BROWNFIELD SOLUTIONS LTD

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

INTRO DEVELOPMENTS LTD

Gould Street and Bilbrook Street, Manchester

Remedial Strategy for 2 No. Pressure Reduction Stations

LC/C5692/13238/Rev C

November 2024

EXECUTIVE SUMMARY OF REMEDIAL PROPOSALS	
Remedial Requirements	**Verification Requirements**
Removal of all hardstanding, floor slabs, any relict structures including relic foundations etc across the site(s) alongside removal of existing drainage runs.	Any crush materials destined for re-use to meet chemical criteria as per Appendix A for protection of both human health and controlled waters.
Excavation and removal of made ground soils (+100mm scrape of natural) and any additional impacted natural soils, followed placement of separation layer and then with subsequent importation of chemically and geotechnically suitable fill material.	Soils remaining in situ to meet compliance criteria in Appendix A. Imported materials to be meet chemical criteria as per Appendix A for protection of both human health and controlled waters.
On completion of the above follow final verification reporting requirements.	Final verification and reporting to include (but not limited to): • The size and extent of the remedial excavations (lateral extent and depth plotted on suitable plans). • Photographic volume of works. • Any treatment undertaken. • All sampling locations and test results. • Details of the separation layer placement. • All the material imported to the site (including volume, source and chemical composition). • All the material exported from the site and waste transfer notes (including volume, destination and chemical composition). • Discharge of any groundwater.

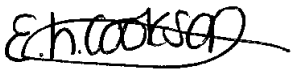
This executive summary should be read in conjunction with the full report, reference LC/C5692/13238/Rev C,and not as a standalone document. Document Version 2.3.

PROJECT QUALITY CONTROL DATA SHEET

Site Name:	Gould Street and Bilbrook Street, Manchester		
Document Name:	Remedial Strategy for New PRS Sites		
Reference:	LC/C5692/13238/Rev C		
Status:	-	20/06/2024	Draft.
	A	11/07/2024	Updated following comments from Remediation Contractor.
	B	19/09/2024	Updated with DQRA values following comments from EA.
	C	20/11/2024	Updated following comments from EA.

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DRAWINGS

Drawing Number	Rev	Title
C5292/01	-	Site Location Plan
C5292/04	-	Remedial Land Exploratory Hole Location Plan
2277-PLA-XX-XX-DR-L-1000	P09	Proposed Site Layout - Hardworks
70067897-WSP-02-XX-DR-CV-0001	P03	Bilbrook Street Compound Planning Proposal
70067897-WSP-00-01-DR-CV-0001	P04	MP/LP Pressure Reduction Installation General Arrangement
GS-AHR-SO-ZZ-DR-A-90-100	P05	Planned Infrastructure Works – Along Gould Street Phase 1a
GS-AHR-SO-ZZ-DR-A-90-102	P05	Proposed Ramped Access to Infrastructure Area off Bilbrook Street – Part of Phase 2 Works
21353-HYD-XX-XX-DR-GE-1002	P1	Site Features Plan (Hydrock 2022)
B023707/02	-	Site Layout Plan (WYG 2020)
B023707/05	-	Previous Exploratory Hole Locations (WYG 2020)
C5692/20	-	Conceptual Site Model (Proposed Cadent PRS Sites)

APPENDICIES

Appendix	Title
Appendix A	Chemical Specification for Soils
Appendix B	BSL Guidance -Re-use of Waste and Disposal
Appendix C	UXO Risk Assessment Report
Appendix D	Exploratory Hole Logs

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1.0 INTRODUCTION

1.1 Context

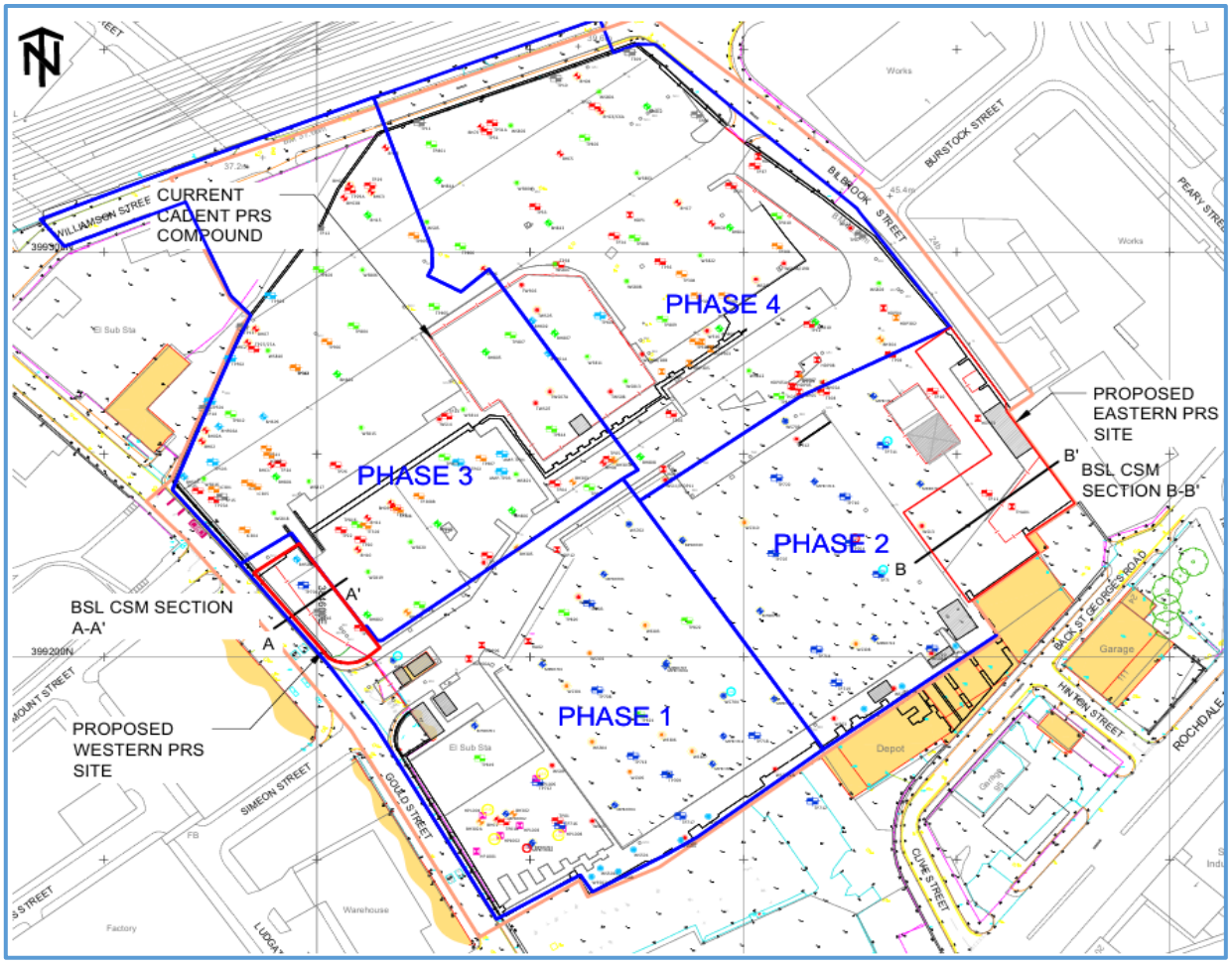
This Remedial Strategy has been produced by Brownfield Solutions Limited (BSL) for Intro Developments Ltd for two proposed pressure reduction sites located off Gould Street and Bilbrook Street, Manchester and has been completed in general accordance with the following guidance:

- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
- BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.

1.2 Proposed Development

The sites are located within the wider proposed Gould Street mixed residential and commercial development which are to be completed over four phases (see below). The wider Gould Street site is host to a large Cadent pressure reduction compound located centrally between phases 3 and 4. In order to facilitate the remediation and development of the wider site, the existing PRS infrastructure needs to be relocated. Without such works, further investigation of the existing Cadent PRS compound area, and any subsequent remediation, is unable to be advanced.

The proposed development therefore comprises the relocation of the existing PRS equipment to two separate Pressure Reduction Stations (PRS) with transmission pipework and infrastructure within the red line boundaries shown below (central western boundary and eastern corner):



The proposed PRS sites fall under Manchester City Council Planning Permissions reference 128431/FO/2020 and the layouts for the development(s) are as per the below plan references:

2277-PLA-XX-XX-DR-L-1000	P09	Proposed Site Layout - Hardworks
70067897-WSP-02-XX-DR-CV-0001	P03	Bilbrook Street Compound Planning Proposal
70067897-WSP-00-01-DR-CV-0001	P04	MP/LP Pressure Reduction Installation General Arrangement
GS-AHR-SO-ZZ-DR-A-90-100	P05	Planned Infrastructure Works – Along Gould Street Phase 1a
GS-AHR-SO-ZZ-DR-A-90-102	P05	Proposed Ramped Access to Infrastructure Area off Bilbrook Street – Part of Phase 2 Works

For reference, the wider development falls under MCC Planning Application 128248/FO/2020.

1.3 Background and Scope

This Remedial Strategy pertains to two parcels of land within the Phase 1 and Phase 2 areas where the gas network infrastructure detailed above is to be diverted to the two new PRS sites.

The wider Gould Street site was a former gasworks with holders, tar tanks and associated historic process buildings present. The majority of these were demolished and remediated approximately 20 years ago, with remediation targets generated to be protective of controlled waters. However, it is known that Tar Tank 1 (in Phases 3 and 4) was not remediated. This is in the location of the existing Cadent network infrastructure which is due to be diverted. In addition, a large telecommunications tower is present in the northeast of the site present within a small compound.

As of October 2024, Brownfield Solutions have completed extensive investigations across the wider site (Phases 3 & 4 in the northern half), building upon earlier work by Hydrock (phases 1 & 2 across the southern half). These investigations are detailed within the BSL Phase I & Phase II Geo-Environmental Assessment Report, reference MB/C5692/13303 Rev A, dated October 2024, which should be read in conjunction with this Remedial Strategy.

The Remedial Strategy is to set out how the remediation of the PRS areas will be undertaken and how the works will be validated. The document explains how the works will be permitted under current regulatory regimes and has been produced to address condition 6 of Manchester City Council Planning Permissions reference 128431/FO/2020, granted on 16th November 2022 at the land bound by Gould Street, Williamson Street, Bromley Street and Binbrook Street, Manchester, M4 4DD (the wider Site area).

The planning condition states:

'Condition 6 (Pre-Commencement Conditions)

Prior to the commencement of the development hereby approved, details of a remediation strategy to deal with the risks associated with contamination of the site in respect of the development hereby approved shall be submitted for approval in writing by the City Council, as Local Planning Authority. This strategy will include the following components:

1. *A preliminary risk assessment which has identified:*
    - *all previous uses*
    - *potential contaminants associated with those uses*
    - *a conceptual model of the site indicating sources, pathways and receptors*
    - *potentially unacceptable risks arising from contamination at the site*
2. *A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off -site*

3. *The results of the site investigation and the detailed risk assessment referred to in (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.*
4. *A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action*

Reason - There is evidence of site contamination at the application site which requires further consideration and examination. In particular, details of outstanding gas monitoring is required to be submitted for consideration and an appropriate remediation strategy prepared. This is pursuant to policy EN18 of the Manchester Core Strategy (2012).'

The following table sets out how each element of planning condition 6 will be addressed:

Condition	Sections	Comments
6.1 – Preliminary Risk Assessment	1.4, 2.0	Desk Study containing PRA referenced in Section 1.4 – Available Information. Desk Study / PRA summarised in Section 2.0 – Ground Model Summary.
6.2 – Site Investigation Scheme	1.4, 2.4	Phase II Geo-Environmental Assessment Reports containing previous SI works are referenced in Section 1.4 – Available Information. Previous SI works are summarised in Section 2.4 – Ground Conditions. Additional SI / testing following removal of the made ground is detailed in Section 4.3 – Site Remediation Requirements.
6.3 – Results of SI, Risk Assessment and Remedial Strategy	2.4, 4.2, 5.0	Results of the previous SI works and associated risk assessments are summarised in Section 2.4 – Ground Conditions. Remedial Options Appraisal is presented in Section 4.2. Proposed remedial works are outlined in Section 4.3 – Selected Remedial Options and also in Section 5.0 – Detailed Remedial Requirements and Other Constraints.
6.4 – Verification Plan	7.0	The verification process is detailed in 7.0.

The scope of work for this document comprises a summary of the ground model, summaries of the risk assessments carried out (LCRM Stage 1), a remedial options appraisal (LCRM Stage 2), Remedial Strategy (LCRM stage 3) implementation details and any validation requirements.

Note that geotechnical aspects are not specifically addressed within this document as it seeks to meet the requirements set out within LCRM. Geotechnical aspects should be considered within a Geotechnical Design Report in accordance with Eurocode 7 or a suitable site specific Earthworks Strategy.

It should also be noted that the wider Gould Street site will not be bound by the methodology presented within this report and will be subject to its own separate remedial options appraisal and remedial strategy report at a future date following the conclusion of further intrusive investigation works.

1.4 Available Information

The following reports have been produced for the wider site and contain intrusive investigation information pertaining specifically to the land parcels for which this Remedial Strategy is being produced. The reports should be read in conjunction with this assessment (listed in date order):

- Entec UK Limited, Site Investigation Report Factual (Mentor No. 3624), dated February 2003.
- Entec UK Limited, Hydrogeological Risk Assessment, no ref number, dated March 2010.
- Entec UK Limited, Stage 5 Remediation Strategy Report, no ref number, dated September 2010.
- Amec, Final Verification Report, reference S05760rr577i3, dated October 2011.
- WYG, Environmental Assessment Ground Investigation Factual Report, reference A074754-55-1, dated June 2015.
- WYG, Land Condition Summary Statement, reference 784-B024707, dated December 2020.
- Hydrock Consultants Ltd, Ground Investigation Report, reference 21353-HYD-XX-XX-RP-GE-0003, dated February 2022.
- BSL Phase I & Phase II Geo-Environmental Assessment Report, reference MB/C5692/13303 Rev A, dated October 2024

It is assumed that the Local Planning Authority will have provided the above reports to the appropriate statutory consultees where required.

1.5 Regulatory Correspondence

BSL are in receipt of correspondence from the Environment Agency (EA) in relation to previous iterations of this strategy.

EA Response SO/2024/124368/01 (4th Sept 2024)
A summary of the key points raised is below in response to the first submission of this strategy (July 2024):

- The Agency are aware that the application to discharge conditions is intrinsically linked to the proposed development of the wider site (phases 1-4).
- Works regarding the pressure reduction stations were the initial phase of works and key to unlocking the additional phases.
- There was not sufficient information to be confident about what works, exactly, were needed such that further assessment and, where necessary, additional ground investigation was likely needed (as much as could be undertaken in such high-risk areas).
- Within the initial Remedial Strategy iteration, there was no consideration of criteria for the protection of controlled waters.
- There was an appreciation that wider remediation of controlled waters is likely to follow as the wider development parcels come forwards,
- Further information was requested.

BSL then proceeded to update the strategy based on the above comments and resubmit (Revision B). The key addition to the strategy was the inclusion of selected remedial targets to be protective of controlled waters in relation to soils.

