIBLE MADE GROUND: Very stiff brown occassionally mottled grey slightly gravelly CLAY. Gravel is fine to medium angular of brick fragments. Reworked material.	0.60	
0.50	3	B						
0.60		V	c_u=>130/>130			Very stiff fissured thinly bedded brown occasionally mottled grey along bedding and fissures slightly gravelly CLAY. Gravel is fine to medium sub rounded of quartzite. Fissures are closely spaced.	(0.90)	
1.20	104	ES						
1.20	4	B						
1.20	5	D						
							1.50	
						Trial pit terminated at 1.50m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 1.50m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log TRIAL PIT LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 15:09 | JM2 |

STRUCTURAL SOILS

TRIAL PIT LOG

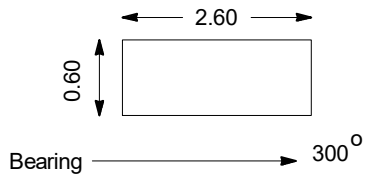
Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP110**
Contract Ref:	Start: **20.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **20.07.21**	**44.40**	**E:384342.1 N:398981.4**	**1** of **2**

Description of strata by stratum code and associated diagrams

Stratum code	Stratum description
a	MADE GROUND: Brown sandy slightly clayey fine to coarse angular GRAVEL of mainly sandstone.
b	MADE GROUND: Light brown angular COBBLE and BOULDER with fines. Fines comprise light brown sandy fine to coarse angular GRAVEL of mainly sandstone. Cobbles and boulders of sandstone up to 100mm x 150mm x 200mm.
c	MADE GROUND: Firm to stiff brown sandy CLAY with fragments of timber and half bricks. Some dark grey discoluration in places.
d	MADE GROUND: Firm brown gravelly CLAY. Gravel is fine to coarse angular of brick and sandstone fragments, with some fragments of tarmac along boundaries.
e	Possible MADE GROUND: Stiff brown slightly gravelly CLAY with some partings of fine and medium sand.

…...at western edge becomes very sandy.

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 1.50m depth.

All dimensions in metres | Scale: **1:50**

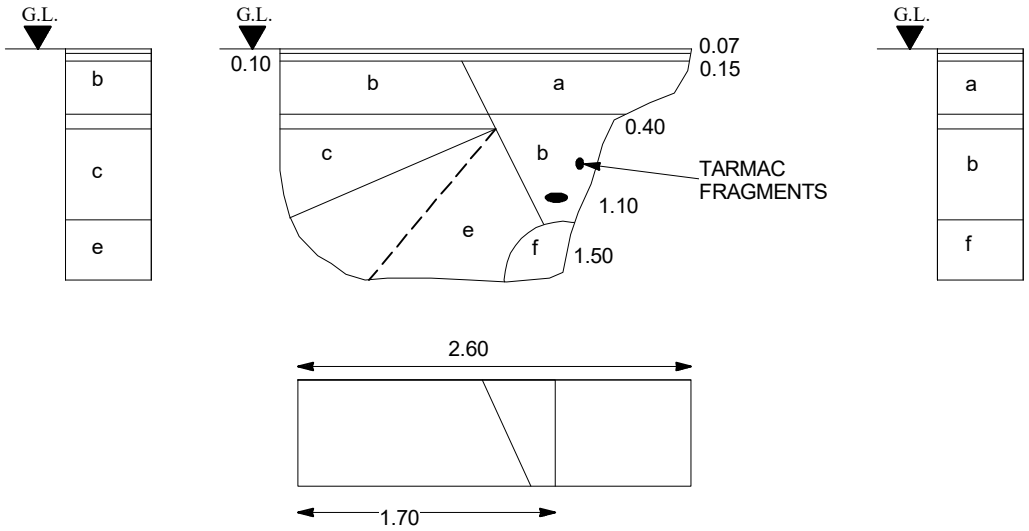
Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 14:46 | JM2 |

STRUCTURAL SOILS

TRIAL PIT LOG

Contract:		Client:		Trial Pit:
2 & 3 Angel Square		**MEPC Ltd**		**TP110**
Contract Ref:	Start: **20.07.21**	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **20.07.21**	**44.40**	**E:384342.1 N:398981.4**	**2** of **2**



Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log X1 - TP LOG - LOGGED BY STRATUM - A4 | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 14:46 | JM2 |

STRUCTURAL SOILS

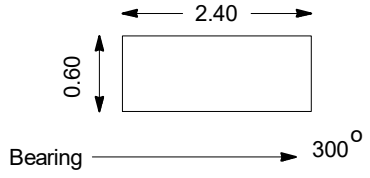
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP110A**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**20.07.21** End: **20.07.21**	**44.40**	**E:384340.1 N:398979.4**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Tarmac	0.07	
						MADE GROUND: Brown sandy slightly clayey fine to coarse angular GRAVEL of mainly sandstone.	0.10 0.15	
						MADE GROUND: Tarmac	0.30	
						MADE GROUND: Brown sandy slightly clayey fine to coarse angular GRAVEL of mainly sandstone.	0.31	
						MADE GROUND: Concrete . . . 0.30-3.20m: the chamber is of brick construction with metal rungs in wall		
						Partially open entrance to a chamber. Metal cover visible in the excavation side. Chamber dipped to 2.90 m below concrete level 3.20m below ground level.	(2.89)	
						Trial pit terminated at 0.31m, base of chamber probed to 3.20m depth.	3.20	

Plan (Not to Scale)



General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Tracked excavator**	**JMcCarthy**	

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Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 15:09 | JM2 |

STRUCTURAL SOILS

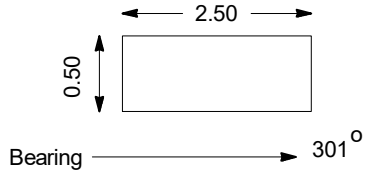
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP111**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	End: **21.07.21**	**42.50**	**E:384324.8 N:398955.0**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Weak greyish black ASPHALT. Matrix is angular to subrounded fine to medium ~20-25% voids	0.10	
0.20	1	D				MADE GROUND: Brown slightly clayey gravelly fine to coarse SAND with high cobble content angular to subangular of brick and occasionally concrete. Frequent metal fragments cotton reels and plastic sheeting.		
0.20	101	ES						
0.20-1.00	2	LB				. . . 0.50m: gravel angular to subrounded fine to coarse of brick occasionally concrete sandstone and quartz		
1.00	102	ES						
1.00	3	D						
							(3.40)	
1.80	103	ES						
1.80	4	D						
1.80-2.70	5	LB				. . . 2.00m: gravel becoming subrounded predominantly.		
						. . . Potential brick floor/basement.		
2.70	104	ES						
2.70	6	D						
							3.50	
						Trial pit terminated at 3.50m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Trial pit sides stable whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 3.50m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**IHayes**	

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Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 15:09 | JM2 |

STRUCTURAL SOILS

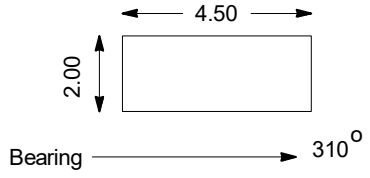
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
2 & 3 Angel Square	**MEPC Ltd**	**TP112**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
765325	**23.07.21** End: **23.07.21**	**41.70**	**E:384311.3 N:398968.3**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADEGROUND: Light grey sandy angular to subangular fine to coarse GRAVEL. Sand is fine to coarse. (Hardcore)	0.20	
						MADE GROUND: Black ASPHALT, aggregate is angular to subangular fine to medium gravel sized, matrix 30%	0.28	
						MADE GROUND: Light brown sandy angular to subangular fine to coarse GRAVEL of brick hardcore sandstone and wood. Low cobble content of brick and sandstone. Frequent fabric content and low boulder content or concrete.	(0.80)	
							1.08	
						MADE GROUND: Blackish brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of brick sandstone quartz low cobble content or brick and low fabric content.	(1.22)	
							2.30	
						Trial pit terminated at 2.30m depth.		

Plan (Not to Scale)



General Remarks

1. Excavation location scanned with GPR and CAT and Genny prior to excavation.
2. Trial pit dry whilst excavating.
3. Partial collapse of sides whilst excavating.
4. On completion, backfilled with arisings and compacted aggregate.
5. Trial pit terminated at 2.30m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**CBailey**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log TRIAL PIT LOG - A4P | 765325-2-AND-3-ANGEL-SQUARE.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Castleford: The Potteries, Pottery Street, Castleford, West Yorkshire, WF10 1NJ. Tel: 01977-552255, Fax: 01977-552299, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 01/11/21 - 15:10 | JM2 |

Appendix F Indicative Fluvial Floodplain Map

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7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



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Site Outline

100
250
Search Buffers (m)

Zone 2 Floodplain

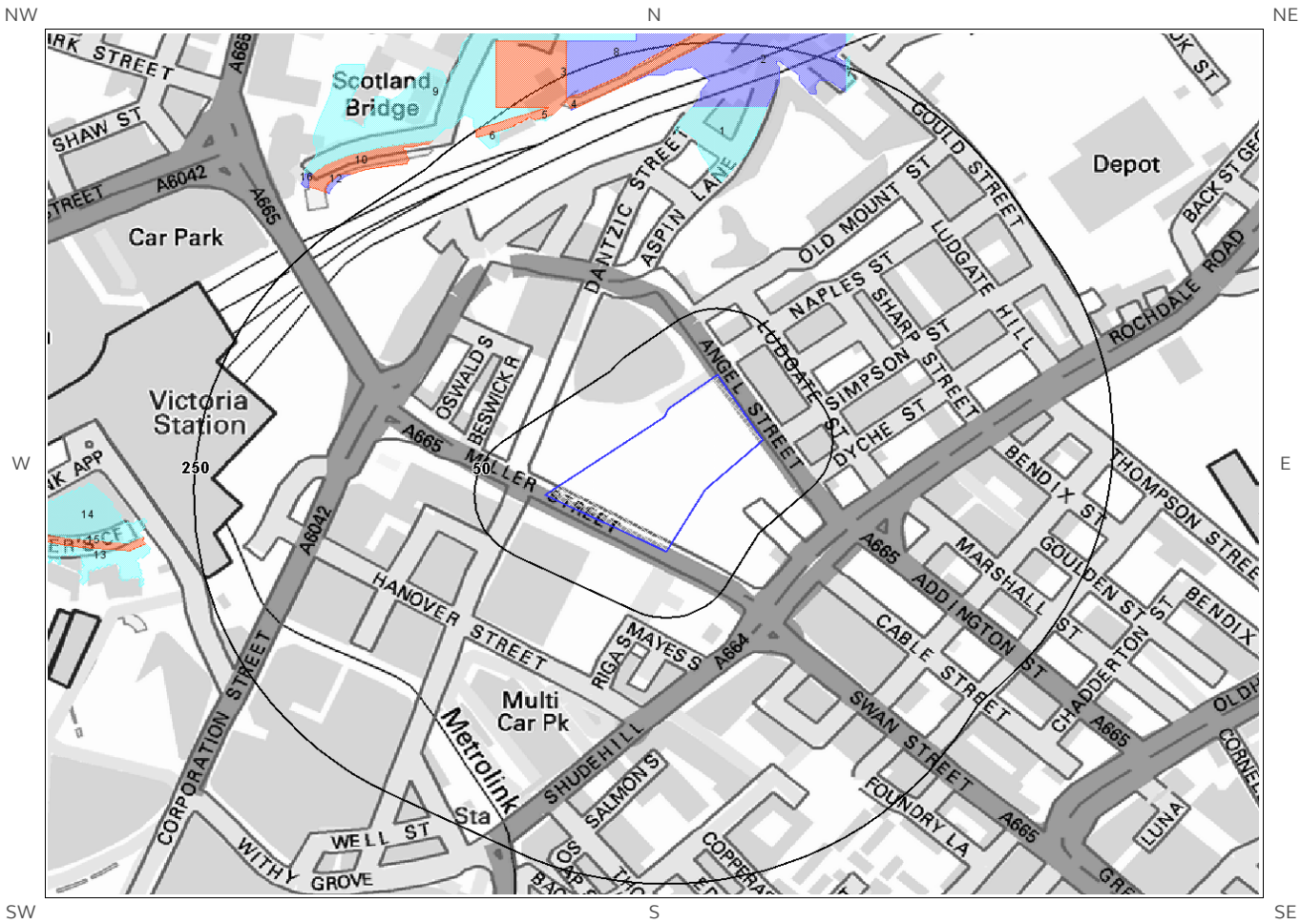
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



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Site Outline

100
250
Search Buffers (m)