EA Response SO/2024/124368/02 (5th November 2024)
A summary of the key points raised is below in response to the second submission of this strategy (Revision B September 2024):

- Concerns were raised regarding the age of SI data utilised.
- The use of human health values for the broader range of contaminants observed is not protective of controlled waters. The Groundwater (Daughter) Directive requirements of 'prevent' and 'limit' are applicable (*BSL concur, and please note this was not the intention; the strategy includes these values to be protective of human health with due consideration that the overall risk to controlled waters from these individual parcels was likely to be low and controlled via complete source removal*).
- Three contaminants of concern to the protection of controlled waters have been identified. However, these contaminants do not encompass the broader range of contaminants that would be anticipated to be observed in association with a development site which was a formerly occupied gas works.
- The EA disagreed with the position statement within the remedial strategy that there is 'insufficient shallow groundwater to drive existing land contamination to re-impact the backfilled materials'. The singular suitable log of BH507 within the remedial strategy, places shallow, semi artesian groundwater at 3.25m below ground level.

EA Teams Meeting (7th November 2024 – 1:00pm)
A meeting between BSL, MCR and the EA was held via Teams at the above date and time. In respect to the PRS sites the following points were raised:

- The Agency have no concerns in principle with the selected remedial technique of source removal, including excavation of made ground material for disposal off site and replacement with chemically suitable 1st generation quarried stone.
- Consideration over how far excavations extend into the natural strata should be considered.
- Concerns were raised over us of the previous ENTEC DQRA values as remedial targets.
- Once remediation is complete, the main concern is the prevention of re-contamination of the sites within a critical timeframe before remediation of the wider site (i.e. once the site is handed over to Cadent, it could not be returned to again for further remediation).
- Groundwater in the PRS areas was considered to have semi-artesian characteristics.
- Site logistics and practices regarding excavation and validation sampling should be considered.
- The EA were happy to consider a semi-quantitative approach; this could involve use of visual/olfactory evidence alongside a PID.
- Remediation of the PRS sites should be considered with respect to the wider scheme and removal of the existing PRS equipment to allow investigation of Tar Tank 1.

Following the above, BSL have updated the strategy to the latest version (Revision C November 2024) taking on board feedback from the EA.

1.6 Limitations

This report has been prepared for the sole use and reliance of the Client, Intro Developments Ltd. This report shall not be relied upon or transferred to any other parties without the express written authorisation of BSL. If an unauthorised third party comes into possession of this report they rely on it at their risk and the authors owe them no duty of care or skill.

Current UK guidance and legislation has been used in the environmental assessment of the site, BSL is not liable for any subsequent changes in the guidance and legislation.

BSL have used reasonable skill, care and diligence in the production of this report. The findings and opinions conveyed via this report are based on information obtained from a number of sources as

detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon. This report may not be relied upon by the client or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full.

The recommendations within this report are based upon the proposed site end use provided to BSL at the time of writing. If the end use or development layout changes from the proposal, then the recommendations may change or become invalid.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

2.0 GROUND MODEL SUMMARY

2.1 Context

The ground model summary presented in this section summarises the works completed at the site to date, including the preliminary risk assessment, previous site investigation schemes and the results of the site investigations which are applicable to the land parcels in question. This addresses conditions 6.1, 6.2 and 6.3 of planning condition 6.

2.2 Description of Site

The wider site is located off Gould Street, Manchester (nearest postcode M4 4DD). It is situated approximately 750m north-east of Manchester City Centre, centred on National Grid Reference 384672 399254 as shown on the Site Location Plan, Drawing No. C5692/01.

Information presented below is specific to the two land parcels to which this report pertains:

Feature	Description
Site Area	Western Land Parcel: approximately 0.04 hectares. Eastern Land Parcel: approximately 0.12 hectares.
Site Access	Access to both land parcels are from within the wider site boundary, accessed off Gould Street to the west.
Current Land Use and Site Features	Western Land Parcel: This land comprises a vegetated verge area in the west, with the eastern part forming part of the wider tarmac car park. The two areas are segregated by palisade fencing. Eastern Land Parcel: The land is predominantly tarmac and concrete hardstanding, with an area in the southeast which comprises a rough gravel surface. A small structure / container is also present.
Potential Sources of Gross Contamination	None present at the time of the walkover, however the eastern land parcel has an area in the southeast which is labelled on the WYG drawing as a 'pigging compound' which is utilised for maintenance of pipework. It is unclear whether the land is still actively used for this.
Vegetation / Ecology	The western land parcel comprises vegetation across much of the land.
Topography	Both parcels of land are generally flat.
Site Boundaries	Western Land Parcel: The boundary between the land and Gould Street is defined by a low brick / stone wall which forms a small retaining feature for the vegetated verge as Gould Street slopes downwards to the north adjacent to the site. The northern boundary comprises a brick retaining wall as the carparking to the north is at a lower elevation. The southern and eastern boundaries are not defined as the landforms part of a wider car park. Eastern Land Parcel: The northeast boundary comprises a high brick wall. The southeast of the site is defined by the walls and buildings for the land bordering the site. The rest of the parcel is undefined and forms part of the wider site car park.
Surrounding Area	The land parcels are set within the wider Gould Street site which comprises a former gas works site now used as car parking with retained energy infrastructure (telecommunications tower / pipework pressure reduction systems etc). Beyond the wider site boundary, the land is located northeast of Manchester City Centre in what has historically been a predominantly industrial area, although re-development of land in recent years has introduced multistorey apartment buildings directly west of Gould Street and on land to the north. Railway tracks elevated from the surrounding land are present to the north beyond William Street and Bromley Street.

2.3 Environmental Setting

Site History
The wider site area in which the land parcels are situated was previously used for the production and storage of gas, with an operational gas works present on site since 1824. The works started in the northwestern area of the site and then expanded south and east to cover the full site area. At its full extent, the retorts were present in the south of the site, with the holders and tar wells in the north. The purifiers, washers and condensers were present in the central area.

More recently the land has been used as a call centre (in the south) and associated car parking, though the call centre building has now been demolished.

It is known that the former holders, tar tanks and associated historic process buildings were majority demolished and remediated approximately 20 years ago. However, it is known that Tar Tank 1 was not remediated and that Centrica/Cadent still have some network infrastructure present on the site which is due to be diverted as part of the future development of the site. In addition, a large telecommunications tower is present in the northeast of the site present within a small compound.

Specific to the land parcels, the 2020 WYG Land Condition Summary Statement report provides the following site history:

***Eastern land parcel**: The earliest historical map dated 1848 shows the site is part of a larger gas works site (Rochdale Road Gas Works). The land parcel is occupied by retorts and garages from 1893 until 1938. Gas works related structures on the site prior to 1893 are not labelled on historical plans. A meter house occupies the site until 1948-1952 when a storage hopper for coal and conveyor belts are constructed. It is understood at this time the area was used for coal storage. The hopper and conveyor belt were removed from the site by 1968 and the site is shown as vacant. The south eastern corner of the site is shown as a separate area on the 1983-1989 map and is assumed to be the pigging compound. An unidentified structure is present on the eastern boundary of the area. Aerial photography from 2000 shows the western half of this area to comprise of an area of heavily vegetated land and car parking.*

There has been little change to this area since, with likely negligible effects on the likely contaminants present.

***Western land parcel**: The earliest historical map dated 1848 shows the site is part of a larger gas works site, the western land parcel was occupied by an office building in the southern half and a larger building in the northern half identified as a process building and later housing purifiers (1908). The building in the southern half is shown on historical site drawings as stores and a canteen in 1958. The buildings onsite were demolished between 1983 and 1988 where the site is shown as vacant. The western half of the site is occupied by dense vegetation while the eastern half is used for car parking.*

As above, there has been little change to this area since, with likely negligible effects on the likely contaminants present.

Published Geology
The 2003 Entec report and online BGS mapping indicate that the published geology should comprise the following sequence of strata (top down):

- Glacial Till (clay, sand and gravel); over
- Chester Formation (sandstone).

Made ground is also considered likely to be present based on the site history.

Hydrogeology

Based on the inferred geology, a summary of the Environment Agency aquifer designations is presented in the table below:

Stratum	Coverage	Aquifer Designation
Glacial Till	Full Site	Secondary Aquifer (Undifferentiated). The classification is assigned where it is not possible to attribute either category A or B to the aquifer.
Chester Formation	Full Site	Principal Aquifer. This is 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.

The site does not lie within 500m of a Source Protection Zone.

A full Hydrogeological Risk Assessment has been published by Entec in 2010 which details in greater depth the hydrogeology of the site and a subsequent Stage 5 Remediation Strategy Report was also produced in 2010 which details remedial measures and DQRA values for the wider site area (discussed in Section 3.0).

Hydrology
The River Irk is located approximately 250m to the northwest of the site, at an elevation which is approximately 15m below the ground level of the site.

Radon
Information from the UK Radon Mapping indicates the property is in an area where less than 1% of homes are at or above the Action Level and therefore no radon protective measures are necessary in accordance with BRE Report 211 'Radon – Guidance on protective measures for new dwellings'.

UXO Risk
The site is known to lie within a moderate UXO risk zone. In order to support further investigation works, a detailed UXO risk assessment by a specialist was commissioned (EOD Contracts reference EOD/24/24210/DTS/REV1/Gould Street, Manchester, M4 4BH dated 12 June 2024). The report was able to demine moderate risk areas of the site where supervision by a UXO engineer and scanning of intrusive position with a magnetometer would be required as below:



Whilst the western and eastern remedial land parcels are not within areas of moderate risk for UXO, UXO awareness safety briefings should be provided to all site personnel.

A copy of the UXO report is provided in Appendix C.

2.4 Ground Conditions

Observed Geology and Groundwater

A significant amount of intrusive investigation and remedial works have been undertaken across the wider site. The following exploratory hole locations are within the land parcel boundaries:

- Parkman investigation, 1992: TP16.
- Entec investigation, 2003: WS13, TP11, TP39, THA01, HDP03.
- Entec investigation, 2010: BH507.
- Amec investigation, 2011: WS13S1, WS13S2.
- Hydrock investigation, 2022: TP701.

Additional BSL and Hydrock positions are also available in the areas immediately surrounding the sites.

Ground conditions encountered within the eastern and western remedial land parcels is presented below, taken from the 2020 WYG Land Condition Summary Statement report and the Hydrock 2022 investigation.

The generalised ground conditions in the PRS areas can be summarised as below (top down):

- Made ground from ground level to a maximum proven depth of 3.30m bgl.
- Natural superficial deposits comprising firm to stiff clay with sand and silt bands proven to 13.25m bgl.
- Solid geology comprising weathered sandstone bedrock proven to 15.00m bgl.

Strata are described in further detail below. Copies of the relevant exploratory hole logs are provided in Appendix D and the locations of the two PRS sites are shown in context to the site-wide exploratory hole locations on BSL drawing No. C5692/04 'Remedial Land Exploratory Hole Plan'.

Made Ground

TP39 located in the south of the western parcel recorded made ground as clayey gravel with brick, concrete, ash and linoleum tiles to a depth of 2.00mbgl (42.83m AOD).

BH507 located in the northern half of the western land parcel encountered made ground as sandy gravel of concrete, brick and spent coal/clinker. The depth of the made ground was proven in this location to 3.20m bgl (circa 41.62 m AOD).

Hydrock TP701 records sandy gravel to 1.10m bgl (not bottomed out) with no significant visual or olfactory evidence of contamination noted (and no groundwater).

Just outside of the western parcel, BH802 shows made ground of gravelly sand to 3.60m bgl (41.02m OD), with no groundwater in shallow made ground or superficial deposits during drilling and no visual or olfactory evidence of significant contamination. WS818 shows black staining and a hydrocarbon odour at 0.50m and 2.00m bgl, with water at 3.00m bgl (39.82m OD), however this position is at a lower elevation than the PRS site, with the base of the made ground in the PRS area higher than the groundwater depth in WS818 and therefore unlikely to be encountered/in continuity.

The made ground in the eastern land parcel comprises of sand and gravel of ash and clinker with occasional cobbles of brick. The made ground in WS13 was encountered to a depth of 2.0m bgl (43.64m AOD), base unproven. A concrete base was encountered in TP11 at a depth of 1.9m bgl (44.01m AOD), overlying this was made ground comprising of burnt brick assumed to have originated from the former retorts.

Just beyond the boundary of the eastern parcel in MPBH715, made ground was encountered as sandy ashy gravel including coal, brick, limestone and sandstone (no significant V/O evidence of contamination). No shallow groundwater was recorded. TP715 indicates similar conditions, with made ground to 1.15m bgl (44.86m OD) and no groundwater.

Superficial Deposits

Superficial deposits have only been encountered in BH507 in the western land parcel and described as firm to stiff sandy clay to a depth of 13.25m bgl, sand lenses and bands or slightly sandy slightly gravelly clay are present from 8.4m bgl. Although BH802 just outside of this area encountered these down to 13.50m bgl, which is consistent.

MPBH715, just beyond the eastern PRS boundary, encountered natural very stiff clay from 2.30m bgl (43.57m OD).

No visual/olfactory evidence of significant contamination was noted.

Bedrock

Geological mapping shows that the bedrock underlying the site comprises of the Chester Sandstone Formation. According to the British Geological Survey (BGS) the thickness of this unit varies between 50m and 220m. Weathered sandstone was encountered in BH507 as red brown fine to medium sand at a depth of 13.25m bgl. In MPBH715, bedrock was recorded at 12.00m bgl, whilst in BH802 bedrock was encountered at 13.50m bgl.

No visual/olfactory evidence of gross or potentially mobile contamination was noted.

Observations
Made ground associated with a reported strong naphthalene odour in WS13 during the Entec 2003 site investigation was subsequently removed as part of the remediation works. Validation results from the excavations did not identify any significant residual contamination.

In the eastern land parcel, burnt brick and gravels of spent coal/coke was also identified in made ground between 0.10m bgl and 3.30m, however there was no visual/olfactory evidence of significant contamination observed, especially within natural strata.

Off site, the only nearby location to exhibit signs of significant contamination is WS818 near to the western parcel with black staining and hydrocarbon odours in the made ground, however this position sits lower than the PRS site and migration of such contamination upwards to the PRS site is considered to be extremely unlikely.

Groundwater
Groundwater within the made ground or shallow superficial strata was not identified in any of the trial pits undertaken within the 2 No. land parcels, nor in adjacent locations MPBH715, TP715 nor BH802 and WS819.

BH507, located in the western land parcel encountered groundwater within the underlying natural strata at 3.30m perched at the base of the made ground just above firm clay (40.28 m OD) and 7.30m bgl (36.28m OD). In contrast WS818 groundwater was encountered at 39.82 OD, and is therefore downgradient of the PRS area, further supportive that it is unlikely to be in continuity with the water below the western PRS area.

Groundwater in the wider site area was found to be present within manmade structures in the made ground and within the sandstone, however during the 2009 Entec investigation works groundwater was not encountered within the fluvio-glacial deposits.

The 2003 Entec intrusive investigation report states that groundwater was found to be perched within the made ground associated with structures and also present at depth within the glacial Till at levels between 37.6m and 34.7m AOD. Groundwater within the sandstone was monitored at levels between 26.8m and 25.7m AOD.

The extensive ground investigations completed over the wider site by BSL in July-September 2024 confirmed the deep groundwater body within the Sandstone bedrock was consistently encountered at approximately 26m AOD. In BH802, located immediately adjacent to the western proposed PRS compound, groundwater levels during the site works were recorded at 26.62m AOD and between 25.417m AOD and 26.517m AOD over 6 No. post-investigation monitoring visits. This dataset confirms beyond reasonable doubt that the deeper groundwater body within the Principal Aquifer is not in hydraulic continuity with the shallower perched groundwater bodies and in turn is not under sufficient positive pressure to influence or interact with the shallow groundwater bodies.

It is therefore considered that groundwater is unlikely to be present in any significant volumes within the land parcels at shallow depths within the made ground.

3.0 SUMMARY OF RISK ASSESSMENTS

3.1 Context

The summary of risk assessments presented in this section details risk assessments which are applicable to the land parcels in question. This addresses condition 6.3 of planning condition 6.

3.2 General

Several phases of site investigation have been undertaken across the wider site to date, some of which included exploratory holes within the two land parcels. The reports pertaining to these works are listed in Section 1.4 and the ground conditions encountered are detailed in Section 2.4. A plan showing the locations of the two PRS sites in context to the site-wide exploratory hole locations is presented as BSL drawing C5692_04 'Remedial Land Exploratory Hole Plan'.

Chemical testing of soils within the land parcels is limited, however the previous site investigations have confirmed the following:

- Gross contamination is not anticipated within the made ground soils at the site as remedial works to remove contamination was undertaken across the wider site area previously, including within the two discreet land parcels, as reported within the WYG 2020 Land Condition Summary Statement. However;
- Hydrock have undertaken additional intrusive investigation works within Phases 1 and 2 which did highlight pervasive arsenic and PAH contamination within made ground soils in close proximity to the land parcels. However; testing of TP701 which falls within the western land parcel did not reveal exceedances of contaminants comparative to commercial GACs.
- There remains a small residual risk that previously unidentified contamination is present within areas between exploratory hole locations and remediation excavations.
- Asbestos testing was not undertaken as part of early intrusive investigation works, however was undertaken as part of the Hydrock 2022 investigation, whereby asbestos contamination was identified in several locations within made ground soils, though was not identified in TP701 in the western land parcel where soils were screened. Based on further data from the wider site, it is reasonable to assume trace asbestos is present across the site.
- There is anticipated to be some degree of contamination impacting the deeper groundwater (i.e. within the Principal Aquifer) underlying the two site areas as a result of migration from the wider gas works area.

Chemical testing results for previous intrusive investigation works are presented in the reports listed in Section 1.4.

3.3 Human Health Risks

Made ground underlies both land parcels which has not been shown to be grossly contaminated, however there remains a small residual risk of unidentified contamination present. Additionally, soils were not screened for the presence of asbestos as part of the original works but based on the recent site investigation works carried out by BSL over the wider site, including additional testing in areas adjacent to the proposed PRS site, trace asbestos is assumed to be present in the made ground across parcels 1-3.

3.4 Permanent Ground Gases and Vapours

Risks from permanent ground gases are considered to be low for the following reasons:

- Ground gas monitoring has been undertaken as part of the previous intrusive investigations (Hydrock and BSL) which indicates CS2 conditions, however;
- Proposed buildings / structures which form part of the Pressure Reduction Stations (PRS) on the land parcels will be fully vented to national grid standards, and therefore hazardous gases will not be able to build up in such quantities as to affect future site users. Furthermore, made ground sources are proposed to be removed from the PRS sites.

Remedial measures in regard to hazardous ground gases are therefore not required at the sites and are not considered further within this report.

It should be noted that this assessment is limited to the two land parcels to which this report pertains and is not applicable to the wider Gould Street site.

3.5 Risk to Controlled Waters

Risks to controlled waters from made ground soils within the boundary of the land parcels is considered to be low as significant gross contamination is not anticipated to be present based on the logs available for these areas and the general lack of groundwater at shallow depths from exploratory logs on and nearby the sites.

It should also be noted that it is proposed to remove all made ground and possible shallow impacted natural soils within these land parcels and replace with chemically suitable soils and aggregates which would not pose a risk to the underlying groundwater and would remove any residual risks from made ground within the site boundaries. By virtue of the removal of made ground, this should contribute to a betterment of groundwater quality beneath the PRS sites albeit on a highly localised scale over the context of the site as a whole. To prevent the risk of re-contamination between newly placed soils and those existing soils surrounding the PRS sites, a break or separation layer is being considered as a belt and braces approach.

Risks to controlled waters, particularly the underlying Principal Aquifer in bedrock, exist within the wider site area which could be impacting the deeper groundwater beneath the site. However; any attempt to treat groundwater in isolation beneath the two land parcels would be disproportionately expensive given the size of the wider site comparative to the land parcels in question, especially in due consideration of the forthcoming remediation to take place as part of the wider development.

It is therefore considered appropriate controlled waters are not subject to specific targeted remedial measures at this time within the parcels, aside from the removal of made ground (i.e. a potential source, which will therefore contribute towards betterment of groundwater quality) particularly in the interest of moving forward with the proposed development of the wider site.

The potential for “re-contamination” after remediation from the wider site area is considered unlikely at this stage given the general nature of the made ground soils and general lack of gross mobile contamination; much of the made ground is described as ashy, therefore likely containing lower mobility metals and PAH contaminants. An excavation buffer zone around the PRS sites would also assist decreasing this risk.

It should be noted that a full controlled waters risk assessment has been undertaken as part of the works for the wider site which includes:

- Undertaking a site wide detailed gap analysis to inform the DQRA.
- Producing a site wide PRA to summarise all existing data in one report.
- Carry out some confirmatory investigation in areas previously investigated and remediated (Phase 1).

- Carry out supplementary trial pitting along route of new gas pipeline filling in data gaps in this area.
- Carry out a detailed drainage risk assessment of the deep sewer that crosses the northern part of the site, to identify if it is part of the wider Water Authority drainage or a standalone localised historic feature.
- Refine the existing site conceptual model based on the supplementary site investigation.
- Carry out subsequent rounds of groundwater sampling and analysis (min 2 No. rounds), enabling detailed comparisons to be made with the groundwater monitoring undertaken prior to the remedial works undertaken in the north of the site.
- Refinement of the hydrogeological model.
- Produce a DQRA for controlled waters, encompassing the latest groundwater and soil data. This would be based on the original model, but with updated parameters and soil concentrations where required.
- Design the remedial strategy and RTCs driven by the DQRA target levels. This would likely encompass a site over dig and extensive on-site testing and validation ensuring any areas not identified during the site investigation are picked up.
- Produce a Piling Risk Assessment to demonstrate piling/penetrative works would not pose a risk to identified receptors.
- Conduct on going regulatory liaison in aid of transparency and to ensure LPA/EA queries are resolved in a timely manner.
- Installation of sentinel monitoring wells for longer term compliance and re-assurance, if required.

Following discussion with the EA via a Teams meeting on 7th November 2024, it was agreed that a semi-quantitative and empirical approach was required for remediation in respect to controlled waters.

As discussed within the Entec report, the key drivers for groundwater contamination at the site are considered to be ammonium, benzene and naphthalene. These values were identified as critical marker compounds for remediation and were based on the significant contamination identified across phases 3-4 within former gas holders which included free phase contamination; such levels of contamination do not appear to be present within the PRS sites, therefore adoption values generated via the ENTEC DQRA is considered to be highly conservative, as these were bases on the maximum measured concentration prior to remediation. The previously generated remedial targets are suggested as being reasonably protective of downgradient groundwater, whilst still being likely to be technical feasible.

Given the sites former usage as a gas works, associated contaminants phenol and cyanide are also suggested as critical drivers for groundwater risks in addition to the above.

BSL therefore propose the following target values below for soils remaining in-situ once made ground has been removed +100mm of natural material. These target values are presented below (also replicated in Appendix A and Section 7.2):

Determinand	Entec Clean Up Target Values – Soils (mg/kg)	BSL Proposed Remedial Target Values in lieu of formally agreed site-wide DQRA– Soils (mg/kg)	Notes and Justification
Naphthalene	250	190	Taken from LQM S4UL based on Commercial human health screening criteria (1% SOM) – this value is lower than the Entec DQRA value which was generated from a controlled waters risk assessment.
Benzene (BTEX)	5	5	Entec Clean Up Target. Value is lower than LQM S4UL commercial criteria (1% SOM)

Determinand	Entec Clean Up Target Values – Soils (mg/kg)	BSL Proposed Remedial Target Values in lieu of formally agreed site-wide DQRA– Soils (mg/kg)	Notes and Justification
			and has therefore been adopted for conservatism.
Ammonium	200 - made ground 400 - glacial deposits	200 (adopting most conservative)	Conservative approach based on Entec Clean Up Target.
Phenol	Not required	760	Entec DQRA considered contaminant to not pose a risk. Total phenols were mainly detected in, and, only exceeded the EQS in shallow groundwater in made ground during Entec SI. This suggests that phenols are not likely to pose a risk for the deep groundwater receptor. Suggested value taken from LQM S4UL Based on Commercial (1% SOM)
Free Cyanide	Not required	373	Entec DQRA considered contaminant to not pose a risk. ATKINS ATRISK commercial value adopted.
Visual/Olfactory Evidence	N/A	Observations of gross contamination – impacted materials to be removed.	Professional judgment.
PID Readings	N/A	<50ppm – removal of soils exceeding this value to be undertaken.	Proposed based on wider site indicative data and professional judgment.

Note where there are two sets of criteria provided (one for human health and one for controlled waters in Appendix A), the most conservative criteria (i.e. the lowest) will apply.

3.6 Summary of Updated CSM

A summary of the findings of the previous investigations and assessments where a risk is present (i.e. an unacceptable source-pathway-receptor linkage) which requires immediate mitigation in order to proceed with development of the identified land parcels is presented in the table below:

Source	Receptor
<- Poses an unacceptable risk to ->	
Elevated concentrations of contamination and asbestos fibres / ACMs within the made ground	Human health / construction workers (Commercial screening criteria adopted) Possible low level and highly localised diffuse pollution of shallow superficial aquifer (Secondary Aquifer (Undifferentiated)).

A visual conceptual site model (pre- and post-remediation) is presented in drawing ref. C5692/20.

Based on the above, it has been recommended that a Remedial Strategy was prepared that identifies the specific remediation requirements for the site.

4.0 REMEDIAL OPTIONS APPRAISAL

4.1 Context

The remedial options appraisal presented in this section details remedial options which are applicable to the land parcels in question. This addresses condition 6.3 of planning condition 6.

4.2 Remediation Options

This section has been produced in general accordance with the requirements of LCRM: Stage 2 Options Appraisal.

The Investigations and risk assessment have concluded that the site will require remediation is the action required to prevent, minimise, remedy or mitigate the effects of the identified unacceptable risks listed in the section above.

The remediation of the site will need to ensure that upon completion of the development, the ground conditions at the site can be shown to be appropriate for the intended use and that they will not pose unacceptable contamination risks to the identified receptors.

For the options appraisal, there are 3 steps to follow:

1) Identify feasible remediation options.
2) Do a detailed evaluation of options.
3) Select the final remediation option.

The objectives of the remediation will be to sever one or more of the linkages within the source-pathway-receptor (S-P-R) model. There are three broad approaches which can be adopted:

- Remove or treat the source of pollutants.
- Remove or modify the migration pathway.
- Remove or modify the behaviour of the receptor.

The options appraisal process considers the available remedial techniques to achieve the above based on following key criteria:

- Effectiveness.
- Practicality.
- Durability.
- Relative Cost.
- Relative Operational Time (in terms of installation or the activity).
- Sustainability.

The feasibility of each of the listed remedial option is assessed in terms of effectiveness at treating the contamination, which is broken down into; effective (Yes), partially effective (Partially) or not effective (No).

The listed techniques are also assessed in terms of relative cost ranging from negligible cost (£) through moderately expensive (££) to prohibitively expensive (£££).

Timescales over which the remediation technique is operational has been relatively assessed as weeks, months, years and decades. If a given technique is only effective over a period in the order of years to decades, then its overall feasibility is diminished.

A sustainable approach can help to ensure that the benefit of doing the remediation is greater than its impact.

The table below summarises the possible remedial options and assesses each against the six key criteria listed above:

Remedial Activity	Effective	Relative Cost	Operational Time	Comments (Practicality / Sustainability / Durability)	Feasible
Civil Engineering Methods					
Clean Cover System	Yes	£	Weeks	Will prevent contact between site end users and shallow contaminated soils, breaking the S-P-R linkage.	Yes - however; it is unlikely that soft landscaping will be included within the final design. Would not address perceived risks to controlled waters associated with retention of made ground in its current form.
Excavation and Disposal (may also require pre-treatment by screening & sorting).	Yes	£££	Weeks	This will effectively remove the source of the contamination, but is much less sustainable compared to other feasible options (excessive cost, take up of landfill space, transport issues, need to replace with clean material). Undertaken during watching brief. Some "sacrificial" natural soils as part of a shallow scrape below the made ground would likely be beneficial.	Yes – removal of made ground soils, including grubbing out of any relic foundations. Replacement with chemically suitable materials required – likely 1st generation clean quarried material or low permeability cohesive fill.
Physical Separation Layer (low permeability geotextile or bento-mat)	Yes	£-ff	Weeks	Will prevent contact between "clean" soils imported for above selected option and potentially contaminated soils and perched groundwater off site, breaking the S-P-R linkage and preventing re-contamination.	Yes – would need to be installed around excavation faces and bases as a separation layer. Unlikely to be required if low permeability cohesive fill is utilised as opposed to granular fill.
Materials Management (Excavation and Re-Use of Suitable Materials)	Yes	ff	Weeks	Excavation and re-use of any suitable materials and potential re-use of treated materials at a suitable depth. Would need to be undertaken in association with a Materials Management Plan (MMP) prepared in accordance with the CLAIRE Definition of Waste Code of Practice and signed off by a Qualified Person.	Yes – in conjunction with other options.
Stabilisation and Solidification	N	ff	Weeks to moths	Mixing of cement/lime into soils to effectively bind contamination to minimise migration from soil to vapour and dissolved phases and reduce the mobility of contaminants in soils. Bench trials would be required to determine the most suitable binder formulation and to prove that solidification/stabilisation	Yes, but discounted as it is considered there is no need for such an aggressive

Remedial Activity	Effective	Relative Cost	Operational Time	Comments (Practicality / Sustainability / Durability)	Feasible
				will be effective in reducing leachate concentrations. Option would still require a cover system to mitigate human health risks.	remediation technique, particularly in respect to the likely low-level contamination present in the context of the site as a whole.

4.3 Selected Remedial Options

Based on the above remedial options appraisal, the most appropriate approaches to the residual risks are listed below:

- Turnover of all made ground soils within the land parcels to allow for grubbing out of relic foundations.
- Removal of all made ground soils to expose natural soils, undertaken under a watching brief, using visual/olfactory evidence and a PID to assist.
- Chemical testing of natural soils beneath the made ground to confirm that potentially contaminated materials have been removed.
- Installation of a physical separation layer to prevent recontamination from the wider site.
- Import of clean, suitable soils to the site, either 1st generation clean quarried material, or potentially under CL:AIRE CoP (e.g. chemically suitable low permeability cohesive fill only) back to desired levels.

The options selected have been chosen because they are considered to be effective, can be carried out practically within the available time periods, are commercially viable and are considered to address the EA concerns raised in regard to 'prevent' and 'limit' principles by removing all made ground soils and any natural grossly impacted soils, any contamination which may be present will be removed, breaking the pollutant linkage. In addition, inclusion of a physical separation layer between new fill and the surrounding site adheres to the 'prevent' and 'limit' principles.