RoFRaS Rating

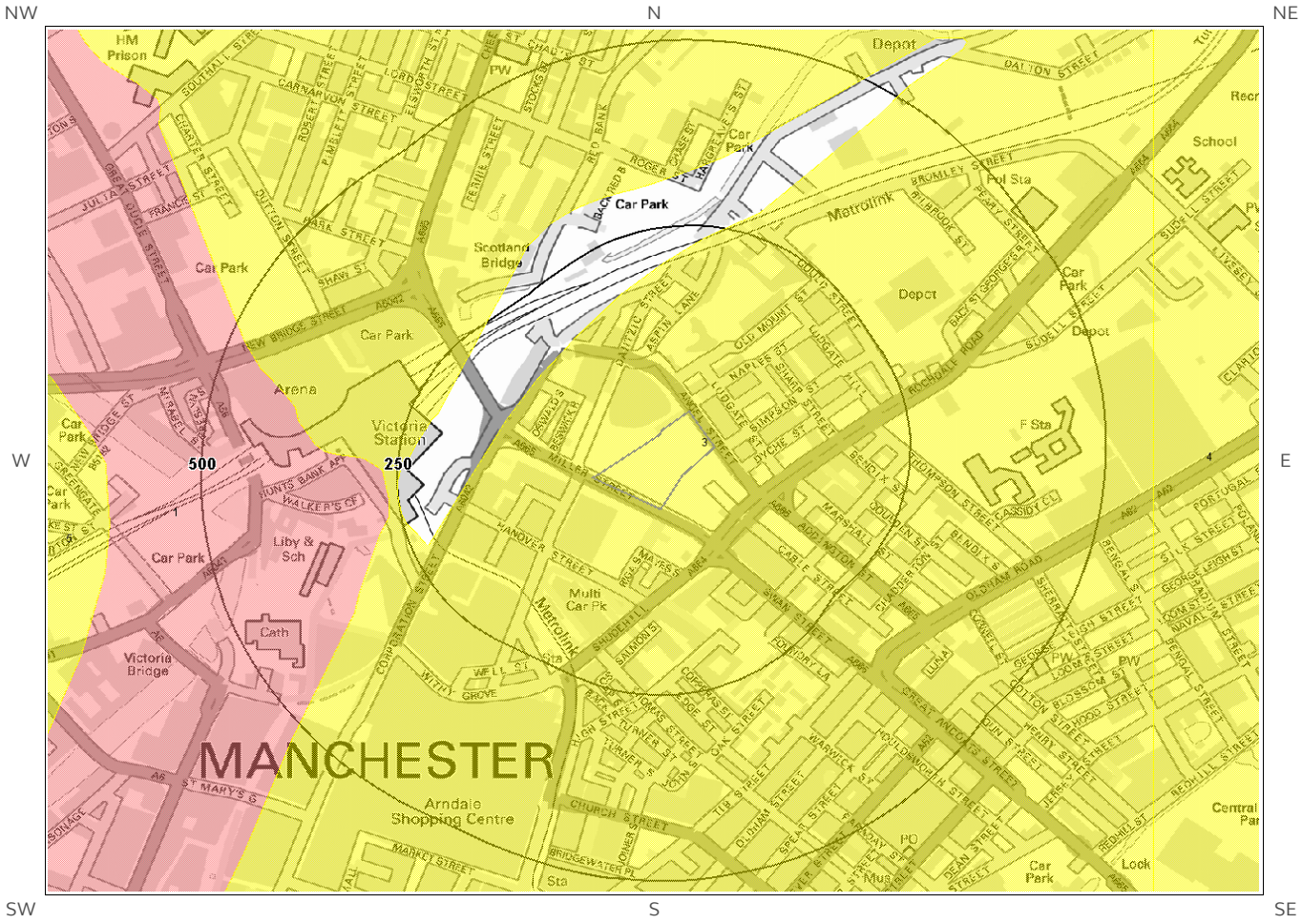
- Very Low
- Low
- Medium
- High

Appendix G Groundwater Vulnerability Map

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6 Hydrogeology and Hydrology

6a. Aquifer Within Superficial Geology



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6b. Aquifer Within Bedrock Geology and Abstraction Licences



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Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

Appendix H Coal Authority Report

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The Coal Authority

CON29M
coal mining report

N.O.M.A, 2 ANGEL SQUARE ANGEL STREET, MANCHESTER

Known or potential coal mining risks

Past underground coal mining	Page 3
Future underground coal mining	Page 3

Further action

No further reports from the Coal Authority are required. Further information on any next steps can be found in our Professional opinion.

For more information on our reports please visit www2.groundstability.com

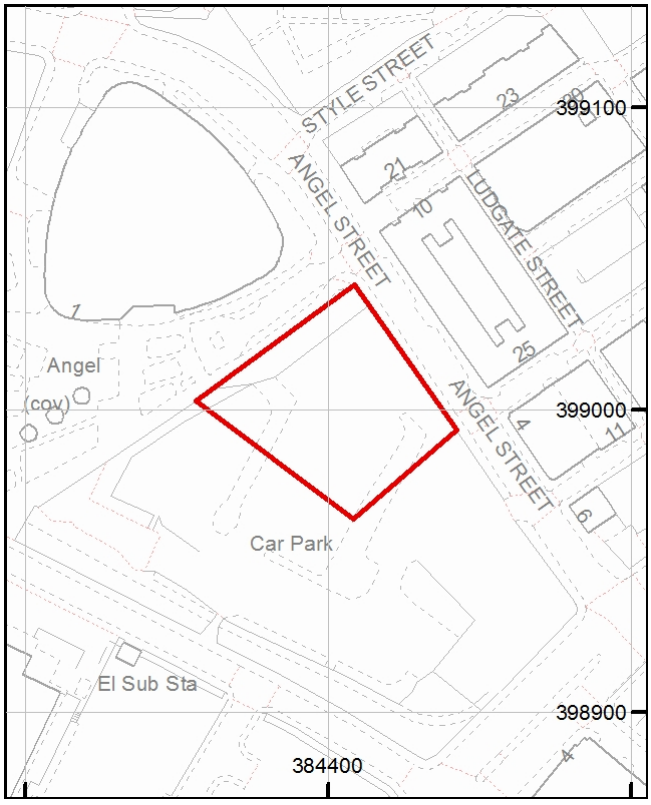
Professional opinion

According to the official mining information records held by the Coal Authority at the time of this search, evidence of, or the potential for, coal mining related features have been identified. It is unlikely that these features will impact on the stability of the enquiry boundary.

Enquiry boundary

Key

Approximate position of enquiry boundary shown



We can confirm that the location is **on the coalfield**

Map data

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This report is prepared in accordance with the latest Law Society's Guidance Notes 2018, the User Guide 2018 and the Coal Authority's Terms and Conditions applicable at the time the report was produced.

Accessibility

If you would like this information in an alternative format, please contact our communications team on 0345 762 6848 or email communications@coal.gov.uk.

Detailed findings

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1 Past underground coal mining

The property is in a surface area that could be affected by underground mining in 1 seam of coal at 820m depth, and last worked in 1965.

Any movement in the ground due to coal mining activity associated with these workings should have stopped by now.

2 Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3 Future underground coal mining

The property is not in an area where the Coal Authority has received an application for, and is currently considering whether to grant a licence to remove or work coal by underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4 Mine entries

There are no recorded coal mine entries known to the Coal Authority within, or within 20 metres, of the boundary of the property.

5 Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6 Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7 Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8 Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9 Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

10 Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11 Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.

12 Withdrawal of support

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

13 Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14 Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Statutory cover



Coal mining subsidence

In the unlikely event of any coal mining related subsidence damage, the Coal Authority or the mine operator has a duty to take remedial action in respect of subsidence caused by the withdrawal of support from land or property in connection with lawful coal mining operations.

When the works are the responsibility of the Coal Authority, our dedicated public safety and subsidence team will manage the claim. The house or land owner ("the owner") is covered for these works under the terms of the Coal Mining Subsidence Act 1991 (as amended by the Coal Industry Act 1994). Please note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

The owner therefore shouldn't incur cost or liability from repairs caused by the withdrawal of support from land and/or property in connection with lawful coal mining operations. Usually these actions will not need to involve your insurance company or mortgage lender.



Coal mining hazards

Our public safety and subsidence team provide a 24 hour a day, 7 days a week hazard reporting service, to help protect the public from hazards caused by past coal workings, such as a mine shaft or shallow working collapse. To report any hazards please call 01623 646 333. Further information can be found on our website: www.gov.uk/coalauthority.

Glossary

Key terms

adit - horizontal or sloped entrance to a mine

coal mining subsidence - ground movement caused by the removal of coal by underground mining

Coal Mining Subsidence Act 1991 - the Act setting out the duties of the Coal Authority to repair damage caused by coal mining subsidence

coal mining subsidence damage - damage to land, buildings or structures caused by the removal of coal by underground mining

coal seams - bed of coal of varying thickness

future opencast coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal from the surface

future underground coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal underground. Although it is unlikely, remaining coal reserves could create a possibility for future mining, which would be licensed by the Coal Authority

mine entries - collective name for shafts and adits

payments to owners of former copyhold land - historically, copyhold land gave rights to coal to the copyholder. Legislation was set up to allow others to work this coal, but they had to issue a notice and pay compensation if a copyholder came forward

shaft - vertical entry into a mine

site investigation - investigations of coal mining risks carried out with the Coal Authority's permission

stop notice - a delay to repairs because further coal mining subsidence damage may occur and it would be unwise to carry out permanent repairs

subsidence claim - a formal notice of subsidence damage to the Coal Authority since it was established on 31 October 1994

withdrawal of support - a historic notice informing landowners that the coal beneath their property was going to be worked

working facilities orders - a court order which gave permission, restricted or prevented coal mine workings

The Coal Authority

CON29M
coal mining report

N.O.M.A, 3 ANGEL SQUARE MILLER STREET, MANCHESTER

Known or potential coal mining risks

Past underground coal mining	Page 3
Future underground coal mining	Page 3

Further action

No further reports from the Coal Authority are required. Further information on any next steps can be found in our Professional opinion.

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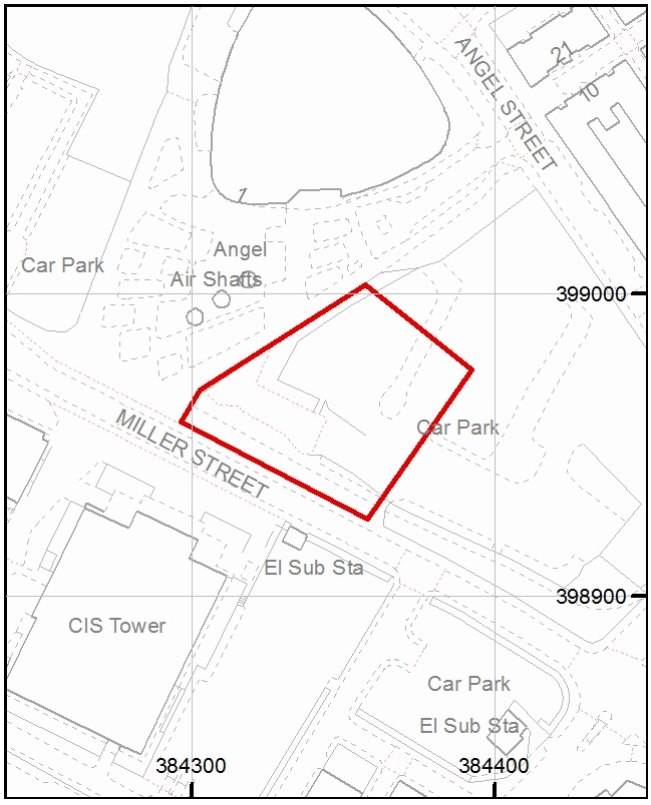
Professional opinion

According to the official mining information records held by the Coal Authority at the time of this search, evidence of, or the potential for, coal mining related features have been identified. It is unlikely that these features will impact on the stability of the enquiry boundary.

Enquiry boundary

Key

Approximate position of enquiry boundary shown



We can confirm that the location is **on the coalfield**

Map data

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Detailed findings

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1 Past underground coal mining

The property is in a surface area that could be affected by underground mining in 1 seam of coal at 820m depth, and last worked in 1965.

Any movement in the ground due to coal mining activity associated with these workings should have stopped by now.

2 Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3 Future underground coal mining

The property is not in an area where the Coal Authority has received an application for, and is currently considering whether to grant a licence to remove or work coal by underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4 Mine entries

There are no recorded coal mine entries known to the Coal Authority within, or within 20 metres, of the boundary of the property.

5 Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6 Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7 Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

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There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

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The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14 Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Statutory cover

Coal mining subsidence

In the unlikely event of any coal mining related subsidence damage, the Coal Authority or the mine operator has a duty to take remedial action in respect of subsidence caused by the withdrawal of support from land or property in connection with lawful coal mining operations.

When the works are the responsibility of the Coal Authority, our dedicated public safety and subsidence team will manage the claim. The house or land owner ("the owner") is covered for these works under the terms of the Coal Mining Subsidence Act 1991 (as amended by the Coal Industry Act 1994). Please note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

The owner therefore shouldn't incur cost or liability from repairs caused by the withdrawal of support from land and/or property in connection with lawful coal mining operations. Usually these actions will not need to involve your insurance company or mortgage lender.

Coal mining hazards

Our public safety and subsidence team provide a 24 hour a day, 7 days a week hazard reporting service, to help protect the public from hazards caused by past coal workings, such as a mine shaft or shallow working collapse. To report any hazards please call 01623 646 333. Further information can be found on our website: www.gov.uk/coalauthority.

Glossary

Key terms

adit - horizontal or sloped entrance to a mine

coal mining subsidence - ground movement caused by the removal of coal by underground mining

Coal Mining Subsidence Act 1991 - the Act setting out the duties of the Coal Authority to repair damage caused by coal mining subsidence

coal mining subsidence damage - damage to land, buildings or structures caused by the removal of coal by underground mining

coal seams - bed of coal of varying thickness

future opencast coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal from the surface

future underground coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal underground. Although it is unlikely, remaining coal reserves could create a possibility for future mining, which would be licensed by the Coal Authority

mine entries - collective name for shafts and adits

payments to owners of former copyhold land - historically, copyhold land gave rights to coal to the copyholder. Legislation was set up to allow others to work this coal, but they had to issue a notice and pay compensation if a copyholder came forward

shaft - vertical entry into a mine

site investigation - investigations of coal mining risks carried out with the Coal Authority's permission

stop notice - a delay to repairs because further coal mining subsidence damage may occur and it would be unwise to carry out permanent repairs

subsidence claim - a formal notice of subsidence damage to the Coal Authority since it was established on 31 October 1994

withdrawal of support - a historic notice informing landowners that the coal beneath their property was going to be worked

working facilities orders - a court order which gave permission, restricted or prevented coal mine workings

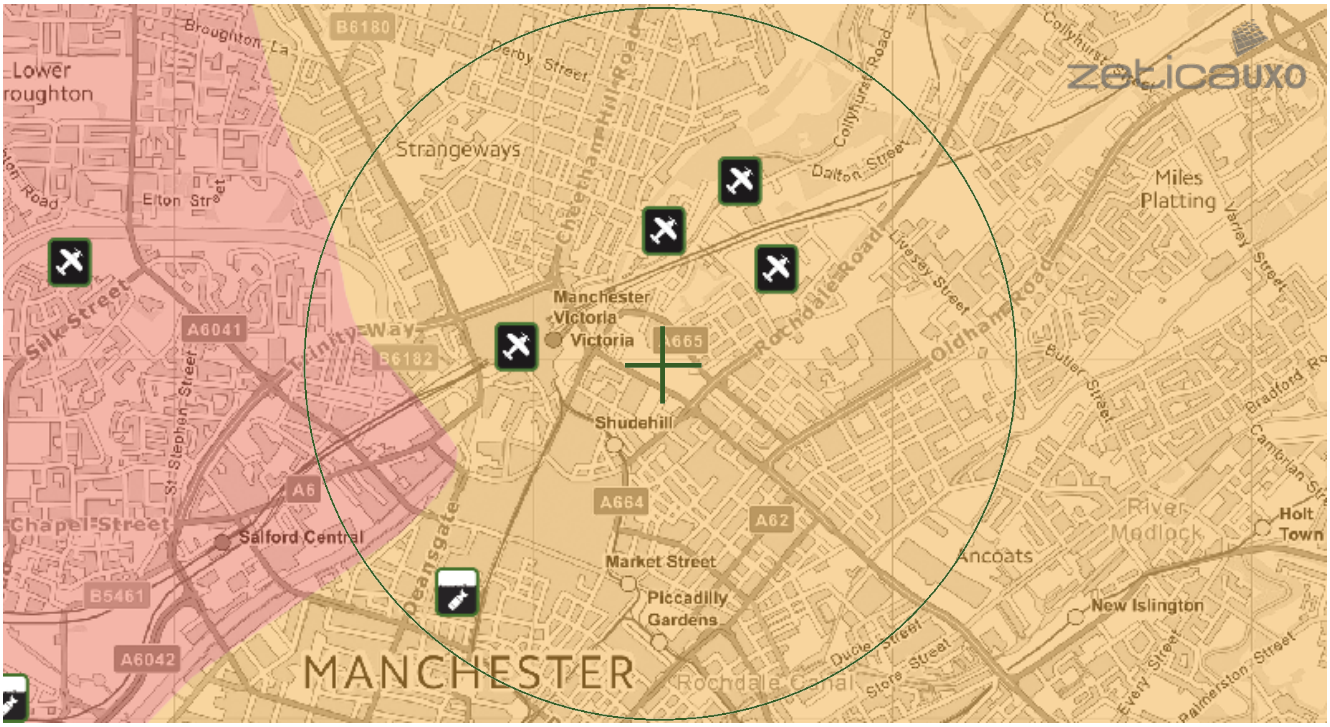
Appendix I Zetica Unexploded Bomb Map/Detailed UXO Report

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UNEXPLODED BOMB RISK MAP

SITE LOCATION

Map Centre: 384367,398988



LEGEND

- **High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
- **Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
- **Low:** Areas indicated as having 15 bombs per 1000acre or less.

miltary | **industry** | **UXO find**
transport | **dock** | **Luftwaffe targets**
utilities | **other**

How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: **(https://zeticauxo.com/downloads-and-resources/risk-maps/)**

Zetica cannot guarantee the accuracy or completeness of the information or data used and cannot accept any liability for any use of the maps. These maps can be used as part of a technical report or similar publication, subject to acknowledgment. The copyright remains with Zetica Ltd.

It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.



Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	2 & 3 Angel Square, Manchester
Client	MEPC
Site Address	2 & 3 Angel Square, Manchester, M4 4HT
Report Reference	DA13039-00
Date	16/04/2021
Originator	AHA

Executive Summary

Site Location and Description

The site is located within the City of Manchester in Northwest England.

The north-east of the site is bound by *Angel Street*, the south-east by a residential apartment block, the south-west by the *A665 Ring Road*, also known as *Miller Street*, while the land to the north-west is occupied by open ground and the Co-operative Insurance Society (CIS) Tower.

Information provided by the client states that the site is currently occupied by public car parking areas operated by RCP Parking Ltd, with the main access from *Angel Street*. Recent satellite imagery confirms this, showing the area within the site boundary to comprise hard standing ground used for car parking, alongside small areas of grassland.

The site is approximately centred on the OS grid reference: **SJ 84368 98990.**

Proposed Works

It is understood that the proposed development will comprise two buildings, one of lower and upper ground plus 10 storeys (2 Angel Square) and one of lower and upper ground plus 11 storeys (3 Angel Square). The remaining site area will include hard and soft landscaping, access and highways, and other associated works.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site to be underlain by the Chester Formation - Sandstone. Sedimentary Bedrock formed approximately 247 to 250 million years ago in the Triassic Period. Local environment previously dominated by rivers.

Taking into account the above-mentioned factors, and the geotechnical information provided by the client, it has been assessed that a 500kg bomb could have had a maximum bomb penetration depth of **5-7m** below WWII ground level.

Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth.

UXO Risk Assessment

1st Line Defence has assessed that there is a **Medium Risk** from items of German aerial delivered and anti-aircraft UXO and a **Negligible Risk** from Allied LSA/SAA across the site. This assessment is based on the following factors:

German Aerial Delivered Ordnance

- During WWII the site was located within the County Borough of Manchester, which sustained an overall low density bombing campaign, with an average of 27.1 items of ordnance recorded per 1,000 acres. As a major industrial centre, with Trafford Park a key area of war production, and important inland port, Manchester was an obvious target for the Luftwaffe. Though the density of bombing was low overall throughout WWII, much of the bombing of Manchester was concentrated in three major raids which caused a great deal of damage to the city centre.
- A local bomb map compiled by Manchester City Council (see **Annex J**) shows a parachute mine strike in the centre of the site boundary. A reference to incendiary bombs on site is made in Graham Pythian's work (see **Section 11.4**), where extensive damage to a shop and warehouse is recorded on 22nd December 1940. This is supported by anecdotal evidence provided by Edna Bumby (see **Section 11.8**), who recalls how Baxendale's and the factory yard – which is known to have been on site from OS mapping – were 'ablaze' on this date. This is not corroborated by the local bomb map, though it should be noted that incendiaries were often not all recorded, due to the vast numbers that they were dropped in.
- A December 1940 photograph taken at ground level (see **Annex K1**), shows vast devastation in the area north of Miller Street, where the site is located. Many buildings have partially collapsed, with numerous walls missing rooves and floors. The 1941 photograph (see **Annex K2**) reveals the extent of the clearance following the damage which occurred on site and its immediate environs, showing that most buildings in the area were so badly damaged that they required demolition and prompt clearance.

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UXO Risk Assessment

- The local bomb map compiled by Manchester City Council (see **Annex J**) shows that all buildings within the site area – apart from the terraced housing facing Angel Street in the north-east – were demolished. Neighbouring properties to the south-east, south-west, and north-west were also demolished. RAF aerial photography clearly shows that that the area was indeed cleared and by 1946 the site comprised only open land.
- At the onset of WWII, OS mapping shows that the site was occupied mostly by commercial and industrial properties plus a Factory Yard, with a row of terraced housing located in the far north-east. However, following the parachute mine incident occurring during the 22nd-24th December 1940 Christmas Blitz, and incendiary bombing, much of the site and the wider vicinity lay in ruins, as shown by photography from the time (see Annex K1). This is of concern, as ground conditions resulting from the bombing would not have been conducive to the easy observation of evidence of UXO. UXBs falling into areas of serious damage was one of the most common reasons for them going unnoticed and unrecorded.
- Similarly, access to the site is likely to have been severely interrupted/ceased during the Christmas Blitz of December 1940, especially following the parachute mine incident. It is considered unlikely to have been subject to post raid checks for UXO. Infrequent access typically increases the likelihood that items of UXO would have gone unnoticed and unreported.
- In summary, due to the significant bomb damage recorded on and bordering the site, there is considered to be a risk that evidence of unexploded bombs falling during the same or subsequent raids could have been easily overlooked. Proactive UXO risk mitigation support is therefore recommended for the intrusive works proposed at the site as a precaution.

Allied Ordnance

- There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

Post-war Redevelopment

- The site has not seen any significant development since the end of WWII. It was left derelict until the 1980s, and was then transformed into a car park.
- The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site.
- Within the footprints of post-WWII redevelopments, the risk from shallow-buried UXO (especially 1kg German incendiaries and British AA projectiles) should have been encountered/removed during initial excavations. However, the risk from deep-buried German UXBs will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at 2 & 3 Angel Square:

All Works

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Open Intrusive Works (trial pits, service pits, open excavations, shallow foundations etc.)

- UXO Specialist On-site Support

Boreholes and Piled Foundations

- Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

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Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel “Butterfly Bomb”
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women’s Auxiliary Air Force
X	Exploded

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1st Line Defence Limited
Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: 2 & 3 Angel Square, Manchester
Client: MEPC

1. Introduction

1.1. Background

1st Line Defence has been commissioned by MEPC to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at the 2 & 3 Angel Square site.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in *CIRIA C681*, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

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2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at 2 & 3 Angel Square. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German aerial delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and Manchester Central Library.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by MEPC.
- Available material from 33 Engineer Regiment (EOD) Archive (now 28 Regt).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to The National Archives and Manchester Central Library.

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3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'[1]

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII, considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

[1] http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/bomb-census-survey-records-1940-1945/.

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4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

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4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to the risk posed by UXO to the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII aerial bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

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5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD teams judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

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6. The Site

6.1. Site Location

The site is located within the City of Manchester in Northwest England.

The north-east of the site is bound by *Angel Street*, the south-east by a residential apartment block, the south-west by the *A665 Ring Road*, also known as *Miller Street*, while the land to the north-west is occupied by open ground and the Co-operative Insurance Society (CIS) Tower.

The site is approximately centred on the OS grid reference: **SJ 84368 98990**.

Site location maps are presented in **Annex A**.

6.2. Site Description

Information provided by the client states that the site is currently occupied by public car parking areas operated by RCP Parking Ltd, with the main access from *Angel Street*. Recent satellite imagery confirms this, showing the area within the site boundary to comprise hard standing ground used for car parking, alongside small areas of grassland.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

It is understood that the proposed development will comprise two buildings, one of lower and upper ground plus 10 storeys (2 Angel Square) and one of lower and upper ground plus 11 storeys (3 Angel Square). The remaining site area will include hard and soft landscaping, access and highways, and other associated works.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the site to be underlain by the Chester Formation - Sandstone. Sedimentary Bedrock formed approximately 247 to 250 million years ago in the Triassic Period. Local environment previously dominated by rivers.

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8.2. Site Specific Geology

Borehole data has been provided by MEPC. See below for a brief description of the geology encountered.

Borehole: BHL01	
Depth (m)	**Description**
0.10-0.30	MADE GROUND : Cobbles.
0.30-2.00	MADE GROUND : Stiff locally closely fissured grey brown and grey slightly sandy slightly gravelly CLAY.
2.00-3.80	Firm brown sandy slightly gravelly CLAY.
3.80-4.40	Medium dense brown slightly silty slightly gravelly fine to medium SAND.
4.40-8.80	Medium dense orange brown slightly silty fine to coarse SAND.
8.80-9.60	Medium dense orange brown slightly silty gravelly fine to coarse SAND.
9.60-13.90	Dense orange brown slightly silty fine to coarse SAND and rounded to sub rounded fine to coarse GRAVEL.
13.90-14.80	Red brown fine to medium grained SANDSTONE.
14.80-22.32	Very weak to weak red brown fine to medium grained SANDSTONE.
22.32-30.00	Weak red brown fine to coarse grained SANDSTONE.

Borehole: BHL03	
Depth (m)	**Description**
0.10	MADE GROUND : Hardcore.
0.10-3.40	MADE GROUND : Medium dense dark grey brown clayey gravelly fine to coarse SAND.
3.40-5.50	Firm to stiff slightly sandy slightly gravelly CLAY.
5.50-7.80	Dense brown slightly silty fine to coarse SAND.
7.80-14.00	Dense orange brown slightly gravelly fine to medium SAND
14.00-16.30	Sand, gravel and clay.
16.30-29.80	Very weak red brown fine to medium grained SANDSTONE.

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9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, the frequency of access and signs of bomb damage.

9.2. Summary of the Historical Background of the Site

The site was the location of one of the first large cotton mills in Manchester, built by Richard Arkwright in the late 1700s. After a fire in 1854 in which the mill burned down, the site was utilised by Baxendale and Co.; an eclectic company of 1,250 employees including plumbers and engineers.[2] This firm occupied the site area until the end of WWII. It was the subject of a 2006 episode of BBC Channel 4's *Time Team* entitled 'Rubble at the Mill', where the team conducted an archaeological exploration of sections of the site area.

Related historical photographs are presented in **Annex D**.

9.3. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex E.** See below for a summary of the site history shown on acquired mapping.

Pre-WWII		
Date	**Scale**	**Description**
1922-1933	1:2,500	This OS map edition indicates the site to be occupied by terraced housing in the far north-east, while the remainder of the site consists of commercial properties and a *Factory Yard* access way. A small section of a disused *Iron Works* is also within the site boundary. The site is bordered to the north-east by *Angel Street*, the disused *Iron Works* and additional commercial properties to the south-east, *Miller Street* binds the site to the south-west, while more commercial properties lie to the north-west, as well as two rows of terraced housing in the far north-west, and far south-west respectively.