Alongside the existing investigation data, the chemical testing proposed is also deemed to satisfy the planning requirement for a site investigation scheme.

4.4 Site Remediation Requirements

The key requirements are summarised in the table below:

Source	Contaminants of Concern	Remediation Method	Further Details / Remedial Requirements
1 – Made Ground	Likely heavy metals, PAHs, SVOCs, possible asbestos.	Source Removal – Excavation of made ground	Once turnover of soils and grubbing out of relic foundations has been achieved, made ground soils will be removed from within the land parcels and stockpiled ahead of off site removal (subject to waste characterisation) and disposal at a suitable facility. To be carried out under a watching brief. A sacrificial 100mm scrape of natural soil shall also be undertaken. Any visual/olfactory impacted natural soils will be removed to a practical depth. Once removed, chemical testing will be undertaken to confirm that "clean" faces have been encountered. The number of tests are detailed in Appendix A. Clean, imported soils will be used to backfill the excavation and allow for development.
		Physical Separation Layer	Adopted in excavations to prevent potential recontamination of newly imported soils.

Detailed requirements are discussed in section 5.0 below. Note where the word “clean” is used from here on, the definition of this shall mean chemically suitable for the intended use.

5.0 DETAILED REMEDIAL REQUIREMENTS AND OTHER CONSTRAINTS

5.1 Context

The detailed remedial requirements presented in this section details the selected remedial options and methodology which are applicable to the land parcels in question. This addresses condition 6.3 of planning condition 6.

5.2 General

This section is intended to fulfil the requirements of LCRM Stage 3: Remediation and Verification.

All remedial works are to be overseen by suitably experienced and qualified site staff and a site watching brief will be in place alongside regular visits by a suitably qualified person to undertake the necessary verification works described.

The table below provides a summary of requirements in terms of the approximate order of works. It should be noted that the precise sequencing has not yet been confirmed by an appointed Contractor. This Remedial Strategy may also be subject to revision, dependant on the requirements of the regulators.

Task	Description
1.	**Pre-Commencement** • Approval of this Remedial Strategy with the Local Authority, Warranty Provider (e.g. NHBC) and Environment Agency (EA) prior to site works commencing. • Appointment of contractor for the works, who is to obtain appropriate permits, licences and approvals. Other appointments as per CDM requirements. • Production and declaration of a Materials Management Plan (MMP) under the DoWCoP prior to any works commencing or confirmation of waste exceptions (U1) to be in place (if required).
2.	**Site Clearance, including Demolition Works (if required)** Subject to all necessary ecological and arboricultural surveys being undertaken and appropriate mitigation measures in place, the site should be cleared and any vegetation below areas of proposed development should be stripped in accordance with Series 200 of the Specification for Highway Works. Demolition of buildings, removal of hardstanding, floor slabs, drainage runs, redundant pipework etc. A watching brief should be maintained during demolition and clearance/soils strip for any previously unidentified contamination.
3.	**Excavation of Made Ground Material and Importation of Soils (Earthworks)** Excavation and off-site disposal of made ground soils and any impacted natural soils within practical excavation depths (inc. 100mm natural soil scrape). A flow chart indicating the general process is detailed in Appendix A. Use of visual/olfactory evidence and PID readings to determine if additional soils need to be removed. Validation sampling and testing of underlying natural soils to verify that potential contamination has been removed. The number of tests are detailed in Appendix A. The results of testing should be compared to the remedial targets in Appendix A, with either further risk assessment undertaken if required or additional soils removed and excavations re-validated. Installation of low permeability separation layer once excavations are complete. Importation of clean, suitable materials to backfill the excavation and achieve proposed ground levels. Placement of materials will be undertaken to an appropriate Earthworks Specification in accordance with SHW Series 600.

Task	Description
4.	**Verification and Reporting of Remedial Work** Collation of information relating to site clearance, chemical testing, any remedial works, remedial verification, material movements and waste transfer documentation where appropriate. A closure Verification Report will be required to close out the declared Materials Management Plan and submitted to CL:AIRE (if required). Complete remedial validation report(s) in line with regulatory guidance and warranty provider requirements. The report(s) should be submitted to the Local Authority and warranty provider for approval following completion.

5.3 Demolition Works

Issues surrounding demolition of above ground buildings is outside the scope of this report, it is assumed that all existing above ground buildings and structures will be removed to ground level prior to remedial works commencing, following completion of any enabling works such as asbestos removal where present.

The excavation of all hardstanding areas, slabs, basement structures, relict foundations and similar below ground obstructions, will be undertaken with materials stockpiled and tested to determine their fate (on-site re-use or off-site disposal) in accordance with a Materials Tracking System.

All excavations should be suitably benched or otherwise supported for the duration of the works in accordance with relevant industry guidance.

Redundant drainage associated with the previous development will require chasing out. Existing connections to be located and capped to prevent contaminated groundwater entering the off-site drainage. The contractor should locate and record connection points and maintain off site connection pipework to allow for future connection if required.

5.4 Earthworks

General Considerations
Work procedures should be designed to minimise the risk of dust becoming airborne by suitable means, such as keeping the exposed soils damp or covered at all times. It is important that the control measures in place are sufficiently robust to prevent release of contaminated dust into the surrounding environment.

Geotechnical Considerations
Whilst geotechnical aspects are not specifically considered within this Remedial Strategy, all earthworks should be undertaken in accordance with an appropriate Earthworks' Specification.

Final site levels have not been provided and therefore the extent of any cut/fill earthworks requirements are unknown, however there will be a requirement to backfill excavations associated with made ground removal within the land parcels. Materials classification for earthworks has not been undertaken.

The contractor should be responsible for controlling groundwater entry into excavations.

Remedial excavations shall extend as far as practicable to the red line planning boundaries and as far as practicable towards off site boundaries against roads, taking into consideration the potential for geotechnical instability.

Materials Management
Any works involving the movement of soils within the site boundaries shall be done in accordance with a Materials Management Plan (MMP) under the CL:AIRE Definition of Waste Code of Practice (CoP) or shall be done in accordance with an appropriate exemptions (e.gs U1). Further guidance is presented in Appendix B.

To implement the DoWCoP, there is a requirement to notify the Environment Agency and Local Authority of the intention to use the code of practice in principal, after which there is a 21-day notice period for their response.

In order to re-use soils under the DoWCoP, there are four key criteria that need to be met:

- The aims and objectives of the project meet the requirements of the Waste Framework Directive.
- The soils can be demonstrated to be suitable for use (backed up by chemical/geotechnical testing and assessment).
- There is certainty of use (i.e. materials tacking which should be in place as part of good site practice in any case).
- Quantity (the quantity of materials used should be known).

Information on existing site levels, proposed levels, volumes generated (e.g. foundation / drainage excavation arisings) would need to be known in order to complete the MMP.

If the DoWCoP is the chosen route, it is an absolute that the MMP should be in place and declared by a Qualified Persons (QP) before works commence, otherwise excavated soils could constitute an illegal deposit of waste and enforcement action could be taken by the EA and HMRC.

In regard to “clean” naturally occurring soils only that are to be re-used on their site of origin, these are covered by a Waste Framework Directive (WFD) exclusion. So long as the project can prove the four criteria (listed above) then permits or the DoWCoP are not required. However, many projects still use the DoWCoP to ensure compliance.

Re-use of soils containing asbestos should comply with the CL:AIRE publication ‘Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials’ (CAR-SOILTM) and CAR 2012.

In terms of the re-use of brick/concrete crush materials, the DoWCoP does cover aggregates, but only on the site of origin and the EA WRAP aggregate Quality Protocol might best apply to ensure quality standards.

Imported Materials and Materials for Re-use
Any soils or materials imported or to be re-used as part of the works should be tested for chemical compliance and suitability in line with the guidance stipulated in Appendix A and the proposed end use.

Any imported material should be approved by BSL and the Local Authority prior to being imported onto site.

Where feasible, imported topsoil should conform to the requirements of BS 3882:2015 (Specification for Topsoil and requirements for use), or as agreed with the client. Imported subsoil should also conform to the requirements of BS 38601:2013 (Specification for subsoil and requirements for use), or as agreed with the client.

In addition, all materials must be free from aggressive / invasive weeds (such as Japanese Knotweed and Giant Hogweed) and bulk vegetative growth.

Hydrocarbon and VOC Impacted Soils
Whilst no significant petroleum hydrocarbon or VOC contamination has been identified in soils based on existing SI data, a watching brief should be in place during works to observe for potential contamination. Remedial excavations shall extend as far as practicable to the red line planning boundaries and as far as practicable towards off site boundaries against roads, taking into consideration the potential for geotechnical instability.

An allowance should be made for measures to temporarily store potentially hydrocarbon impacted groundwater encountered during excavations until testing has been undertaken and a suitable disposal route defined. Any groundwater disposal is the responsibility of the remediation contractor and this must be done under suitable discharge consent.

Asbestos Impacted Soils
Based on the findings of the recent site-wide investigation undertaken by BSL, trace asbestos should be assumed in all made ground soils across phase 1-3 unless proven otherwise, i.e. by testing.

During the excavation, sorting and screening of soils, any easily identifiable asbestos containing material (e.g. asbestos cement sheeting tile etc) shall be removed by hand picking and disposed off-site to a suitably licensed waste facility by a suitably qualified and licensed contractor.

The reuse of excavated soils contaminated by asbestos should also be carried out in accordance with "Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance (shortened name CAR-SOILS™)" with work requirements assessed by a competent person in line with the Joint Industry Working Group (JIWG) Decision Support Tool for CAR 2012 Work Categories (i.e. are the works notifiable or not and are they non-licenced or licenced).

Re-use of Asbestos Impacted Soils
In terms of materials placement (i.e. re-use), if implemented, the following criteria will deliver a site that is suitable for use in terms of asbestos risk (applicable to the built environment only):

- Soils between finished ground level to 0.60m depth must be characterised by nil asbestos.
- Soils below 0.60m depth or directly beneath building plots (i.e. below hardstanding, floor slabs, driveways etc) and adopted highways/pavements must be characterised by asbestos at or <0.001% w/w asbestos.
- For soils >1.00m below finished ground levels, asbestos in soils should be<0.1% w/w and providing that asbestos contaminated soils are placed below this depth, then it is considered that there is no risk to human health. Efforts should be made to remove any visible ACM, providing it is practical to do so and does not generate any increased level of risk.

Provision will need to be made for hand picking of identifiable asbestos containing materials where observed and these materials will need to be placed in a locked skip prior to disposal to an appropriate waste facility.

These criteria have been used on similar sites to the satisfaction of the local regulatory authority.

Records of all activities undertaken, especially where soils containing 0.1% w/w to 0.001% w/w are placed below 1.00m, should be kept in a Health & Safety file for future reference, noting that this primarily applies to persons engaged in excavation works below 1.00m depth. CAT B training is likely to be required for

operatives excavating below these depths, although the contractor should undertake their own risk assessments to confirm requirements.

Well Decommissioning
Existing monitoring wells which fall within the boundaries of the land parcels are required to be decommissioned to remove potential pathways. Covers and pipe shall be removed, and the resultant annulus filled with bentonite grout or concrete in accordance with EA guidance.

UXO
The UXO desk study indicates that much of the wider site is Medium Risk, however the eastern and western land parcels are within low risk areas.

As a minimum precaution, all personnel working on the land 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.

5.5 Importation of Fill Material

Soils will be required to be imported to site to act as fill following the removal of made ground and any natural grossly impacted soils.

Imported materials to be used should meet the chemical criteria outlined in Appendix A.

Note that all obstructions will need to be grubbed out to at least 2000mm below finished levels, final depth to be agreed with the BDP engineer and Centrica.

It should be noted that the screening criteria and scenarios adopted within Appendix A are conservative, thus an exceedance of a contaminant will not necessarily deem the material to be unsuitable. Any exceedances detected and overall material suitability will be assessed on a case by case basis, with the results included and discussed in the Validation Report.

5.6 Records

Accurate records and as-built drawings will need to be kept, updated and provided for all aspects of the remedial works as they progress.

The construction works should be devised in a way to allow the maximum re-use of site won materials adhering to current waste regulations. To allow this and demonstrate compliance with Waste Management Licensing Regulations the Contractor should maintain an accurate Materials Management Plan (MMP). These shall show the source, description, classification and placement location of all fill used on the site. The plans shall be revised regularly with archive versions maintained for future reporting purposes. The MMP should show the extent of any excavations undertaken on site.

5.7 Stockpile Management

Segregation of materials and stockpiles should be maintained, and accurate records kept to avoid the potential for cross contamination. Good site practice for stockpile management includes, but is not limited to:

- Damping down of the site surface, excavations and stockpiles to prevent the generation of dust (wind blown asbestos fibres can contaminate "clean" topsoil stockpiles potentially resulting in expensive disposal costs).
- Stockpiles sizes should be kept to a minimum to reduce 'wind whip' causing potentially hazardous material to be blown from the pile.
- Once at the intended size, stockpiles should be "sealed" to ensure no excess materials are placed and mixed into the stockpiled to prevent cross contamination.
- Clean, validated material proposed for re-use as part of the cover system should ideally be placed on a suitable polythene membrane or clean concrete hardstanding to prevent any cross contamination.
- Appropriate loading of plant to prevent spillages.
- Appropriate signage should be displayed so that site workers/visitors are aware of the intended use and are alerted to the potential hazards associated with the material to be stored on site.

Examples of good site practice for stockpile management are presented below:

Stockpile sealed and cordoned off with warning sign	Sheeting of contaminated materials
	

5.8 Testing

Prior to commencing any works the Contractor will submit to the Clients Representative (Suitably qualified Geo-environmental Engineers) details for the testing laboratories to be used together with their UKAS and MCERTS accreditations (as appropriate). The Clients Representative will approve the laboratories subject to them holding the relevant certifications. Alternatively, providing the Client's Representative is a suitably qualified Engineer, then they may attend site to obtain samples for appropriate testing.

Tests carried out by a laboratory without the approval of the Client's Representative will be rejected.

All samples will be taken in accordance with relevant guidance (e.g. BS 10175:2011+A2:2017).

The contractor is responsible for the testing of the physical properties of any imported or processed material to be used in the engineering works. This applies to both site won and any imported materials.

Site won material shall be tested to confirm its chemical suitability. Contaminated material for disposal should be tested to define the most economical disposal route. In addition, any material to be imported to the site shall be tested and its suitability demonstrated prior to it being brought to the site.

The geotechnical suitability of site-won materials will be confirmed before reuse, by appropriate earthworks testing, in accordance with an Earthworks Specification (preparation of which is outside the scope of this remedial strategy).

5.9 Permits

The appointed contractor will need to hold or obtain relevant waste permits or exemptions (where applicable) in accordance with the Environmental Permitting Regulations 2016 to carry out waste recovery, treatment and re-use activities on site. Alternatively, waste recovery and re-use operations shall be in accordance with the CL:AIRE Definition of Waste Code of Practice (DoWCoP), 2011 and an approved Materials Management Plan (MMP) declared under the DoWCoP by a Qualified Person (QP).

A crusher/screener will also require a waste permit or exemption. Aggregates should be processed in accordance with relevant WRAP Quality Protocol to produce a non-waste product.