Post-WWII		
Date	**Scale**	**Description**
1951-1952	1:2,500	This OS map edition shows all the structures previously on site to have been cleared, as well as those in the surrounding area. The site area comprises open land and the *Factory Yard* access way. The site remains bound by *Angel Street* to the north-east, it is bordered by the building previously used for the *Iron Works*, which is now unlabelled, *Miller Street* lies to the south-west, and open land with a small *Warehouse* is situated north-west. Several structures to the south-east are labelled as *Ruin*, as well as a single building to the west.

[2] *https://www.gracesguide.co.uk/Baxendale_and_Co*

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10. Introduction to German Aerial Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German aerial delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Aerial Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German aerial delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Annex F**.

Generic Types of WWII German Aerial Delivered Ordnance		
Type	**Frequency**	**Likelihood of detection**
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see **Annex G**). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present–day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

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10.3. Failure Rate of German Aerial Delivered Ordnance

It has been estimated that 10% of WWII German aerial delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex H**.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an aerial delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex G**).

10.4.2. WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

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10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – Chester Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

Taking into account the above-mentioned factors, and the geotechnical information provided by the client, it has been assessed that a 500kg bomb could have had a maximum bomb penetration depth of **5-7m** below WWII ground level.

Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the *flying bomb* or *pilotless aircraft*, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their range was limited by their position of deployment across Europe and as a result the vast majority of V-weapon strikes were directed against targets in the south-east of England, predominantly in the London Boroughs and Home Counties. This limitation of capability meant targets in Manchester were generally too far to be considered for V-weapon strikes by the Luftwaffe.

However, V-1 pilotless aircraft were released off the Yorkshire coast from beneath Heinkel He111 bombers on Christmas Eve, 1944. One V-1 pilotless aircraft fell within the Civil Defence area for Manchester in Didsbury.

The risk from V-weapons is therefore considered negligible and will not be further addressed in this report.

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11. The Likelihood of Contamination from German Aerial Delivered UXBs

11.1. World War I

A WWI map of air raids and naval bombardments across England is presented in **Annex I**. This source does not record any WWI bombing incidents to have affected the site.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of the County Borough of Manchester

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the County Borough of Manchester, which sustained an overall low density bombing campaign, as represented by bomb density data figures. As a major industrial centre – with Trafford Park a key area of war production – and important inland port, Manchester was an obvious target for the Luftwaffe. Though the density of bombing was low overall throughout WWII, much of the bombing of Manchester was concentrated in three major raids which caused a great amount of damage. The worst of which, known as the Christmas Blitz, occurred on the nights of the 22nd and 23rd December 1940.

Records of bombing incidents in the civilian areas of the County Borough of Manchester were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents are presented in the following sections.

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11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German aerial delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the County Borough of Manchester between 1940 and 1945.

Record of German Ordnance Dropped on the County Borough of Manchester		
Area Acreage		**27,255**
Weapons	High Explosive bombs (all types)	712
	Parachute mines	18
	Oil bombs	7
	Phosphorus bombs	0
	Fire pots	0
	Pilotless aircraft (V-1)	1
	Long range rocket bombs (V-2)	0
Total		**738**
Number of Items per 1,000 acres		**27.1**

Source: Home Office Statistics
This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. Blitz Britain: Manchester and Salford by Graham Pythian

The published source Blitz Britain: Manchester and Salford by Graham Pythian presents a transcript of the document 'Manchester Emergency Committee's Log Book of Bombing Incidents 22-24 December 1940' (hence covering the 'Manchester Blitz' period). This is stated to have been obtained from the Emergency Committee Records/Police Museum and Archives, though it was not possible to obtain original documents. One reference to incendiaries on site at *29 Miller Street* was found, see below for the transcription:

> *'North St & Miller St, City, 29 Miller St*
> *Incendiary bombs at 9.00 p.m. 22nd [1940].*
> *Shop and warehouse extensively damaged by fire.*
> *Fire extinguished and incident closed.'*

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11.5. Record of the Locations of Aerial Bombs on the City of Manchester

A local bomb map compiled by Manchester City Council showing HE bomb and fire bomb strikes, as well as recording damaged and demolished structures, within the borough was obtained from the Manchester University Library. The section showing the area of the site is described in the table below and presented in **Annex J.**

Record of the Locations of Aerial bombs on the City of Manchester – Annex J	
Date Range	**Comments**
1940-1945	This map shows a green circle in the centre of the site boundary, denoting a 'mine' strike, referring to a parachute mine. All buildings within the site area – apart from the terraced housing facing *Angel Street* in the north-east – were demolished. Neighbouring properties to the south-east, south-west, and north-west were also demolished.

11.6. Manchester Bomb Damage Cards

Bomb damage cards compiled by Manchester City Council during WWII have been obtained from the Manchester Central Library by 1st Line Defence, and are held in-house. These reports recorded information such as the date, location, type and damage caused by only major bomb incidents in Manchester, and are therefore not often comprehensive.

Whilst these records were consulted in-house, no reference could be found to damage sustained on site or to any structures in the proximity of the site.

11.7. Air Raid Damage Files

Air Raid Damage files for Manchester have been obtained from The National Archives by 1st Line Defence and are held in-house. These reports recorded information such as the date, time, type and damage caused by major bomb incidents in Manchester and are therefore not often comprehensive. No relevant information regarding the site area could be located.

11.8. Miscellaneous Internet Sources

Miscellaneous Internet Sources		
Date	**Source**	**Description**
22nd December 1940	Manchester Archive Plus[3]	Excerpt from Edna Bumby, taken from Collyhurst Recollections - 'Hannah Street was lit up by orange flames from the goods yard on Rochdale Road and Tate and Lyle sugar warehouse, Baxendale's and factory yard was ablaze.'
23rd December 1940	Our Blitz – Red Sky Over Manchester[4]	'Baxendale's extensive warehouses in Miller Street were reduced to desolation'

[3] *https://manchesterarchiveplus.wordpress.com/2014/12/22/duringthemcrblitz/*

[4] *Our Blitz: Red Skies Over Manchester,* Kemsley Newspapers Ltd., Manchester, 1945, p. 10-11

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11.9. WWII-Era Aerial Photography

WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England), the Aerofilms Collection available from *Britain from Above* and the Manchester City Council 'Local Image Collection'. This photography provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (**see Annex K**).

WWII-Era Aerial Photography		
Date	**Source**	**Description**
December 1940	Our Blitz – Red Sky Over Manchester[5] (See **Annex K1**)	This photograph, taken at ground level facing north from *Miller Street*, shows a large area of damage in the vicinity of the site area. Many buildings have collapsed sections, with walls standing without rooves. While it is uncertain where the precise site boundary lays in this photograph, it does illustrate the poor ground conditions present on and around the site following extensive bomb damage.
1941	Manchester City Council[6] (See **Annex K2**)	This photograph, taken at ground level facing north from *Miller Street*, shows the clearance work occurring on site and its immediate environs. Piles of rubble can be seen alongside the road, and where Baxendale & Co Ltd used to be. Similarly to the previous photograph, it is unclear where the precise site boundary lies, but it shows that the area on and around the site was nearly all cleared by 1941.
7th May 1946	Historic England (See **Annex K3-4**)	WWII-era aerial photography dated 7th May 1946 gives a good visual account of the damage within the site boundary and in the wider vicinity. All buildings within the site area have been cleared, corroborating the OS mapping from 1951-1952. Most structures to the north-west of the site boundary have also been cleared, except for three isolated structures. Some structures also survived to the south-east, where the *iron foundry* was located on OS mapping. There are also several areas of clearance both to the north-east across *Angel Street*, and to the south across *Miller Street*.
1948	Britain from Above (See **Annex K5**)	This oblique aerial photograph dated 1948 shows no obvious change from 1946, with the site area cleared of all structures.

[5] *Ibid.*
[6] *https://images.manchester.gov.uk/index.php., ref. m03361*

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11.10. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.11. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) (now 29 Regt) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date MEPC will be advised.

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11.12. Evaluation of German Aerial Delivered UXO Records

Factors	Conclusion
Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.*	During WWII the site was located within the County Borough of Manchester, which sustained an overall low density bombing campaign, with an average of 27.1 items of ordnance recorded per 1,000 acres. As a major industrial centre, with Trafford Park a key area of war production, and important inland port, Manchester was an obvious target for the Luftwaffe. Though the density of bombing was low overall throughout WWII, much of the bombing of Manchester was concentrated in three major raids which caused a great deal of damage to the centre of the city. The local bomb map compiled by Manchester City Council (see **Annex J**) shows a parachute mine strike in the centre of the site boundary. A reference to incendiary bombs on site is made in Graham Pythian's work (see **Section 11.4**), where extensive damage to a shop and warehouse is recorded on 22nd December 1940. This is supported by anecdotal evidence provided by Edna Bumby (see **Section 11.**8), who recalls how Baxendale's and the factory yard – which we know from OS mapping was within the site boundary – were 'ablaze' on this date. This is not corroborated by the local bomb map, though it should be noted that incendiaries were often not all recorded, due to the vast numbers that they were dropped in.
Damage *If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.*	The December 1940 photograph taken at ground level (see **Annex K1**), shows vast devastation in the area north of *Miller Street*, where the site is located. Many buildings have partially collapsed, with numerous walls missing rooves and floors. The 1941 photograph (see **Annex K2**) reveals the extent of the clearance following the damage which occurred on site and its immediate environs, showing that most buildings in the area were so badly damaged that they required demolition and prompt clearance. The local bomb map compiled by Manchester City Council (see **Annex J**) shows that all buildings within the site area – apart from the terraced housing facing *Angel Street* in the north-east – were demolished. Neighbouring properties to the south-east, south-west, and north-west were also demolished. RAF aerial photography clearly shows that that the area was indeed cleared and by 1946 the site comprised only open land.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	At the onset of WWII, OS mapping shows that the site was occupied mostly by commercial and industrial properties plus a *Factory Yard*, with a row of terraced housing located in the far north-east. However, following the parachute mine incident and incendiary bombing, occurring during the 22nd-24th December 1940 Christmas Blitz, much of the site and the wider vicinity lay in ruins, as shown by photography from the time (see **Annex K1**). Due to this, it is highly anticipated that the ground cover would not have been conducive to the detection of evidence of UXO. This is mainly a result of the level of damage and debris that was present on site in the aftermath of the bombing incidents, with aerial photography and local bomb mapping showing that the site was cleared of all structures. It should be considered possible that the mine incident may have obscured signs of UXO dropped during the same raid, or that UXO subsequently may have gone missing in the ruins.

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Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post- raid checks for evidence of UXO.*	Access to the properties on site is expected to have been frequent at the outbreak of WWII, owing to their predominantly commercial and industrial nature. However this was likely to have been severely interrupted during the Christmas Blitz of December 1940, especially following the parachute mine incident, which left much of the site and its vicinity in ruins. Access to seriously damaged and destroyed properties would likely have ceased. Owing to the fact that most of the site was cleared during the war, as well as adjacent and nearby properties to the east, south and west, it is thought likely that access to the site area was significantly reduced for much of the war thereafter, and therefore unlikely to have been subject to post raid checks for UXO. Infrequent access typically increases the likelihood that items of UXO would have gone unnoticed and unreported.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

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12. Introduction to Allied Explosive Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military was usually subject to clearance before returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas, such as the location of the site, can be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2. Small Arms Ammunition

The most common type of ordnance encountered on land used by the military are items of Small Arms Ammunition (SAA). SAA refers to the complete round or cartridge designed to be discharged from varying sized hand-held weapons such as rifles, machine guns and pistols. SAA can include bullets, cartridge cases and primers/caps.

12.3. Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

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12.3.1. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	**Description**			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LSA Ammunition	**Gun type**	**Calibre**	**Shell Weight**	**Shell Dimensions**
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as ''Z'' batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			

The closest recorded HAA to the site was located approximately 1.4km north-east of the site, however the range of a projectile can be up to 15km. The site would also have been in range of mobile light anti-aircraft guns.

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Aerial Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex L**.

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13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Allied UXO Contamination	Conclusion
Military Camps *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 1.4km north-east of the site, however the range of a projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance.
Home Guard Activity *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	1st Line Defence has no evidence of any Home Guard activities on the site.
Defensive Positions *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any defensive features formerly located on or bordering the site footprint.
Training or firing ranges *Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.*	There is no evidence of such features affecting the site.

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Defensive Minefields *Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.*	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture *Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.*	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields *Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.*	The site was not situated within the perimeters or vicinity of a military airfield.

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14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German aerial delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Manchester City Council bomb mapping, Home Office bombing statistics, miscellaneous internet sources, in-house and published data, and WWII and post-WWII era aerial photography of the proposed site. The record set is of generally good quality. While no written records were found to support the parachute mine incident on site, historical photography from throughout the war and thereafter was useful in illustrating the vast amount of damage on site and in the immediate environment.
German Aerial Delivered Ordnance	• During WWII the site was located within the County Borough of Manchester, which sustained an overall low density bombing campaign, with an average of 27.1 items of ordnance recorded per 1,000 acres. As a major industrial centre, with Trafford Park a key area of war production, and important inland port, Manchester was an obvious target for the Luftwaffe. Though the density of bombing was low overall throughout WWII, much of the bombing of Manchester was concentrated in three major raids which caused a great deal of damage to the city centre. • A local bomb map compiled by Manchester City Council (see **Annex J**) shows a parachute mine strike in the centre of the site boundary. A reference to incendiary bombs on site is made in Graham Pythian's work (see **Section 11.4**), where extensive damage to a shop and warehouse is recorded on 22nd December 1940. This is supported by anecdotal evidence provided by Edna Bumby (see **Section 11.8**), who recalls how Baxendale's and the factory yard – which is known to have been on site from OS mapping – were 'ablaze' on this date. This is not corroborated by the local bomb map, though it should be noted that incendiaries were often not all recorded, due to the vast numbers that they were dropped in. • A December 1940 photograph taken at ground level (see **Annex K1**), shows vast devastation in the area north of Miller Street, where the site is located. Many buildings have partially collapsed, with numerous walls missing rooves and floors. The 1941 photograph (see **Annex K2**) reveals the extent of the clearance following the damage which occurred on site and its immediate environs, showing that most buildings in the area were so badly damaged that they required demolition and prompt clearance. • The local bomb map compiled by Manchester City Council (see **Annex J**) shows that all buildings within the site area – apart from the terraced housing facing Angel Street in the north-east – were demolished. Neighbouring properties to the south-east, south-west, and north-west were also demolished. RAF aerial photography clearly shows that that the area was indeed cleared and by 1946 the site comprised only open land. • At the onset of WWII, OS mapping shows that the site was occupied mostly by commercial and industrial properties plus a Factory Yard, with a row of terraced housing located in the far north-east. However, following the parachute mine incident occurring during the 22nd-24th December 1940 Christmas Blitz, and incendiary bombing, much of the site and the wider vicinity lay in ruins, as shown by photography from the time (see Annex K1). This is of concern, as ground conditions resulting from the bombing would not have been conducive to the easy observation of evidence of UXO. UXBs falling into areas of serious damage was one of the most common reasons for them going unnoticed and unrecorded.