It is the contractor's duty of care to ensure that any waste to be treated or disposed off-site is transported by a licenced waste carrier and that the waste facility is licenced, permitted or holds an appropriate exemption.

Evidence of the above should be maintained and provided on request along with any waste transfer or consignment notes for materials removed off-site.

5.10 Surface Water Runoff

The contractor should provide and maintain means to intercept surface run off in accordance with good site practice. Run-off from the site shall not be allowed to enter adjacent waterways or drainage gullies without the permission of the Drainage and Highway Authorities.

Surface waters from the site shall be discharged to the mains sewer under consent from the local Water Authority.

It should be noted that groundwater impacted by hydrocarbons may require some form of treatment prior to discharge, alternatively if only small amounts of water are encountered, this could be stored and removed to a suitable waste disposal facility.

5.11 Unexpected Contamination

If any unexpected contaminated materials are encountered by the contractor, then works should cease in that area and the contractor should consulted BSL for advice prior to any irrevocable action at the site.

6.0 STAKEHOLDERS AND RESPONSIBILTIES

6.1 Key Stakeholders

A summary of the key project stakeholders is presented below (not exhaustive):

Client / Developer	Consultant / Engineer	Contractor	CDM Stakeholders	Regulators
Intro Developments Ltd	Brownfield Solutions Ltd (BSL) BDP Civil and Structural Consulting Engineers	Demolition, Remediation and Groundworks Contractors (Jackson Remediation)	Principal Contractor (TBC) Principal Designer (TBC) Health and Safety Executive (HSE)	Manchester City Council (regulator - Human Health risk and planning consent) Environment Agency (EA) (regulator - controlled waters and waste)

6.2 Client

The remediation works will come under the umbrella of CDM 2015 Regulations. The Client is responsible for formally appointing a Principal Designer and Principal Contractor, otherwise the Client assumes the role of Principal Designer. All pre-construction information will need to be made available to the appointed duty holders and sufficient time and resources allowed.

6.3 Consultant/Engineer (Client's Representative)

A suitably qualified Geo-Environmental Engineer/consultant should be appointed as the client's representative to oversee the works, who will have a visiting role throughout and provide advice when required.

They should be responsible for:

- Providing appropriate supervision of the remedial works (either part time or full time).
- Monitoring the works to ensure compliance with this strategy and specification.
- Audit testing of materials. (However, it is the responsibility of the contractors to demonstrate the suitability/acceptability and the compliance of the material with the specification).
- Approval of test results.
- Validation of the works.

They will maintain records of the works to include the following:

- Record sheets to include a summary of the activities.
- Aspects relating to Environmental Control or non-compliance with this strategy.
- Test Results.

Liaison will be carried out with relevant regulators prior to commencing on site. The design of the Remedial Strategy can be adapted to avoid unnecessary delays at a later date.

Validation information will be supplied to the Local Authority for approval in a Verification Report. The report will include relevant site records and stand as certification that the remedial works have been carried out in accordance with this strategy.

6.4 Contractor

The contractor appointed to oversee the development construction works should comply with the following regulations, guidance and legislation relating to the works:

- Environmental Protection Act 1990.
- Health and Safety Executive "Protection of Workers and the General Public during the Redevelopment of Contaminated Land", HS(G)66, HMSO 1991.
- Duty of Care Regulations 1991.
- Water Resources Act 1991.
- Water Industry Act 1991.
- Environment Act 1995.
- The Control of Substances Hazardous to Health Regulations 2002.
- Hazardous Waste Regulations.
- Control of Asbestos Regulations (CAR) 2012.
- Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance (shortened name CAR-SOIL™)".
- The Construction, Design and Management Regulations 2015.

The contractor should provide adequate supervision for all the site works. This shall include a suitably experienced Remediation Engineer or Site Manager who will validate the work and maintain records allowing preparation of a validation report for the works.

The appointed contractors will be responsible for maintaining all records in connection with the works.

Records shall include details of:

- All the material imported to the site (including volume, source and chemical composition).
- All the material exported from the site (including volume, destination and chemical composition).
- The size and extent of the remedial excavations (lateral extent and depth plotted on suitable plans).
- Any treatment undertaken.
- Details of the contractor's waste exemptions, if applicable.
- Discharge of any groundwater.

6.5 CDM Stakeholders - Health & Safety

The appointed Principal Contractor (PC) will need to produce a Construction Phase Plan for the work, prepare risk assessments and method statements. The PC will be responsible for the coordination of welfare and H&S matters on-site including sub-contractors.

The Principal Designer/Client will review the Construction Phase Plan and notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (via form F10). Unless otherwise agreed with the client, the table below provides a broad outline of the overall project team.

All works should be carried out in a manner that will safeguard all site employees. This should include but not be limited to; site induction for all staff and visitors, training/safety awareness training, issue of Personal Protective Equipment (PPE) and the provision of suitable welfare facilities. Further advice is

provided within HSE publication 'HSG 66 Protection of Workers and the General Public during Redevelopment of Contaminated Land'.

The works should be carried out in a manner to protect against damage to property or nuisance to property or persons on the site or within its immediate vicinity. Noise and dust issues should be considered. Members of the public should be excluded from the works areas and the contractor should maintain suitable security to ensure unauthorised persons cannot access the works.

Appropriate temporary protection and warning signs should be erected to warn of hazards that may result as a consequence of the works.

6.6 Regulators

Implement the regulations and environmental standards set by government. The contents of this report will need to be agreed in advance of works with the regulators.

7.0 VERIFICATION PLAN

7.1 Context

The verification plan presented in this section details how the selected remedial works will be recorded and verified. This addresses condition 6.4 of planning condition 6.

7.2 Remedial Excavations

All made ground soils and relic foundations / obstructions will be removed during remedial excavations under a watching brief by a suitably experienced and qualified Geo-Environmental Engineer. The proposed process for remediation and validation is prescribed in the flow chart included within Appendix A.

Soils will be removed down to natural strata, plus an initial 100mm scrape into the natural material, with the supervising engineer observing for visual/olfactory evidence of contamination and use of a PID. BSL suggest a PID value for natural materials exhibiting a PID reading of >50ppm to be removed. This is based on professional judgement and comparison of available PID readings from the wider site where there is known significant impaction of soils/groundwater correlated to chemical test data.

Following removal, chemical testing will be undertaken to confirm that "clean" faces have been encountered. The number of tests are detailed in Appendix A with 1 sample per 20m of linear excavation to sidewalls and 100m^2 base – an approximate 10m grid) and the process to follow should any exceedances be identified is also presented in Appendix A.

Soils remaining in situ or to be imported should comply with the below target values:

Determinand	Entec Clean Up Target Values – Soils (mg/kg)	BSL Proposed Remedial Target Values in lieu of formally agreed site-wide DQRA– Soils (mg/kg)	Notes and Justification
Naphthalene	250	190	Taken from LQM S4UL based on Commercial human health screening criteria (1% SOM) – this value is lower than the Entec DQRA value which was generated from a controlled waters risk assessment.
Benzene (BTEX)	5	5	Entec Clean Up Target. Value is lower than LQM S4UL commercial criteria (1% SOM) and has therefore been adopted for conservatism.
Ammonium	200 - made ground 400 - glacial deposits	200 (adopting most conservative)	Conservative approach based on Entec Clean Up Target.
Phenol	Not required	760	Entec DQRA considered contaminant to not pose a risk. Total phenols were mainly detected in, and, only exceeded the EQS in shallow groundwater in made ground during Entec SI. This suggests that phenols are

Determinand	Entec Clean Up Target Values – Soils (mg/kg)	BSL Proposed Remedial Target Values in lieu of formally agreed site-wide DQRA– Soils (mg/kg)	Notes and Justification
			not likely to pose a risk for the deep groundwater receptor. Suggested value taken from LQM S4UL Based on Commercial (1% SOM)
Free Cyanide	Not required	373	Entec DQRA considered contaminant to not pose a risk. ATKINS ATRISK commercial value adopted.
Visual/Olfactory Evidence	N/A	Observations of gross contamination – impacted materials to be removed.	Professional judgment.
PID Readings	N/A	<50ppm – removal of soils exceeding this value to be undertaken.	Proposed based on wider site indicative data and professional judgment.

All soils surplus to requirements and which do not meet the chemical remediation criteria and geotechnical criteria for will be disposed off site to a suitably licensed facility.

Material being imported should comply with the testing and chemical requirements set out within Appendix A.

7.3 Physical Separation Layer

Prior to importation of fill, a low permeability bentonite mat geotextile (or similar) will be installed within excavations as a separation layer to mitigate against potential recontamination of newly placed soils. Photographic evidence of installation should be provided.

7.4 Imported Soils

Imported materials / soils will be required to backfill the remedial excavations. Any imported material should comply with the testing and chemical requirements set out within Appendix A.

7.5 Well Decommissioning

Wells located within the land parcels should be decommissioned in accordance with EA guidance and backfilled with a low permeability material (i.e. concrete or bentonite). For decommissioned wells, photographic evidence should be provided of their removal and infilling.

7.6 Contingency Planning

Should significantly contaminated material be encountered during the development (e.g. gross hydrocarbon impaction) then a suitably qualified geo-environmental engineer should be consulted for advice. Measures may include the excavation of the material which should stockpiled on 2000-gauge polythene sheeting, sampled and tested for an appropriate range of contaminants to determine disposal routes.

Should gross asbestos contamination be identified, then all works should cease until an Asbestos Management Plan is put into place (if not done so already) and remedial requirements are confirmed by a suitably qualified geo-environmental engineer. Note remedial works under such instances may be classified as either licenced or non-licenced and may be notifiable to the Health and Safety Executive (HSE). Works would need to comply with CAR 2012 and CARSOILS™.

7.7 Reporting

On receipt of all information, the appointed Geo-Environmental Engineer will compile a Verification Report(s). The report will be a concise document that provides records and collected evidence of the remediation carried out at the site. The final report should contain:

- Introduction, including description of the project and background to the works.
- Summary references to site investigation data, risk assessments and the Remedial Strategy.
- A description of the works undertaken and any treatment records.
- Details of chemical validation testing.
- Details of the separation layer installation.
- Reference to the MMP (if utilised), records of where material was moved from/imported from/to and final destinations, including volumes, suitable for use criteria, QP declaration references etc.
- Details of how any out of specification materials were dealt with and final destination, including waste transfer notes.
- Appropriate site plans and photographic record.
- Conclusions, detailing any additional works that may be required.
- Details of any long term monitoring requirements, if any.

This should then be submitted to the regulators and warranty providers for approval, which should close out the requirements of this Remedial Strategy.

8.0 REFERENCES

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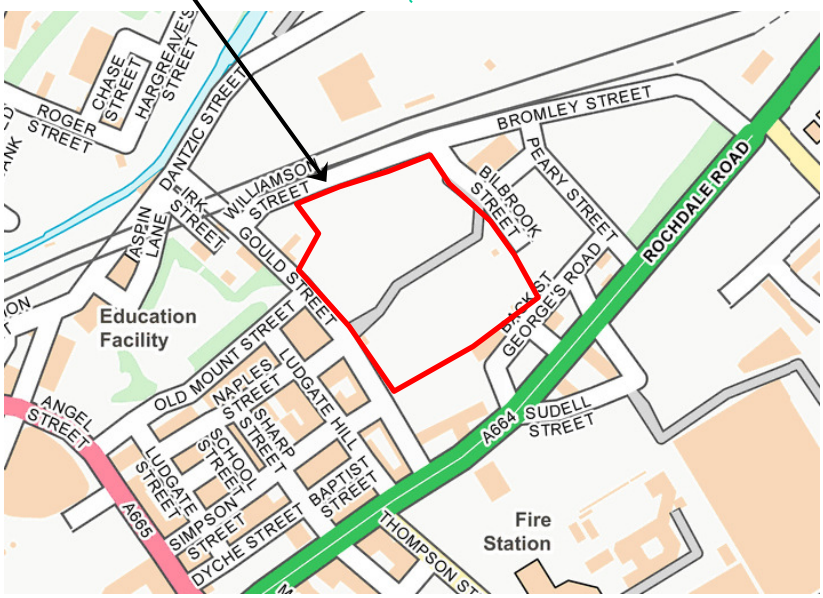
DRAWINGS



SITE LOCATION

NEAREST POSTCODE: M4 4HY

SITE ENTRANCE WHAT3WORDS: ///CARE.BANANA.PILE



REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

CLIENT
SOUTH VALLEY ESTATES

PROJECT TITLE
GOULD STREET, MANCHESTER

DRAWING TITLE
SITE LOCATION PLAN

DRAWING No.	REVISION	SCALE	DATE
C5692/01	-	NTS	06/06/24

DRAWN BY	CHECKED BY
SD	AJS



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

BOUNDARY KEY

- **Site Boundary**

PAVING KEY

- H1 **Yorkstone Flag Paving** — To footpaths and adopted areas. Size/colour/finish: To MCC standard detail.
- H2 **Large Format Granite Paving** — To the Lane and Williamson Street / Park edge. Colour: Grey / mix to complement architectural material palette (subject to further detailed design)
- H3 **Clay Paving** — To pedestrian areas throughout the site. Size: small format units. Colour: Various to complement architectural material palette
- H4 **Resin Bound Gravel** — To courtyard spaces. Size/colour: Buff colour
- H5 **50/50 Permeable Paving** — To the Lane. Size/colour: Paving infill units to match adjacent Clay Paving
- H6 **Self bound Gravel** — To play areas along central street. Size/colour: Buff colour
- H7 **Timber Deck Surfacing** — To private curtilages
- H8 **Natural stone stepping stones** — To paths through planting. Size/colour: TBC
- S1 **Natural stone steps** — To have hazard warning paving to top and bottom of steps. Colour: Grey
- H9 **Exposed Aggregate Concrete Surfacing** — To vehicle access routes off Gould St / Bilbrook St
- HG3 **Tarmacadam Surfacing** — To vehicle access routes adjacent to gas compounds

FURNITURE AND STRUCTURES KEY

- F1 **Bicycle Stands** — Root-fixed, 1m spacings
- F2 **Telescopic Bollards** — Automated system with CCTV
- F3 **Feature Seating Elements** — To the Lane and Viaduct Green. Timber tops with Corten Steel frame
- F4 **Feature Seating Elements** — To Courtyards. Timber tops with Corten Steel frame
- F5 **Seating Edge** — To Courtyards. Timber tops to edge of planting areas
- F6 **Seating Edge** — To Public Realm generally. Natural Stone with timber tops
- F7 **Informal Play Features** — To the Lane, Slinky and Courtyards. Play boulders and other informal play features
- F8 **Green Structure** — To the Lane. Steel frame referencing gasometers with planting
- F9 **Original Pediment from Gas Works Office** — To corner of Green at Gould St. Reclaimed from site, use subject to assessment of condition
- F10 **Perforated Corten Balustrade** — To the Lane at Bilbrook St. Opportunity for graphic artwork incorporation
- F11 **Metal Gate to access ramp** — To the Phase 3 car park access. To have access control for residents and National Grid

Revision	Date	Description	Drawn	Apprvd.
S2-P09	06-05-21	Material update, gate added to P2 ramp	TF	MS
S2-P08	29-10-20	Planning Issue	TF	MS
S2-P07	24-09-20	Planning Issue	TF	MS
S2-P06	18-09-20	Planning Issue	TF	MS
S2-P05	11-09-20	Planning Issue	TF	MS
S3-P04	04-09-20	Draft Planning Issue	TF	MS
S3-P03	08-07-20	Design Development	TF	MS
S3-P02	09-06-20	Design Development	TF	MS

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Client MCR Property Group

Project The Gasworks, New Town

Drg Title Hardworks

Created on	Created by	Approved by
04.05.20	MS	KR

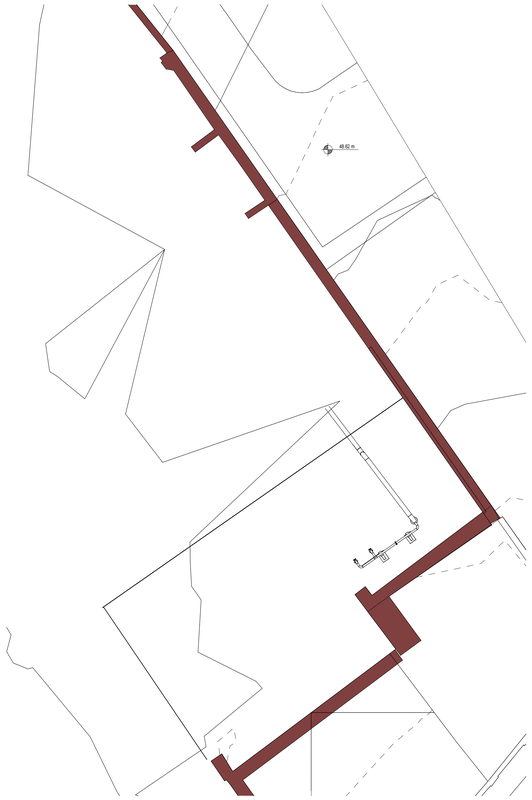
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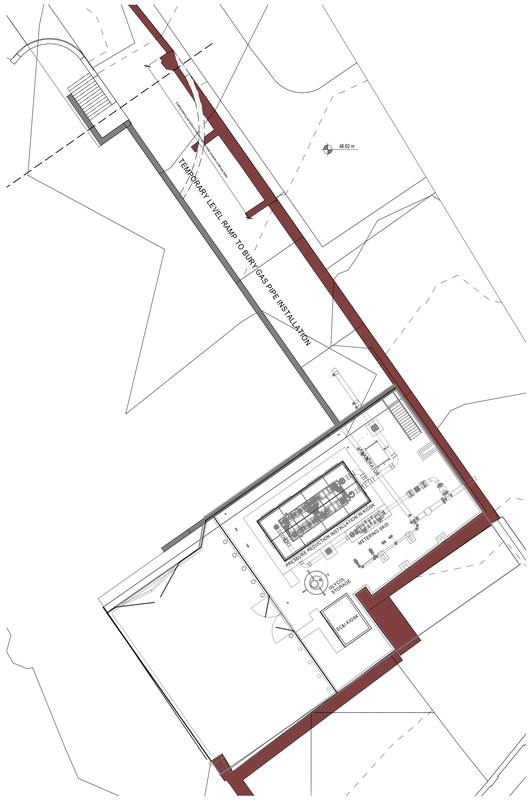
Suitability S2

Revision P09

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EXISTING PLAN



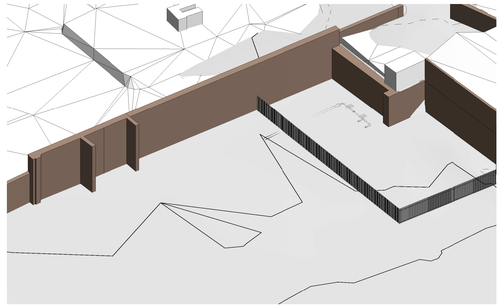
PROPOSED PLAN - PHASE 1B - GAS INFRASTRUCTURE



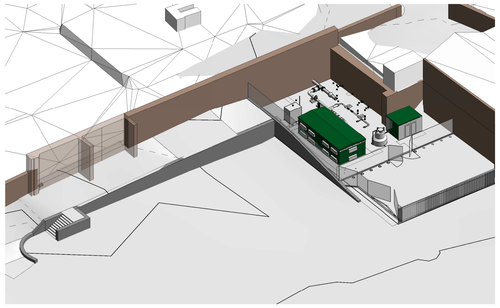
PROPOSED PLAN - PHASE 2 - ADJACENT BUILDING SHOWN



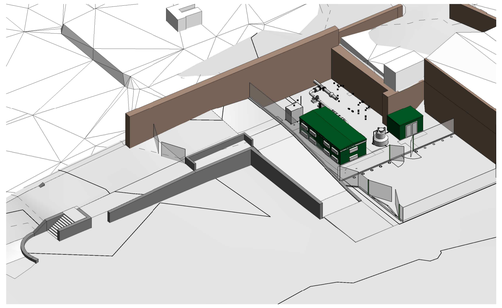
SITE LOCATION PLAN



3D VIEW - EXISTING - NORTH WEST AERIAL

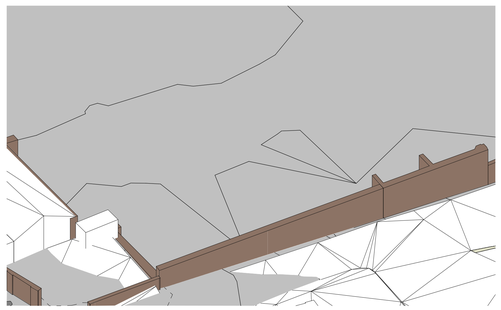


3D VIEW - PHASE 1B - NORTH WEST AERIAL

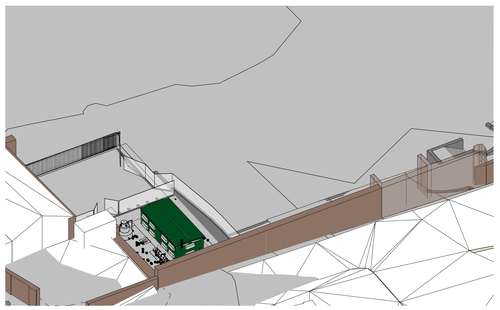


Phase 2 building removed for clarity

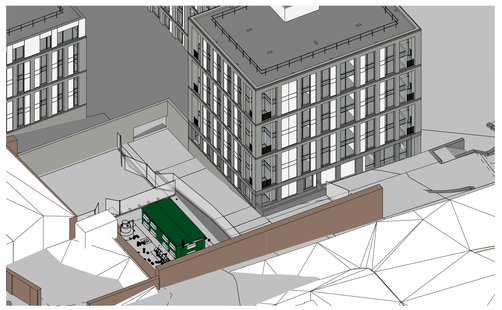
3D VIEW - PHASE 2 - NORTH WEST AERIAL



3D VIEW - EXISTING - SOUTH EAST AERIAL



3D VIEW - PHASE 1B - SOUTH EAST AERIAL



3D VIEW - PHASE 2 - SOUTH EAST AERIAL

NOTES

Gas pit works layout taken from WSP drawing 70085522-WSP-02-XX-DG-ME-0002.

Phase 1b access still from existing Bilbrook Street utilising existing ramp on site.
Phase 1b ramp installed on site to provide required cover to Gas Pipe.

PLANS

SCALE 1 : 200
0 4 8 12

Rev	Description	Date	Dr by	App by
5	Minor Amendments following planning comments	11.03.22	FW	DL
4	Layout Updated	28.02.22	FW	DL
3	Clarification to Gas Infrastructure Works	13.12.21	FW	DB
2	Drawing amended to reflect comments discussed during workshop dated 11.08.20	12.08.20	SL	DB
1	Drawing amended to reflect comment raised workshop	10.08.20	SL	DB

original by: SL
date created: 08/06/20
Approved by: DB

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5th Floor
55 Princes Street
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M2 4EW
United Kingdom

T +44(0)161 8287900
E manchester@ahr.co.uk
www.ahr.co.uk

client name: Southvalley Estates Ltd

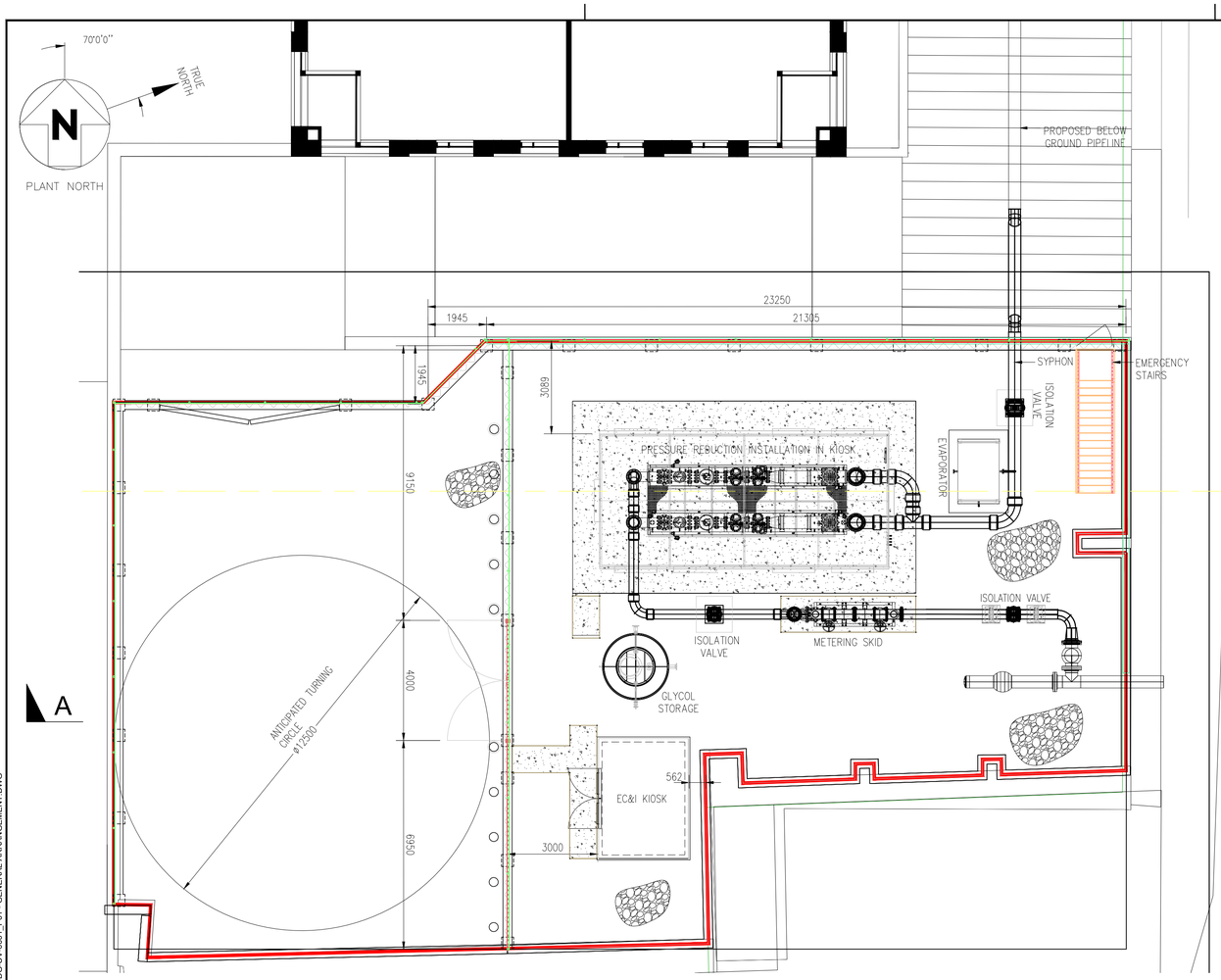
project: The Gasworks New Town - Site

drawing: Proposed ramped access to Infrastructure area off Bilbrook Street - Part of Phase 2 works

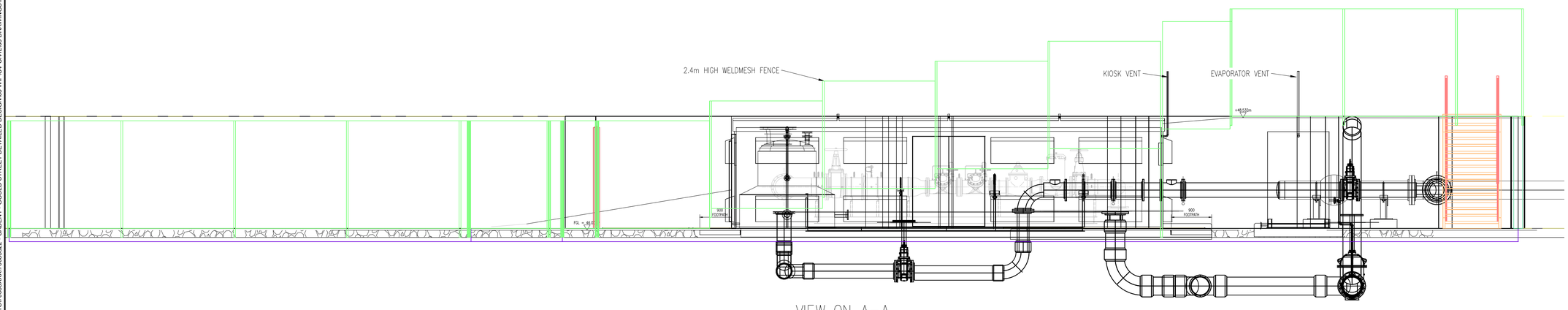
computer file: C:\Revit Projects\Gould Street Amended Site Plan R22\21_Fadhlin.Mhta.rvt
plot date:

project number: 2015.00541.000
scale: 1 : 200 @A0
drawing number: GS-AHR-SO-ZZ-DR-A-90-102
rev: 5
issue status: S2

This drawing is to be read in conjunction with all related drawings. All dimensions must be checked and verified on site before commencing any work or producing shop drawings. The originator should be notified immediately of any discrepancy.
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PLAN VIEW
(SCALE 1:100)



VIEW ON A–A
(SCALE 1:50)

0 5 10 m
SCALE 1:100

0 1 2 3 4 5 m
SCALE 1:50

NOTES:
DRAFT ONLY – NOT TO BE UTILISED FOR PLANNING

LEGEND

- CADENT RED LINE DEMISE BOUNDARY
- 2.4m HIGH BLACK WELDMESH FENCE
- BOLLARDS
- REMOVABLE BOLLARDS
- FOOTPATHS
- HARD LANDSCAPING (STONE CHIPPING)
- EXISTING ABOVE GROUND PIPEWORK RETAINED DURING CONSTRUCTION
- EXISTING ABOVE GROUND PIPEWORK RETAINED
- NEW ABOVE GROUND PIPEWORK
- NEW BELOW GROUND PIPEWORK

REV	DATE	BY	DESCRIPTION	CHK	APP
P03	22/02/22	B.H.	UPDATED FOR PLANNING APPLICATION	R.A.	M.T.
P02	18/01/21	M.G.	FENCE CORNER CHAMFERED	R.A.	M.T.
P01	13/01/21	R.B.	DRAFT – FOR RED LINE BOUNDARY	R.A.	M.T.