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	• Similarly, access to the site is likely to have been severely interrupted/ceased during the Christmas Blitz of December 1940, especially following the parachute mine incident. It is considered unlikely to have been subject to post raid checks for UXO. Infrequent access typically increases the likelihood that items of UXO would have gone unnoticed and unreported. • In summary, due to the significant bomb damage recorded on and bordering the site, there is considered to be a risk that evidence of unexploded bombs falling during the same or subsequent raids could have been easily overlooked. Proactive UXO risk mitigation support is therefore recommended for the intrusive works proposed at the site as a precaution.
Allied Ordnance	• There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

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15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 Regt). It should also be noted that in addition to 29 Regt archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

The site has not seen any significant development since the end of WWII. It was left derelict until the late 1970s-early 1980s, and was then transformed into a car park.

The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site.

Within the footprints of post-WWII redevelopments, the risk from shallow-buried UXO (especially 1kg German incendiaries and British AA projectiles) should have been encountered/removed during initial excavations. However, the risk from deep-buried German UXBs will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

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16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Generally speaking, the risk of encountering any type of UXO will be minimal for any works planned within the footprint and down to the depth of post-war foundations and excavations.

16.2. Encountering Aerial Delivered Ordnance

Since an aerial delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

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17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Aerial Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted.. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

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18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

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19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that there is an overall **Medium Risk** from German and anti-aircraft unexploded ordnance at the site of proposed works. There is also an assessed **Negligible Risk** from Allied LSA/SAA ordnance.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs			✓	
German 1kg Incendiary Bombs			✓	
Allied Anti-Aircraft Artillery Projectiles			✓	
Allied Land Service and Small Arms Ammunition	✓			

This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the 'Proposed Works' section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

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20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at 2 & 3 Angel Square:

Type of Work	Recommended Mitigation Measure
All Works	• **UXO Risk Management Plan** It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. • **Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.
Shallow Intrusive Works/Open Excavations	• **Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works** When on site the role of the UXO Specialist would include: • Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. • Providing UXO awareness briefings to any uninformed staff and advise staff of the need to modify working practices to take account of the ordnance risk. • To aid incident management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard.
Borehole/Piles	• **Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth:** 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited **15/04/2021**

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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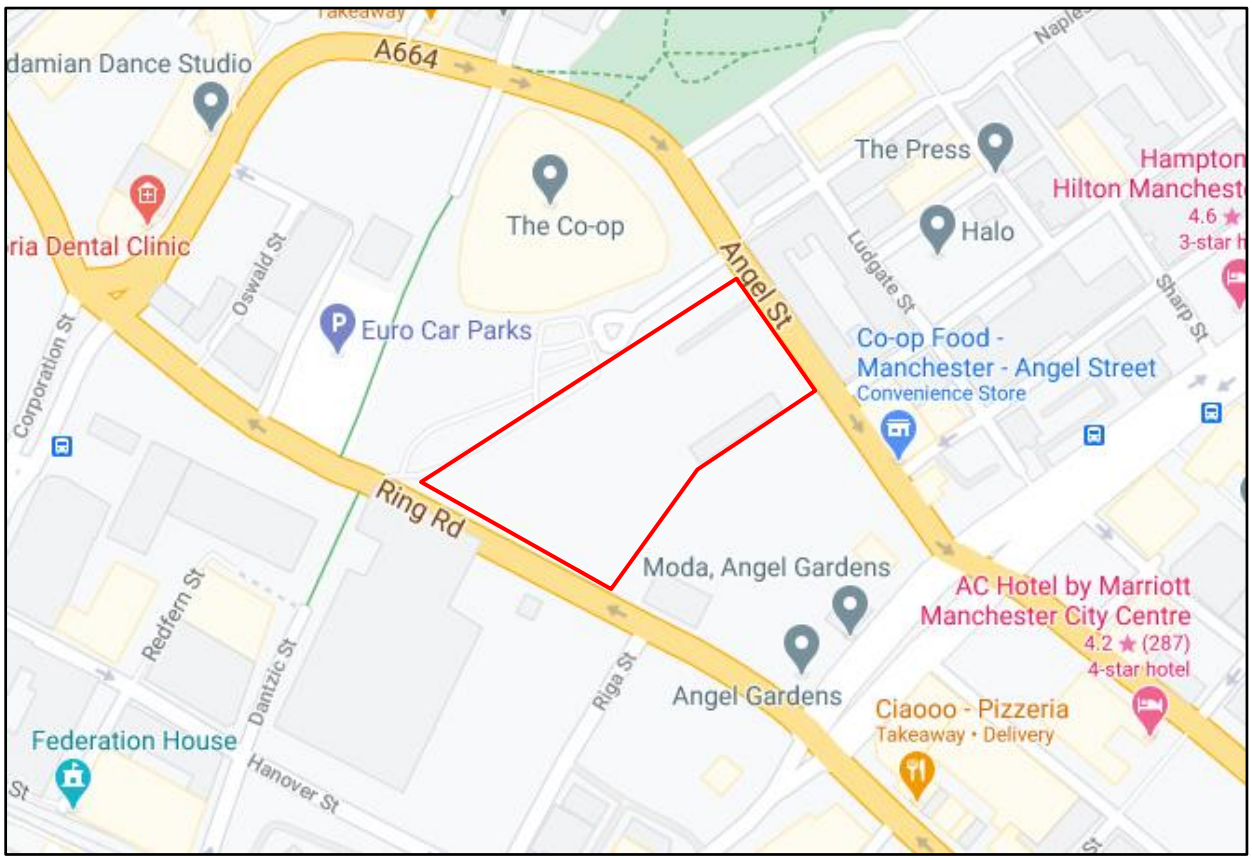
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Site Location Maps

Annex: **A**





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Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **MEPC**

Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

Source: Google Maps

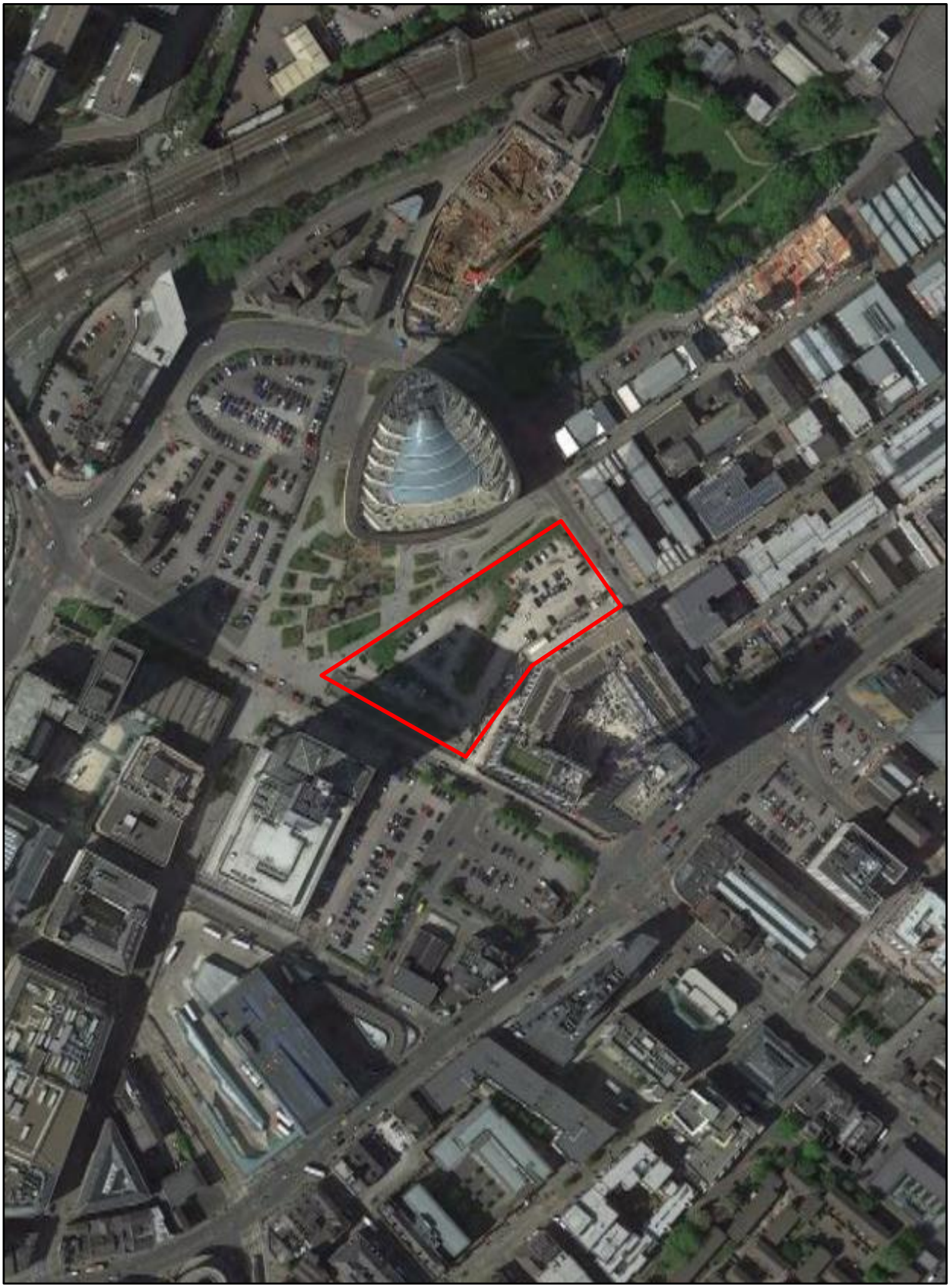
Approximate site boundary

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Recent Aerial Photography

Annex: **B**



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Approximate site boundary

Project: **2 & 3 Angel Square, Manchester**

N

Ref: **DA13039-00**

Source: Google Earth ™ Mapping Services

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Client Provided Site Plan

Annex: **C**



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Approximate site boundary

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Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

Source: Buro Happold

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'Baxendale's Iron Foundry, Kenyon Street, 1903'



'Arkwright Mills, Factory Yard, off Miller Street, 1930'



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Project: **2 & 3 Angel Square, Manchester**

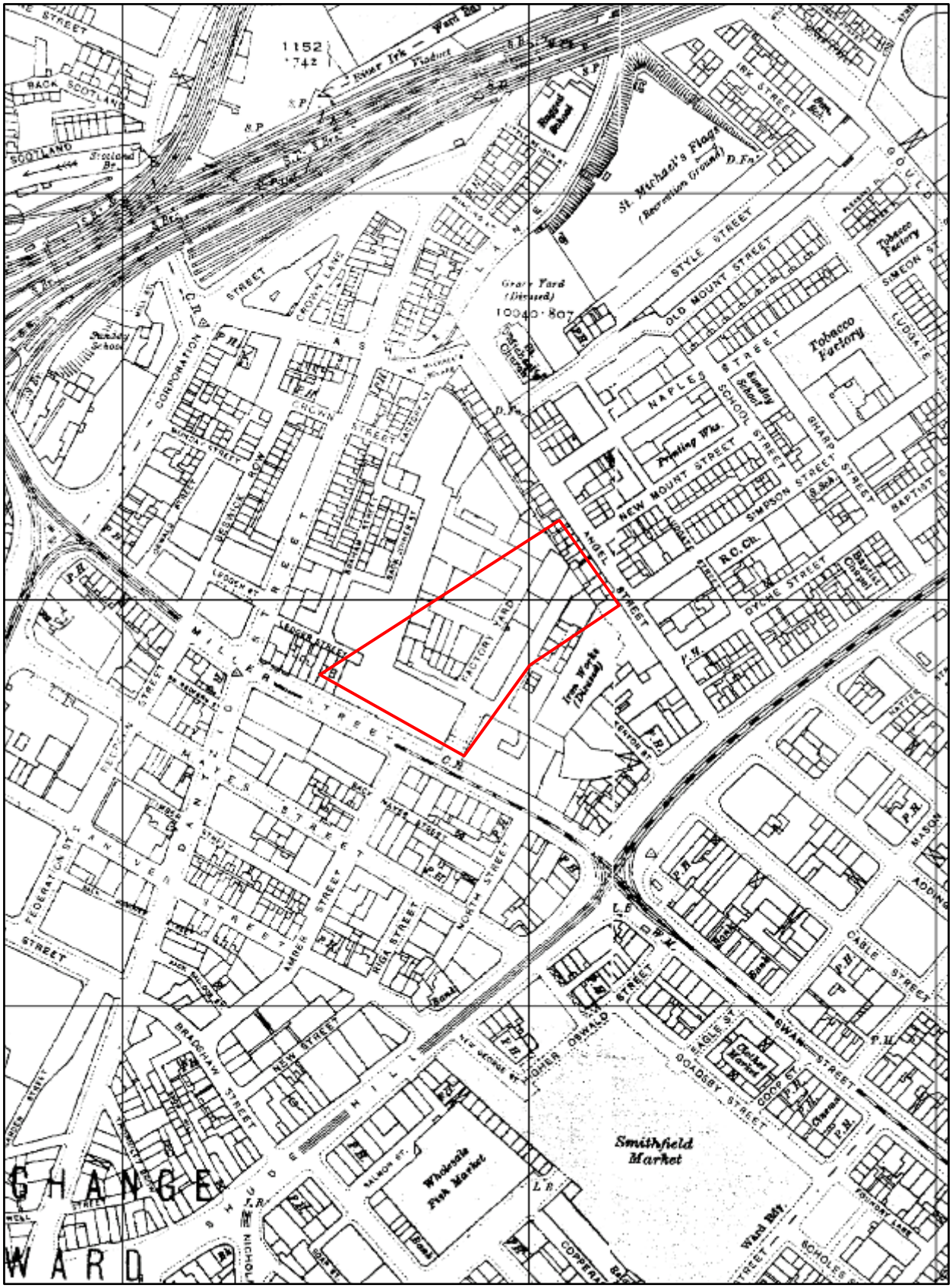
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Source: Manchester County Council: Local Image Collection

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1922-1933 Historical Map

Annex: E1



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Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

Source: Landmark Maps

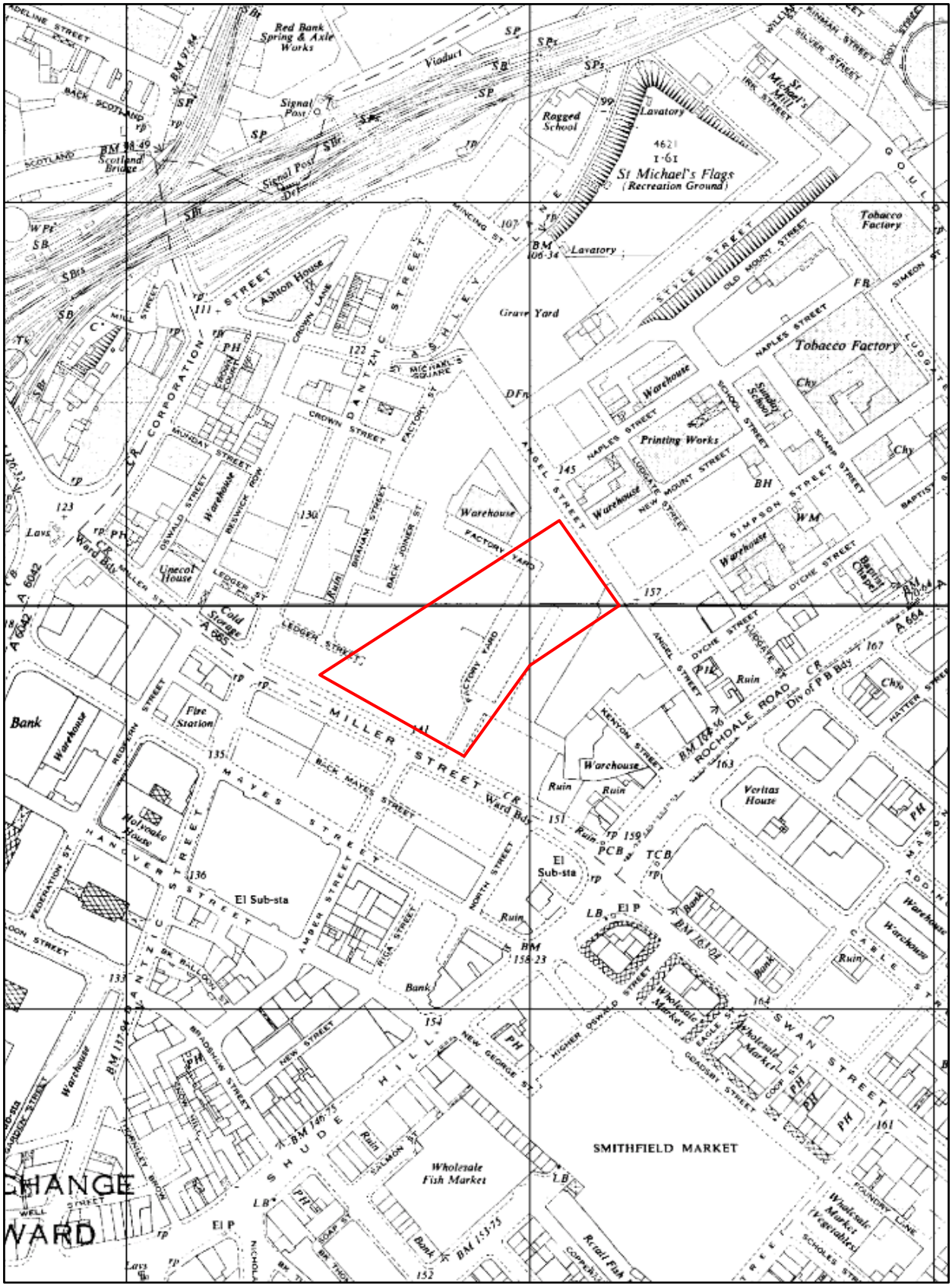
Approximate site boundary

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1951-1952 Historical Map

Annex: **E2**



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Client: **MEPC**

Approximate site boundary

N

Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

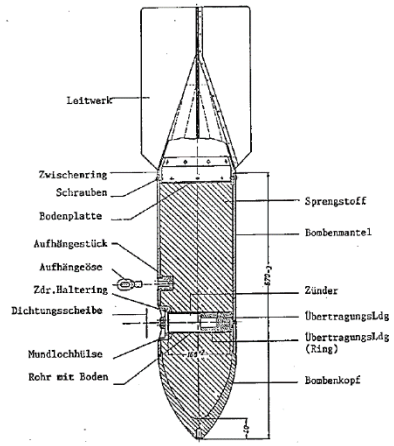
Source: Landmark Maps

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Examples of German Air-Delivered Ordnance

SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

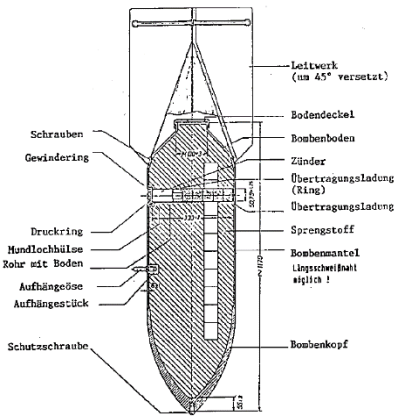






SC 250kg High Explosive Bomb

Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).



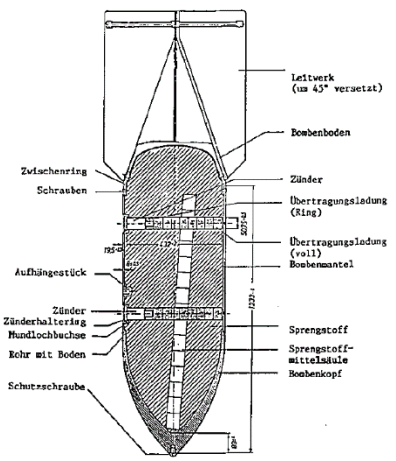


SC250 bomb being loaded onto German bomber

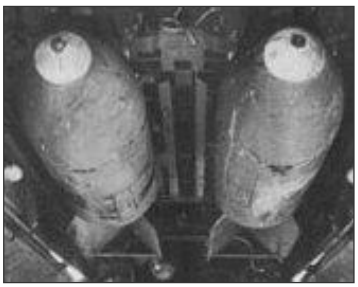


SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialen filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming







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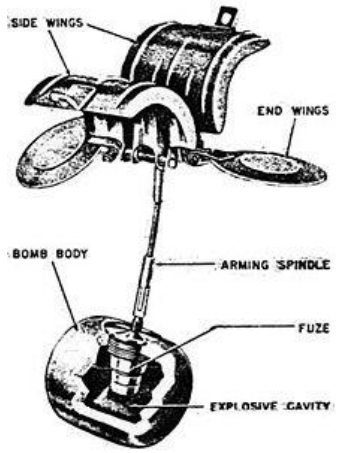
Source: Various sources

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Examples of German Air-Delivered Ordnance

SD2 Anti-Personnel 'Butterfly Bomb'

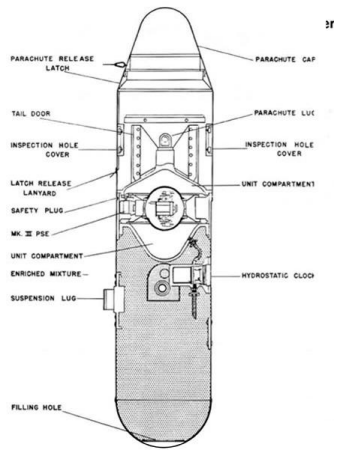
Bomb Weight	Approx. 2kg (4.41lb)
Explosive Weight	Approx. 7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuse (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it span.





Parachute Mine (Luftmine B / LMB)

Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to cause extensive damage in a 100m radius.



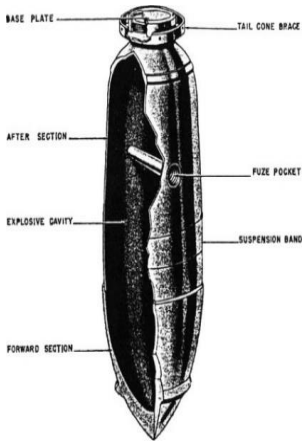






SC 1000kg

Bomb Weight	Approx. 993-1027kg (2,189-2,264lb)
Explosive Weight	Approx. 530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction





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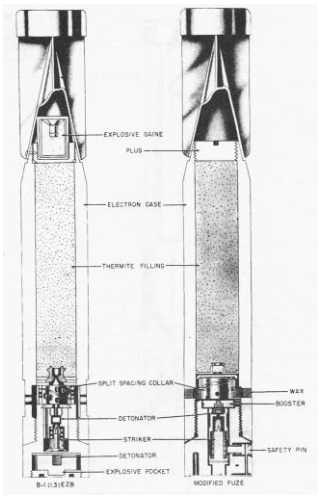
Source: Various sources

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German Incendiary Bombs

1kg Incendiary Bomb

Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)
Explosive Weight	Approx. 680g (1.5lb) Thermite 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters on towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.

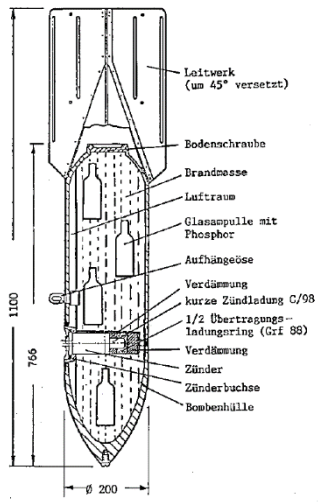


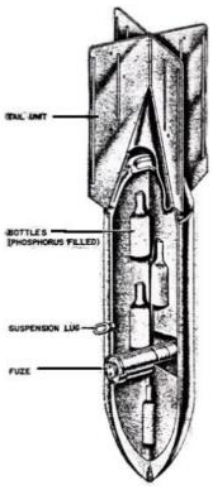




C50 A Incendiary Bomb

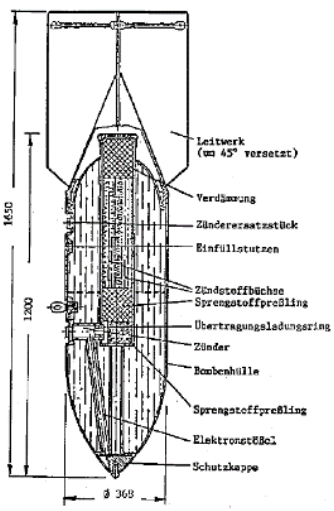
Bomb Weight	Approx. 41kg (90.4lb)
Explosive Weight	Approx. 0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against any targets where an incendiary effect is required
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture





Flam C-250 Oil Bomb

Bomb Weight	Approx. 125kg (276lb)
Explosive Weight	Approx. 1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration





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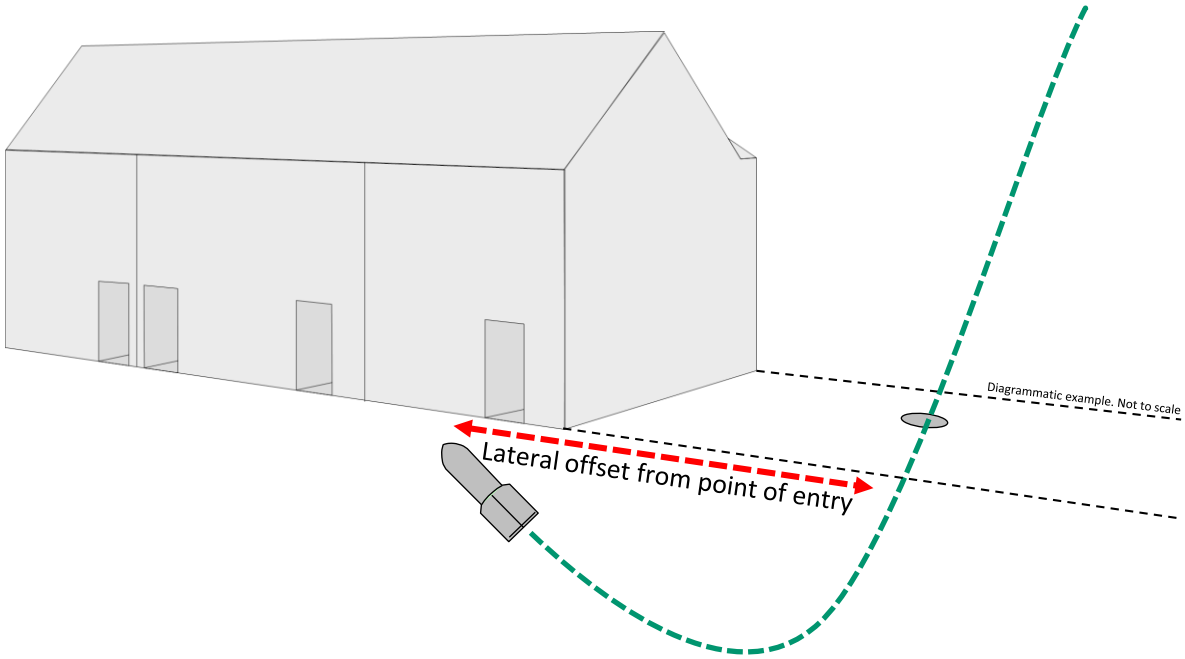
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The 'J-Curve' Effect Principle









Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites. The photograph above shows 250kg bomb found in Bermondsey pointing upwards, demonstrating 'J-curve'

One of the most common scenarios for UXO going unnoticed was when a UXB fell into a 'bomb site' (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).