DRAWING STATUS: DRAFT

wsp
8 First St, Manchester, M15 4RP, UK
T+ 44 (0) 161 200 5000
wsp.com

CLIENT: Balfour Beatty Cadent Your Gas Network

PROJECT: GOULD STREET

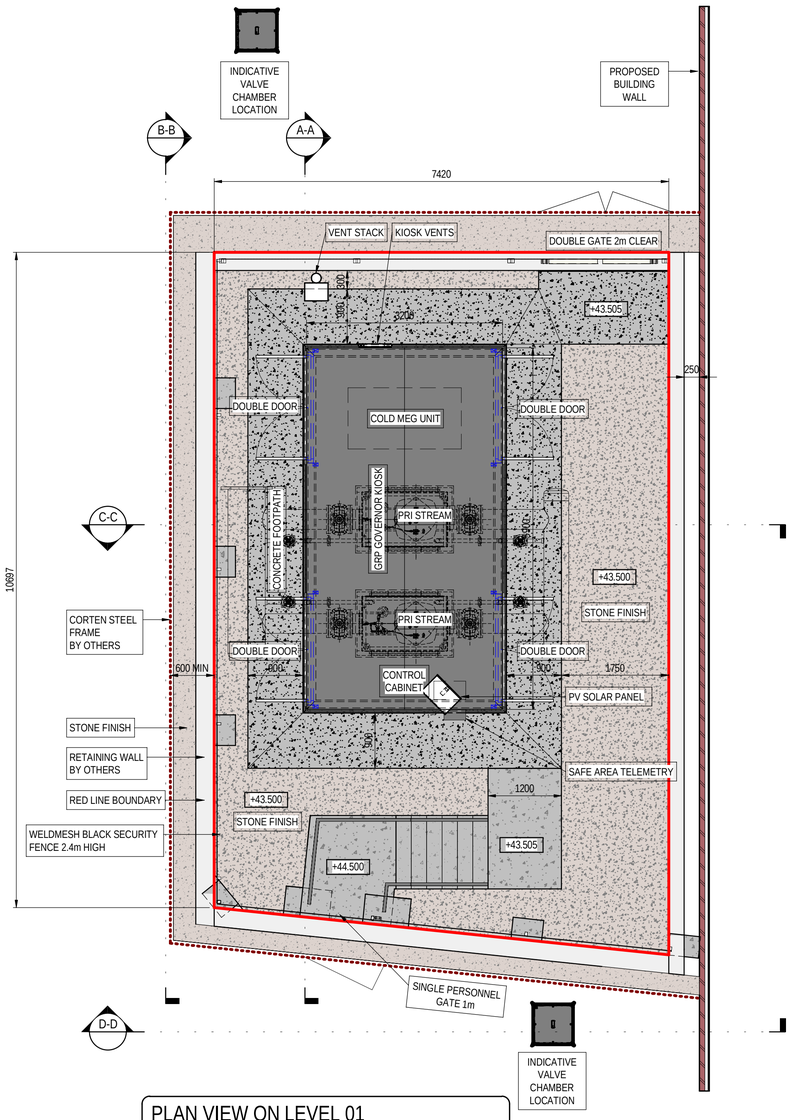
TITLE: BILLBROOK STREET COMPOUND PLANNING PROPOSAL

SCALE @ A1:	CHECKED:		APPROVED:
1:100	M GORDIJENKO		
PROJECT No:	DESIGNED:	DRAWN:	DATE:
70067897	B HALL	B HALL	JAN 21

DRAWING No: 70067897-WSP-02-XX-DR-CV-0001 REV: P03

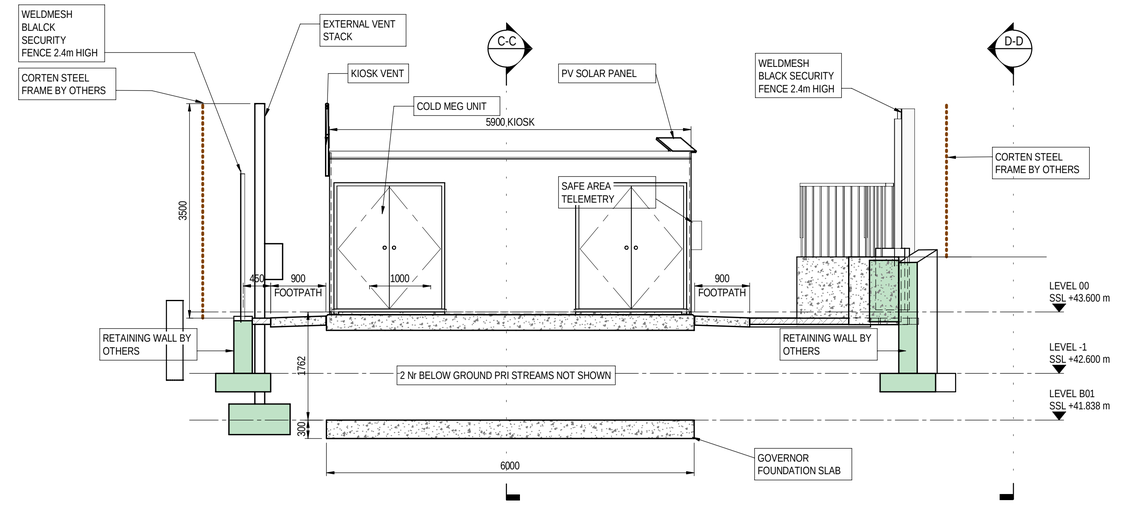
© WSP UK Ltd

File name \\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\70085XXX\70085522 - CADENT - GOULD STREET DIETAILED DESIGN\03 WIP\CV CIVIL\03 DRAWINGS\70067897-WSP-02-XX-DG-CV-0001_P01 - GENERAL ARRANGEMENT.DWG



PLAN VIEW ON LEVEL 01

1 : 50

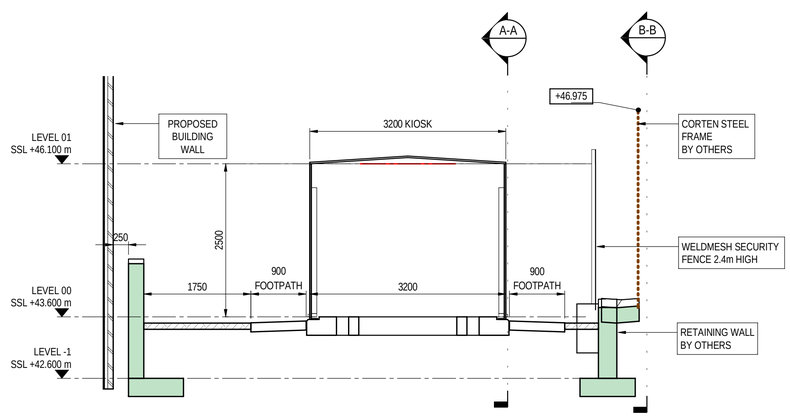


A-A LONG SECTION THROUGH PRI INSTALLATION

1 : 50

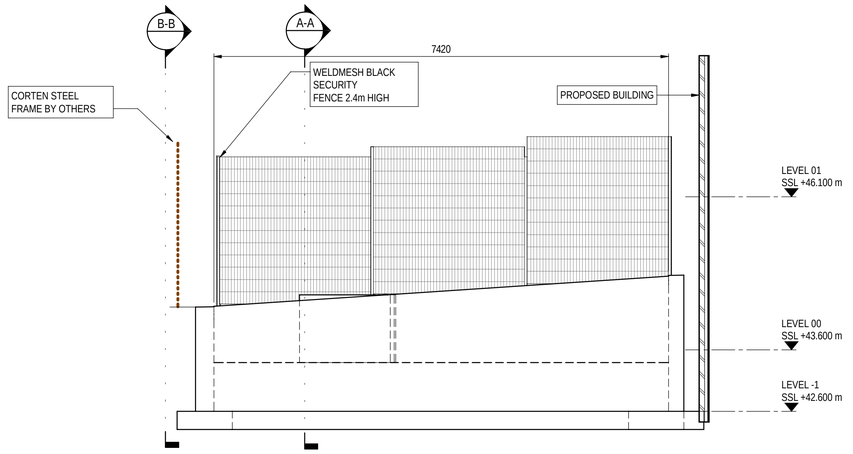
B-B ELEVATION VIEW FROM GOULD STREET

1 : 50



C-C SHORT SECTION THROUGH PRI INSTALLATION

1 : 50



D-D ELEVATION ON SHORT SIDE

1 : 50

GRAPHIC SCALE: 1:50

DO NOT SCALE

KEY:

- CADENT RED LINE DEMISE BOUNDARY
- CORTEN STEEL FRAME - HEIGHT INDICATIVE DETAIL TO BE SHOWN ON THIRD PARTY DRAWING

NOTES:

RETAINING WALL SHOWN INDICATIVELY - TO BE DESIGNED BY OTHERS

PV SOLAR PANEL LOCATION TO BE FINALISED ON SITE

REV	DATE	BY	DESCRIPTION	CHK	APP
P4	18/03/2022	BH	FENCING DETAILS UPDATED	RA	MT
P3	22/02/2022	BH	UPDATED FOR PLANNING APPLICATION	RA	MT
P2	14/07/2021	BH	ARCHITECTURAL SCREENS ACCOMMODATED	MG	MG
P1	04/08/2020	BH	FIRST ISSUE	MG	

DRAWING STATUS: FOR INFORMATION

wsp
Manchester First Street, Manchester, M15 4RP, UK
T+ 44 (0) 161 200 5000, F+ 44 (0) 161 200 5001
http://www.wsp.com

CLIENT: CADENT

ARCHITECT:

PROJECT: GOULD STREET PRI REPLACEMENT

TITLE: MP/LP PRESSURE REDUCTION INSTALLATION GENERAL ARRANGEMENT

SCALE @ A1:	CHECKED:	APPROVED:
AS SHOWN	MG	MG

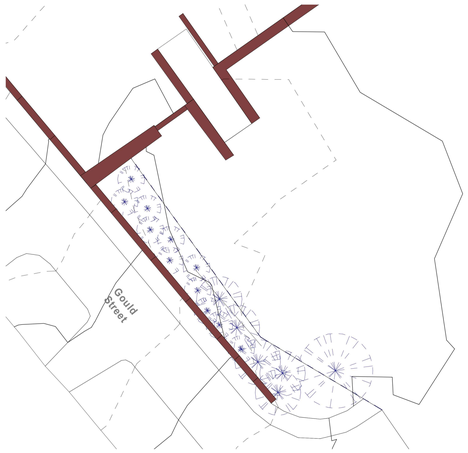
PROJECT NUMBER:	DESIGNED:	DRAWN:	DATE:
70067897	MG	BH	04/08/2020

DRAWING No: 70067897-WSP-00-01-DR-CV-0001 REV: P4

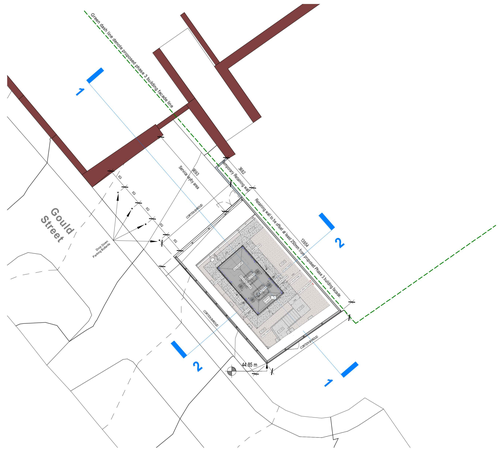
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\\Uk.wspgroup.com\Central Data\Projects\70085xxx\70085522 - Cadent - Gould Street Detailed Design\03 WIP\CV Civil\02 Models\70067897-WSP-01-XX-M3-CV-0001-S1 - Gould Street MP-LP 210714_MP.rvt 22/02/2022 09:25:02

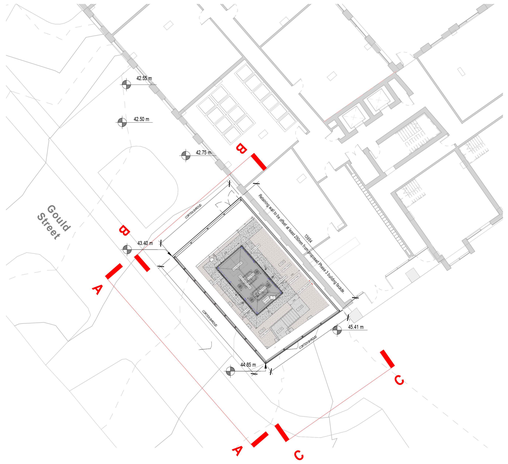
Last saved in Autodesk Revit 2021.



EXISTING PLAN



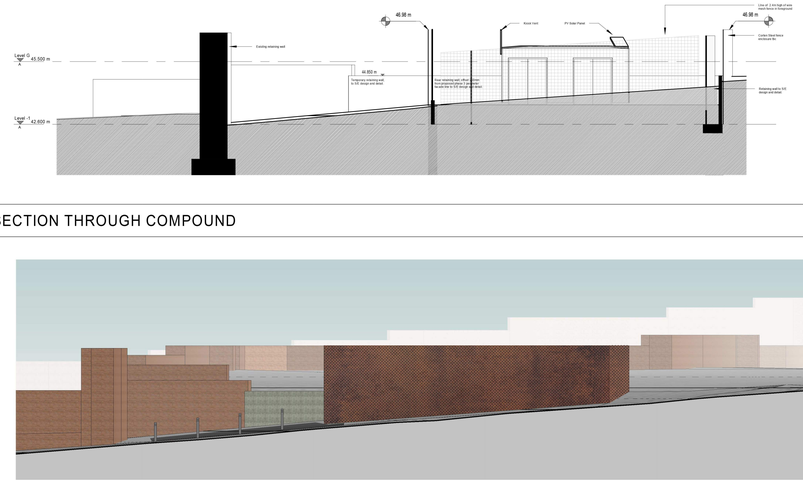
PROPOSED PLAN - PRIOR TO CONSTRUCTION OF ADJACENT BUILDING



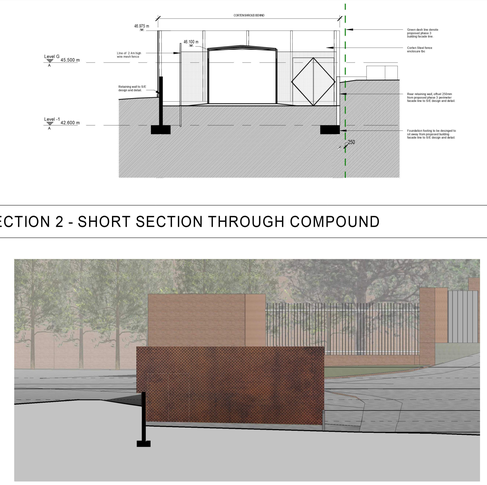
PROPOSED PLAN - WITH ADJACENT BUILDING



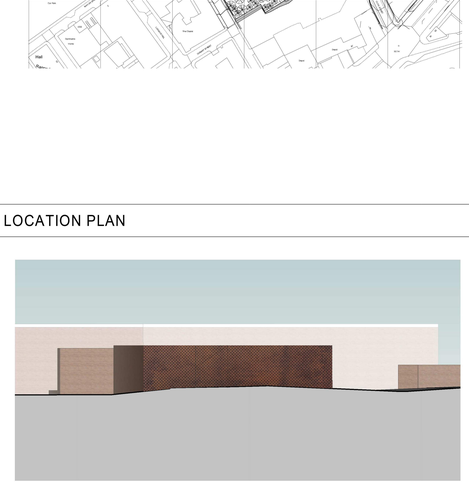
SITE LOCATION PLAN



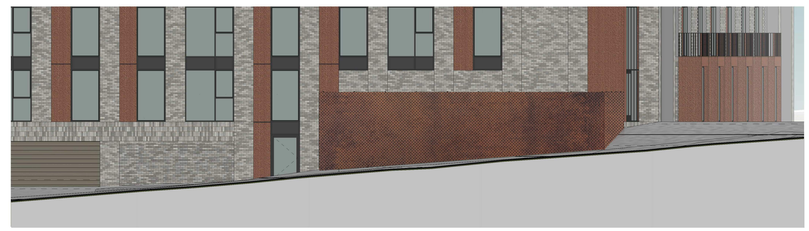
ELEVATION A - PRIOR TO CONSTRUCTION OF ADJACENT BUILDING