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BBC NEWS

Bermondsey bomb: World War Two device safely removed



An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

March 2015

BBC NEWS

Bethnal Green WW2 bomb: Experts remove unexploded device



An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

A 200m (650ft) exclusion zone was set up around the device.

August 2016

BBC NEWS

Bath WW2 bomb scare: Device defused, police say



A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

The discovery of the bomb on Thursday **led to the evacuation of hundreds of homes** and many road closures in the Lansdown area of the city.

A cordon around the site was lifted on Friday evening, more than 24 hours after residents were asked to leave their homes.

May 2016

BBC NEWS

London City Airport reopens after WW2 bomb moved



London City Airport has reopened after an unexploded 500kg World War Two bomb was safely moved from the area.

The device was discovered at the King George V Dock on Sunday during planned work at the east London airport.

All flights were cancelled on Monday after an exclusion zone was put in place, **with the closure affecting up to 16,000 passengers and nearby residents being evacuated from their homes.**

May 2015

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Examples of Unexpected Detonation of WWII Bombs

Annex: **H2**

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013

BBC NEWS

World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010



June 2006

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Examples of Land Service Ammunition finds in the UK

Annex: H3



Unexploded Second World War bomb discovered under Somerset footpath

By Western Daily Press | Posted: January 21, 2014

The unexploded bomb was found in Somerset

Comments (0)

An unexploded bomb dropped in Britain during the Second World War has finally been discovered – underneath a popular footpath in Somerset.



23 August 2014 Last updated at 15:01

Unexploded WW2 bomb found at Kenfig Pool, Bridgend

Dean Smith believes the shell was made in Germany

Bomb experts have been called to a south Wales nature reserve after an unexploded World War Two shell was discovered by a walker in Bridgend.

Dean Smith, 38, of Pyle, was walking near Kenfig Pool on Saturday when he saw a fin sticking out of the sand.

He reached down to pick it up, but ending up falling and landed with the 2ft-long (0.6m) bomb on top of him.

The site has been cordoned off by police and the Royal Logistics Corps will carry out a controlled explosion.

Related Stories

'Panic' as dog nearly thrown grenade

WW2 bomb found at wind farm exploded

WWII bomb found in kitchen cupboard



Mortar thought to be from WWII found on Oshawa's Camp-X grounds

August 24, 2016 | 5:42 am

What is believed to be a World War II mortar has been discovered in south Oshawa. A man out in Intrepid Park, the site of the Camp-X Second World War training grounds, discovered the round with his metal detector on Tuesday evening. Durham police are held the scene overnight awaiting military officials from Trenton to come and properly detonate the mortar.



Unexploded bomb found in farmer's field

17 May 2010

A live Second World War mortar shell was blown up by Army experts after a farmer found it in his field.

The discovery was made in the field alongside the A20 between Folkestone and Dover.

The mortar shell, which was around a foot long and 3in in diameter, was around 50ft from the main road.

The farmer alerted police and PC Trevor Moody and PCSO Michelle Brady went to the field.

PC Moody contacted the Army who sent in a bomb disposal unit.

An Army officer confirmed the live shell was from the Second World War and was packed with high explosives.

They moved it a safe distance away from the A20 and carried out a controlled explosion.

PC Moody said: "Given that we live in an area that saw much action during the Second World War, it is not uncommon for us to be alerted about unexploded bombs."

The incident was on Thursday.

Click here for more news from Kent.



Royal Navy bomb disposal experts remove a World War Two shell discovered in a nature reserve

- A World War Two bomb was discovered in a Plymouth nature reserve
- Amateur metal detector found the shell and partially dug it up
- Royal Navy experts carried the explosive away before disposing of it

By VALERIE EDWARDS FOR MAILONLINE

PUBLISHED: 01:29, 13 January 2016 | UPDATED: 09:51, 13 January 2016

Share 338 shares 10 View comments

A World War Two bomb was reportedly found at Efford Nature Reserve in Plymouth after a member of the public was metal detecting and partially dug it up.

The Royal Navy Bomb Disposal team was called in to remove the bomb and police have closed off Military Lane, with the possibility of Military Road also being closed.

Police were called at around 1.30pm yesterday after what appeared to be a shell was discovered and partially dug up near Military Lane, Efford.



Holiday beach cordoned off after landslip sends more than a THOUSAND Second World War bombs and rockets tumbling onto the sands

- Bad weather led to ground movement which exposed the huge arsenal at Mappleton, East Riding
- A dog walker stumbled across the deadly find on Saturday and 15 controlled explosions were carried out
- Rockets, mortar bombs and 25-pounder bombs were recovered after they were fired into the cliffs by RAF aircraft during the war
- Most of the devices were dummy rounds used for bombing practice but contain enough explosives to cause terrible injuries

© Jonathan Pow

Bomb Beach Alley: Rockets were found after a landslide on Mappleton beach in 2012



Army bomb disposal team called to Blacksole Bridge in Herne Bay

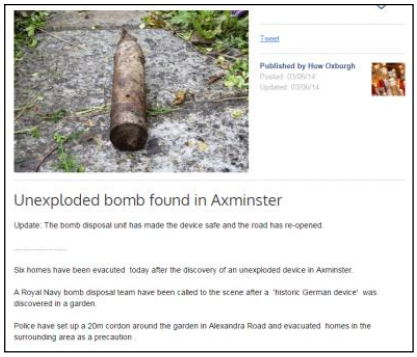
by Aidan Barlow abarlow@thekmgroup.co.uk 08 July 2015

It was like a scene from Dad's Army when Army bomb disposal experts found wartime explosives made by the Home Guard in makeshift bottles.

A team was called to the Blacksole Bridge in Herne Bay after the wartime bombs were found.

The team from the Royal Logistics Corps set up a 30 metre exclusion zone for pedestrians around the railway embankment after the suspected homemade phosphorous bombs were found.

The scene at Blacksole Bridge after wartime explosives were found in the railway cutting



Tweet

Published by Huw Oxburgh

Posted: 03/06/14

Updated: 03/06/14

Unexploded bomb found in Axminster

Update: The bomb disposal unit has made the device safe and the road has re-opened.

Six homes have been evacuated today after the discovery of an unexploded device in Axminster.

A Royal Navy bomb disposal team have been called to the scene after a 'historic German device' was discovered in a garden.

Police have set up a 20m cordon around the garden in Alexandra Road and evacuated homes in the surrounding area as a precaution.



Storms and floods unearth unexploded wartime bombs

By Claire Marshall

BBC environment correspondent

There has been a dramatic increase in the number of wartime bombs unearthed because of the winter storms and flooding.

Bomb disposal teams in the South West have dealt with double the number of unexploded ordnance than in the same period last year.

Since mid December, the Royal Navy's Southern Dive Unit has recovered or disposed of 244 items of ordnance.

During the same period last year, they dealt with just 108 items.

The storms have uncovered a lethal past

Almost 70 years after the end of WWII, one legacy of that conflict continues to turn up on beaches and harbours around Britain.

Unexploded shells, bombs and mines continue to be discovered every year, and the Royal Navy's Southern Dive Unit is tasked with making these devices safe.

Its area of responsibility stretches for some 2,250km (1,400 miles). It begins from the highwater mark in Hull and proceeds seaward to the territorial limit, and then runs clockwise around the British Isles - including the Isle of Wight, Channel Islands, and Isles of Scilly - to finish in Liverpool.

Related Stories

Ancient trees revealed by storms

Land Service Ammunition (LSA) resulting from historic military activity is commonly encountered across the UK by the public and construction industry alike. Such finds are much more common in rural areas than in urban environments, and can often be anticipated in areas such as former RAF stations or ranges. However, many such items are encountered entirely by surprise where the landowner or developer has no knowledge of any previous military use of the land.

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Source: Various news sources

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Unexploded WW2 bomb forces Salford road closures

6 November 2015



The shell was discovered at the site of the former Royal Ordnance Factory in Green Lane, which has been demolished to make way for housing

An unexploded World War Two bomb has been found at a former munitions factory in Greater Manchester, leading to a partial evacuation of the area.

Army bomb disposal experts were called to the former Royal Ordnance Factory in Green Lane, Patricroft, Salford, at about 11:30 GMT.

Surrounding roads were closed while the mortar shell was examined.

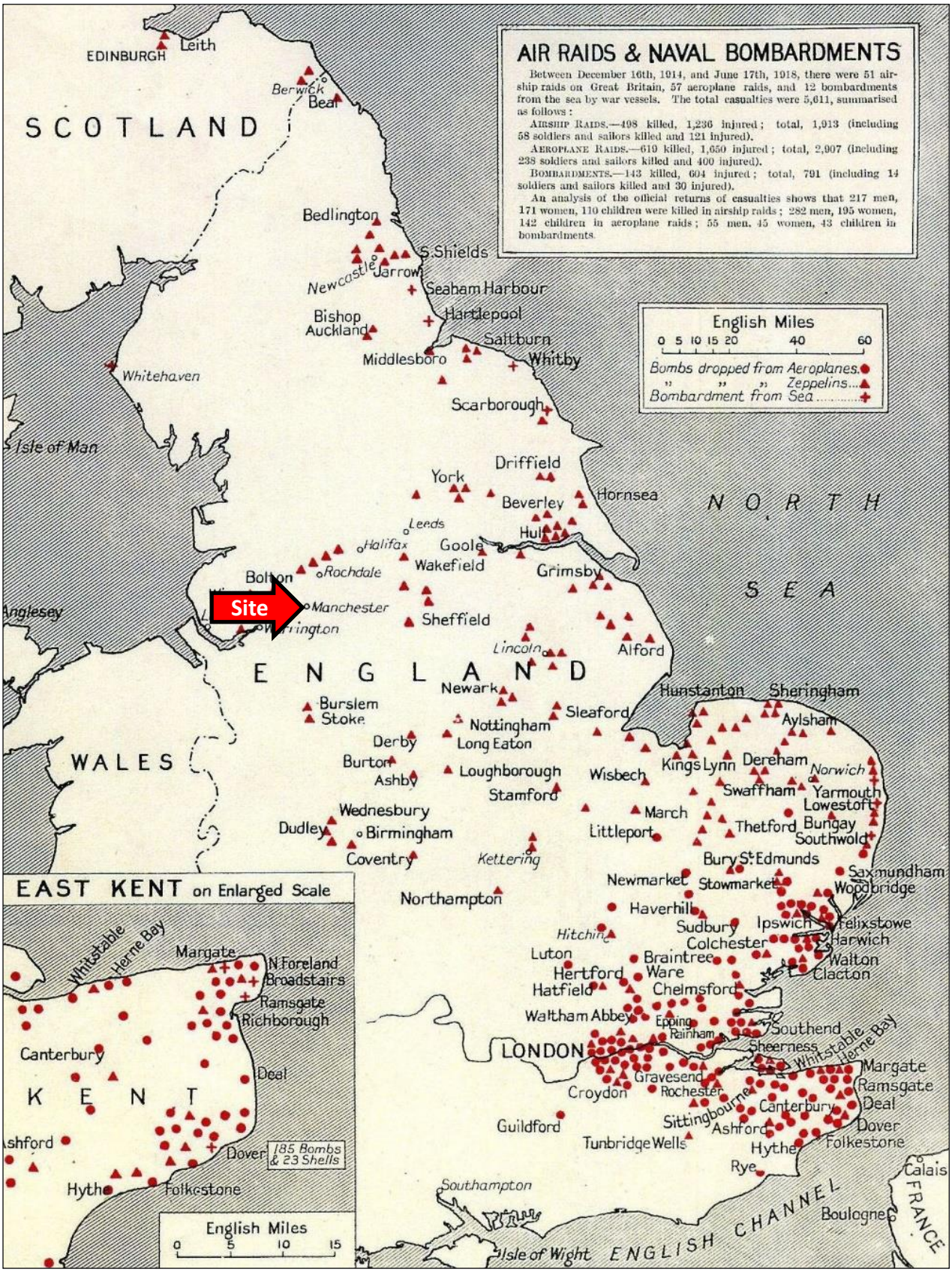
A spokesman for Greater Manchester Fire and Rescue said the device was found to be no longer dangerous.

It was removed from the site of the building, which is being demolished to make way for housing, and roads were reopened within an hour.

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WWI Map of Air Raids and Naval Bombardments

Annex: I



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Source: J. Morris, *German Air Raids on Britain*

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Approximate site boundary

N

Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

Source: University of Manchester Library

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'Gutted warehouses in Miller Street, where block after block of the great group of warehouses owned by Baxendale's, Ltd., was destroyed'

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Source: *Our Blitz: Red Skies Over Manchester,* Kemsley Newspapers Ltd., 1945

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Ground Level Photograph 1941

Annex: **K2**



'Miller Street, Blitzed property (Baxendales)'

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Source: Manchester City Council: Local Image Collection

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RAF Aerial Photography 7th May 1946

Annex: **K3**



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Approximate site boundary

Project: **2 & 3 Angel Square, Manchester**

N

Ref: **DA13039-00**

Source: National Monuments Record Office (Historic England)

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RAF Aerial Photography 7th May 1946

Annex: **K4**



1ST LINE DEFENCE

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Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **MEPC**

Approximate site boundary

N

Project: **2 & 3 Angel Square, Manchester**

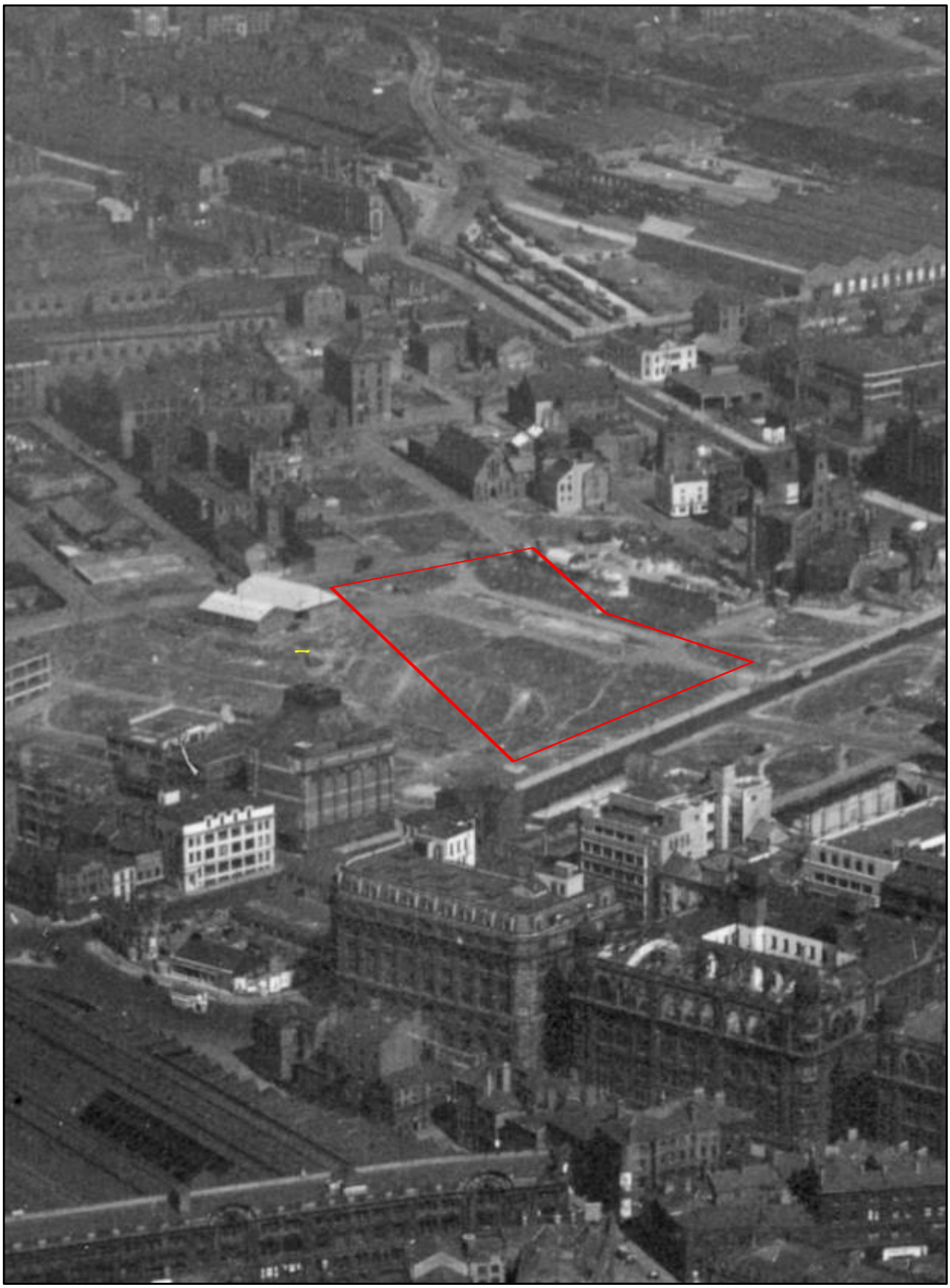
Ref: **DA13039-00**

Source: National Monuments Record Office (Historic England)

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Oblique Aerial Photography 1948

Annex: **K5**



1ST LINE DEFENCE

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Client: **MEPC**

Approximate site boundary

Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

Source: Britain from Above

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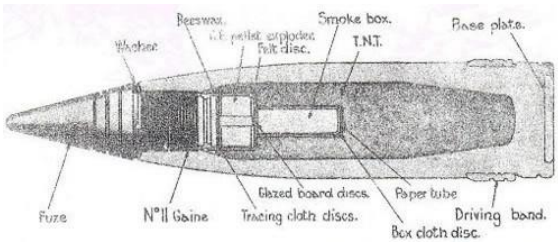
Examples of Anti-Aircraft Projectiles

3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft





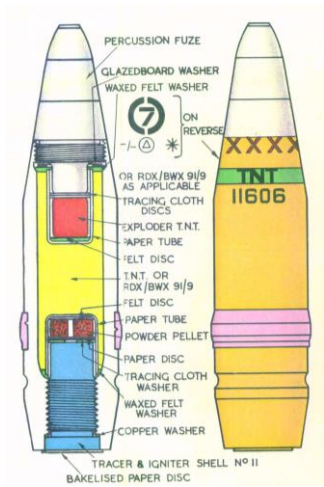


40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft



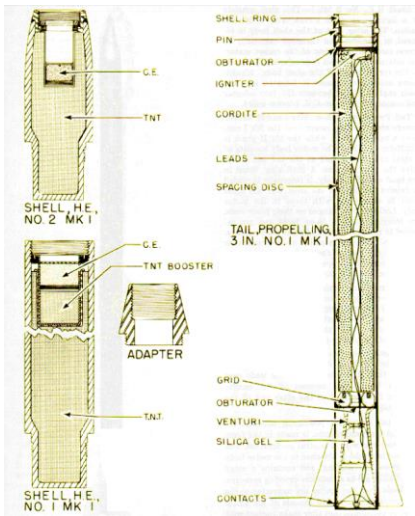




3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor





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Client: **MEPC**

Project: **2 & 3 Angel Square, Manchester**

Ref: **DA13039-00**

Source: Various sources

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Appendix J Hazard Check List

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Ground Engineering Hazard Check List

Job Nr: 050930 **Project: 2 & 3 Angel Square, Manchester**

Rev: 00 **Date: July 2022**

BURO HAPPOLD

Ref No.	Hazard	Risk (Y/N?)					What action have you taken	Further action(s) required	Action Req'd By		
		C	P	H&S	E	S			Client	Des'nr	Cont'r
1.00	**Site Appraisal**										
1.01	Are access restrictions (e.g. site access, turning circles in the vicinity of the site, or congested sites) likely to cause restrictions in the ability to access the site for ground investigation purposes? *(Refer to BH CDM Policy hazard note 6.4)*	N	N	N	N	Y	Access to Total Car Parks Limited car park provided through gate at southeast end of the car park.	Contractor to liaise with Total car Parks Limited prior to start/during of works.	-	Y	Y
1.02	Is there restricted space at the perimeter of the site boundary for required investigation?	N	N	N	N	N	None required.	-	-	-	-
1.03	Could the location of investigations result in undermining or cause vibration to existing structures resulting in structural collapse or damage?	N	N	Y	Y	Y	No structures identified within a reasonable distance of the proposed exploratory holes.	-.	-	-	-
1.04	Will any ground investigation works impede the means of escape from occupied or nearby premises or restrict access for emergency vehicles during construction?	N	N	N	N	N	None required.	-	-	-	-
1.05	Are there any overhead power lines crossing the site?	N	N	N	N	N	None required.	-	-	-	-
1.06	Will working over or adjacent to water be required at the site?	N	N	N	N	N	None required.	-	-	-	-
1.07	Will rope access or work on or adjacent to steep slopes be required at the site?	N	N	N	N	N	None required.	-	-	-	-
1.08	Will working in confined spaces be required?	N	N	N	N	N	None required.	-	-	-	-
1.09	Is the site in an area where damage to plant and/or equipment stored on site needs to be considered?	Y	N	N	N	Y	All working areas must be fenced off and locked if equipment is to be left on site overnight.	Secure container to be used if required by contactor.	-	-	Y
1.10	Are munitions or unexploded ordnance present or likely to be present on site?	N	Y	Y	N	Y	An Unexploded Ordnance Desk Study has been completed to assess risk. All exploratory hole locations to be cleared by a UXO specialist.	During the GI, on site presence from suitable UXO company is required to clear all exploratory hole positions to bedrock.	-	Y	Y

Risk Categories: C = Cost; P = Programme; H&S = Health & Safety; E = Environmental and S = Serviceability

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Ground Engineering Hazard Check List

Job Nr: 050930 **Project: 2 & 3 Angel Square, Manchester**

Rev: 00 **Date: July 2022**

BURO HAPPOLD

Ref No.	Hazard	Risk (Y/N?)					What action have you taken	Further action(s) required	Action Req'd By		
		C	P	H&S	E	S			Client	Des'nr	Cont'r
1.11	Is there the presence or likely presence of tunnels or mineshafts?	N	N	N	N	N	None required.	-	-	-	-
1.12	Is the site in an area that has or is likely to have experienced mining activities?	N	N	N	N	N	None required.	-	-	-	-
1.13	Is the site in an area that is likely to contain natural cavities, voids or solution features?	N	N	N	N	N	None required.	-	-	-	-
1.14	Is there a possibility that existing structures, below or above ground, could contain or incorporate asbestos or other suspect harmful chemicals? *(Refer to BH CDM Policy hazard note 6.3)*	N	N	Y	Y	N	Buildings demolished on site in the 1950s after World War Two bombing and in the 1980s may have contained asbestos. Asbestos found in archaeological excavation for Arkwrights Mill (Oxford Archaeology 2014). Asbestos removal Dec 2014/Jan 2015.	Asbestos testing during ground investigation.	-	-	Y
1.15	Does the site history indicate that the site is likely to be contaminated either above or below ground?	Y	N	Y	Y	N	The site is in an industrial area of Manchester City Centre which has previously been used for a variety of industrial uses. However, ground investigation laboratory data onsite and at the adjacent 1 Angel Square site/ NOMA Plot L site recorded limited elevated chemical concentrations within the ground and as such the risk is low. Notwithstanding the foregoing, chemical testing in respect of asbestos during site specific ground investigation will be required.	Chemical testing during site specific ground investigation will be required.	-	-	Y
1.16	Is there the presence or likely presence of below ground fuel tanks that may or may not have fuel in them?	N	N	N	N	N	None required.	-	-	-	-
1.17	Are there likely to be any harmful or explosive gases below ground?	N	N	Y	Y	N	Ground gas monitoring has been undertaken as part of previous site specific ground investigation.	-	-	-	Y
1.18	Are there gas storage tanks on or near the site?	N	N	N	N	N	None required.	-	-	-	
1.19	Are there any live services within the existing structures and or on the site? Have these been adequately identified especially next to live services? *(Refer to BH CDM Policy hazard note 6.5)*	N	Y	Y	N	Y	Available service plans to be provided to contractor.	Contractor to review service information provided and provide for CAT scans, manhole lifting and complete hand dug inspection pits	-	-	Y

Risk Categories: C = Cost; P = Programme; H&S = Health & Safety; E = Environmental and S = Serviceability

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Ground Engineering Hazard Check List

Job Nr: 050930 **Project: 2 & 3 Angel Square, Manchester**

Rev: 00 **Date: July 2022**

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Ref No.	Hazard	Risk (Y/N?)					What action have you taken	Further action(s) required	Action Req'd By		
		C	P	H&S	E	S			Client	Des'nr	Cont'r
1.20	Are there any legal or other constraints to obtaining access to work on boundary walls from the neighbours' side?	N	N	N	N	N	None required.	-	-	-	-
1.21	Are there any permits or consents required for ground investigation work, e.g. hot springs	N	N	N	N	N	None required.	-	-	-	-
1.22	Will work on the site require access to or be adjacent to land owned by Network Rail?	N	N	N	N	N	None required.	-	-	-	-
1.23	Is there the presence or likely presence of below ground structures on site i.e. basements?	N	Y	Y	N	N	Infilled basements and concrete/brick obstructions likely due to the development history of the site.	Provision of breaker required for inspection pits.		Y	Y
1.24	Is there the presence or likely presence of deep chambers?	N	N	N	N	N	None required.	-	-	-	-
1.25	Is there the presence or likely presence of tunnels below or near the site?	N	N	Y	N	Y	Abandoned culvert (1850 mm diameter) running northwest – southeast across the northern half of the site.	-	-	-	-
1.26	Will ground investigation result in excessive noise, dust, vibration which could affect adjacent properties such as schools and hospitals etc.?	N	N	N	N	N	None required.	-	-	-	-
1.27	Are there any site issues with regard to water e.g. flooding, tidal and ground water?	N	N	N	N	N	None required.	-	-	-	-
1.28	Are there likely to be any archaeological features on site?	N	N	N	N	N	None required.	-	Y	Y	Y
1.29	Are there likely to be any ecological features on site?	N	N	N	N	N	None required	-	Y	Y	Y

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