ELEVATION B - PRIOR TO CONSTRUCTION OF ADJACENT BUILDING



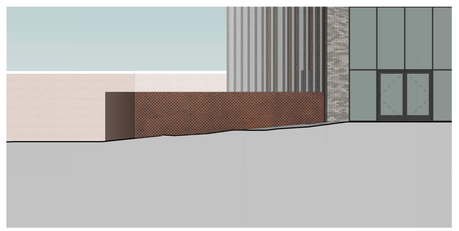
ELEVATION C - PRIOR TO CONSTRUCTION OF ADJACENT BUILDING



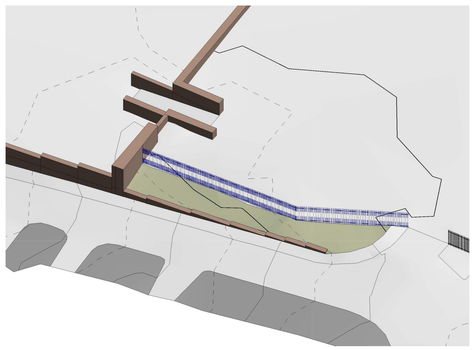
ELEVATION A - IN CONTEXT WITH ADJACENT BUILDING



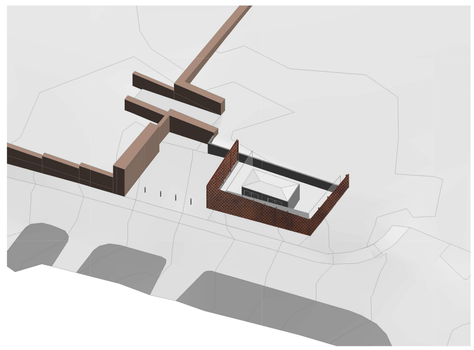
ELEVATION B - IN CONTEXT WITH ADJACENT BUILDING



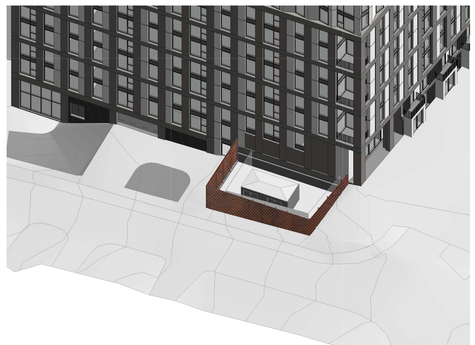
ELEVATION C - IN CONTEXT WITH ADJACENT BUILDING



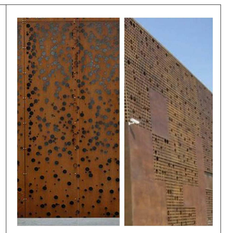
EXISTING 3D AERIAL



PROPOSED 3D AERIAL - PRIOR TO CONSTRUCTION OF ADJACENT BUILDING



PROPOSED 3D AERIAL WITH ADJACENT BUILDING



Coreten Steel sheet screen cladding with laser cut decorative pattern to be agreed.
Refer to precedent images above.
Pattern shown in drawings on left only indicative.

PLANS
SCALE 1 : 200
0 4 8 12

SECTION
SCALE 1 : 100
0 2 4 6

Rev	Description	Date	Dr by	App by
5	Minor Amendments following planning comments	11.03.22	FW	DL
4	Layout updated	15.02.21	FW	DL
3	Clarification to Gas Infrastructure Works	13.12.21	FW	DB
2	Drawing amended to reflect comments discussed during workshop dated 11.08.20	12.08.20	SL	DB
1	Drawing amended to reflect comment raised workshop.	10.08.20	SL	DB

original by: SL
date created: 07/29/20
Approved by: DB

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United Kingdom

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E manchester@ahr.co.uk
www.ahr.co.uk

client name: Southvalley Estates Ltd

project: The Gasworks New Town - Site

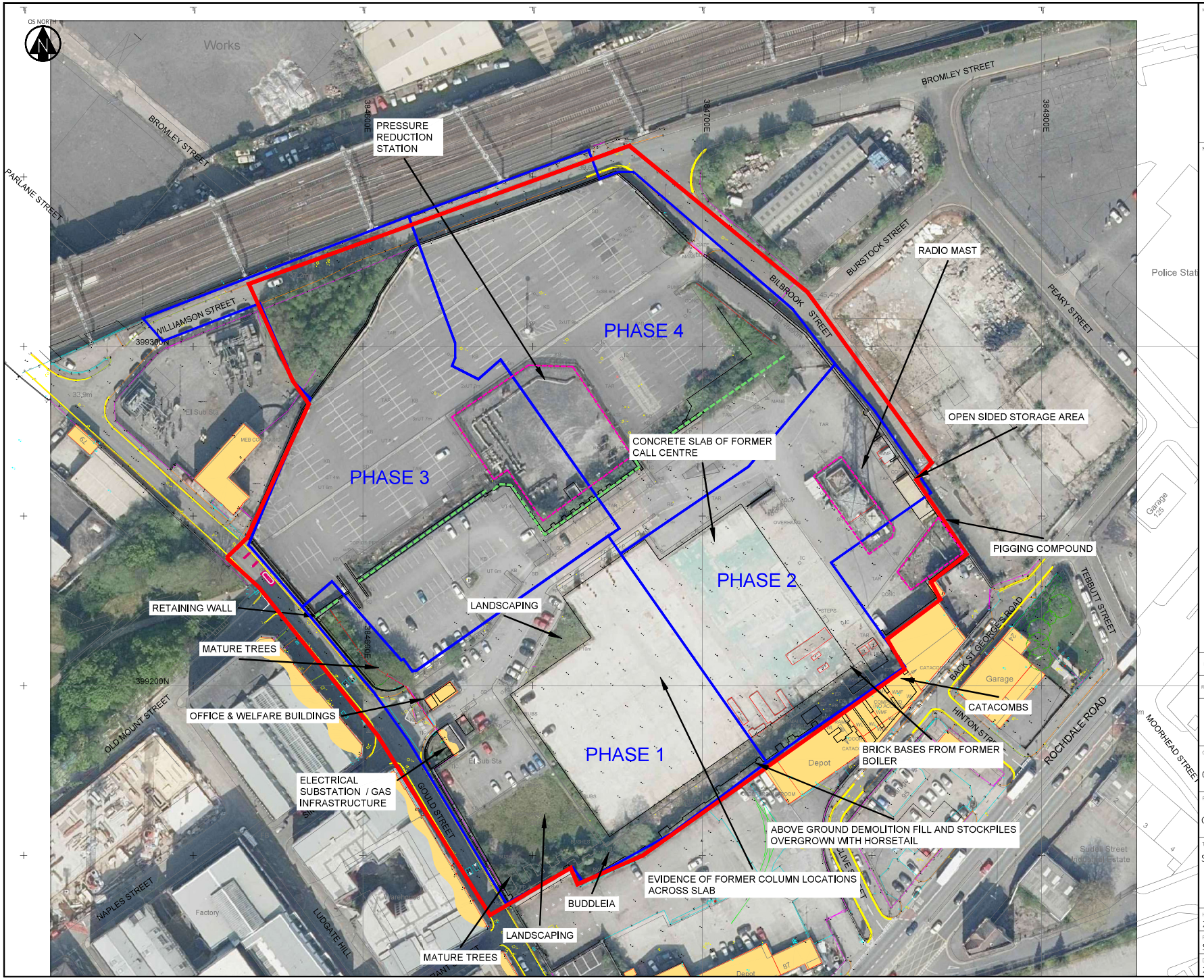
drawing: Planned Infrastructure works - Along Gould Street Phase 1a

computer file: C:\Revit Projects\Gould Street Amended Site Plan R2021_Fedrkin.RVA.rvt
plot date:

project number: 2015.00541.000
scale: As indicated@A0

drawing number: GS-AHR-SO-ZZ-DR-A-90-100
rev: 5
issue status: S2

This drawing is to be read in conjunction with all related drawings. All dimensions must be checked and verified on site before commencing any work or producing shop drawings. The originator should be notified immediately of any discrepancy.
This drawing is copyright and remains the property of AHR.



KEY

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.
3. This drawing has been based on the following drawings and information: 200414_Merged-Topography

Key:

- Retaining Wall
- Development Phases
- Retaining Wall
- Retained Gas Infrastructure Land

REV.	DESCRIPTION	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P1	FIRST ISSUE	LW	17/12/21	AC	17/12/21	DH	17/12/21

Hydrock
4 Lakeside
Festival Way
Stoke-on-Trent
ST1 5RY
t: +44(0) 1782 261919
e: stoke@hydrock.com
or visit www.hydrock.com

CLIENT: CROWNING DEVELOPMENTS LIMITED

PROJECT: GOULD STREET

TITLE: SITE FEATURES PLAN

HYDROCK PROJECT NO.	SCALE @ A1
21353	1:500

PURPOSE OF ISSUE	STATUS
SUITABLE FOR INFORMATION	S2

DRAWING NO. (PROJECT-CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER): 21353-HYD-XX-XX-DR-GE-1002

REVISION: P1

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS



KEY

- SITE BOUNDARY
- EXISTING STRUCTURES
- TARMAC
- TREES / VEGETATION
- BARE GROUND / GRAVEL?
- CONCRETE

REV	DESCRIPTION	BY	CHK	APP	DATE

Client:

NATIONAL GRID PROPERTY HOLDINGS LTD

3 SOVEREIGN SQUARE
SOVEREIGN STREET
LEEDS
WEST YORKSHIRE
LS1 4ER

TEL: +44 (0)113 278 7111
e-mail: leeds@wyg.com

Project: B024707

GOULD STREET
MANCHESTER

Drawing Title:

SITE LAYOUT PLAN

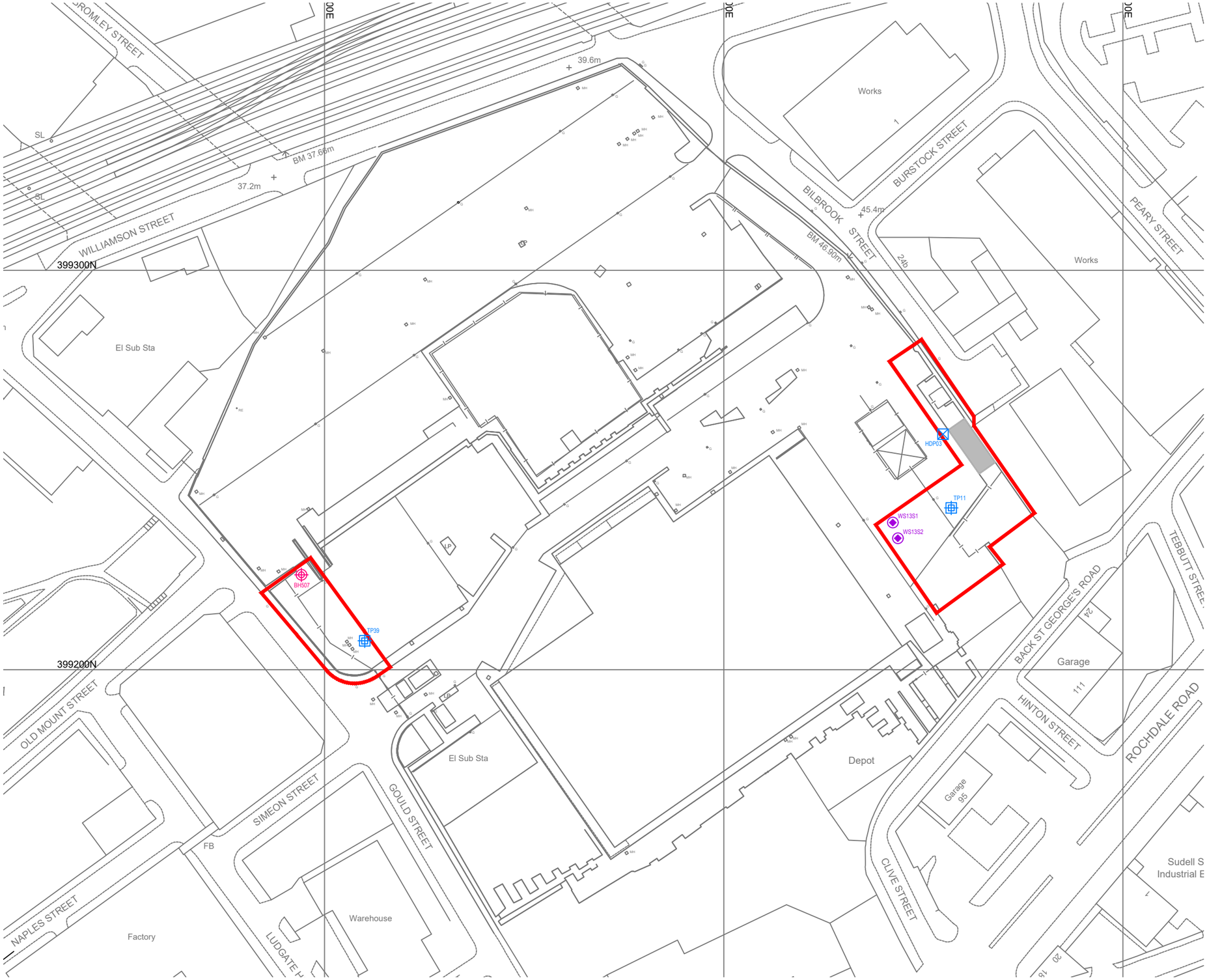
Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
1:1,000	CM	23.11.20				

Project No.	Office	Type	Drawing No.	Revision
B024707	LDS	N	02	

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DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

N



0 10 20 30 40 50 m

SCALE 1:1000

KEY

SITE BOUNDARY

EXISTING STRUCTURES

SITE INVESTIGATION DECEMBER 2011

VALIDATION SAMPLE

SITE INVESTIGATION DECEMBER 2010

BOREHOLE

SITE INVESTIGATION DECEMBER 2003

TRIAL PIT

HAND DUG PIT

REV	DESCRIPTION	BY	CHK	APP	DATE

Client:

NATIONAL GRID PROPERTY HOLDINGS LTD

3 SOVEREIGN SQUARE
SOVEREIGN STREET
LEEDS
WEST YORKSHIRE
LS1 4ER

TEL: +44 (0)113 278 7111
e-mail: leeds@wyg.com

Project: B024707

GOULD STREET
MANCHESTER
LOCATION CODE: 0011

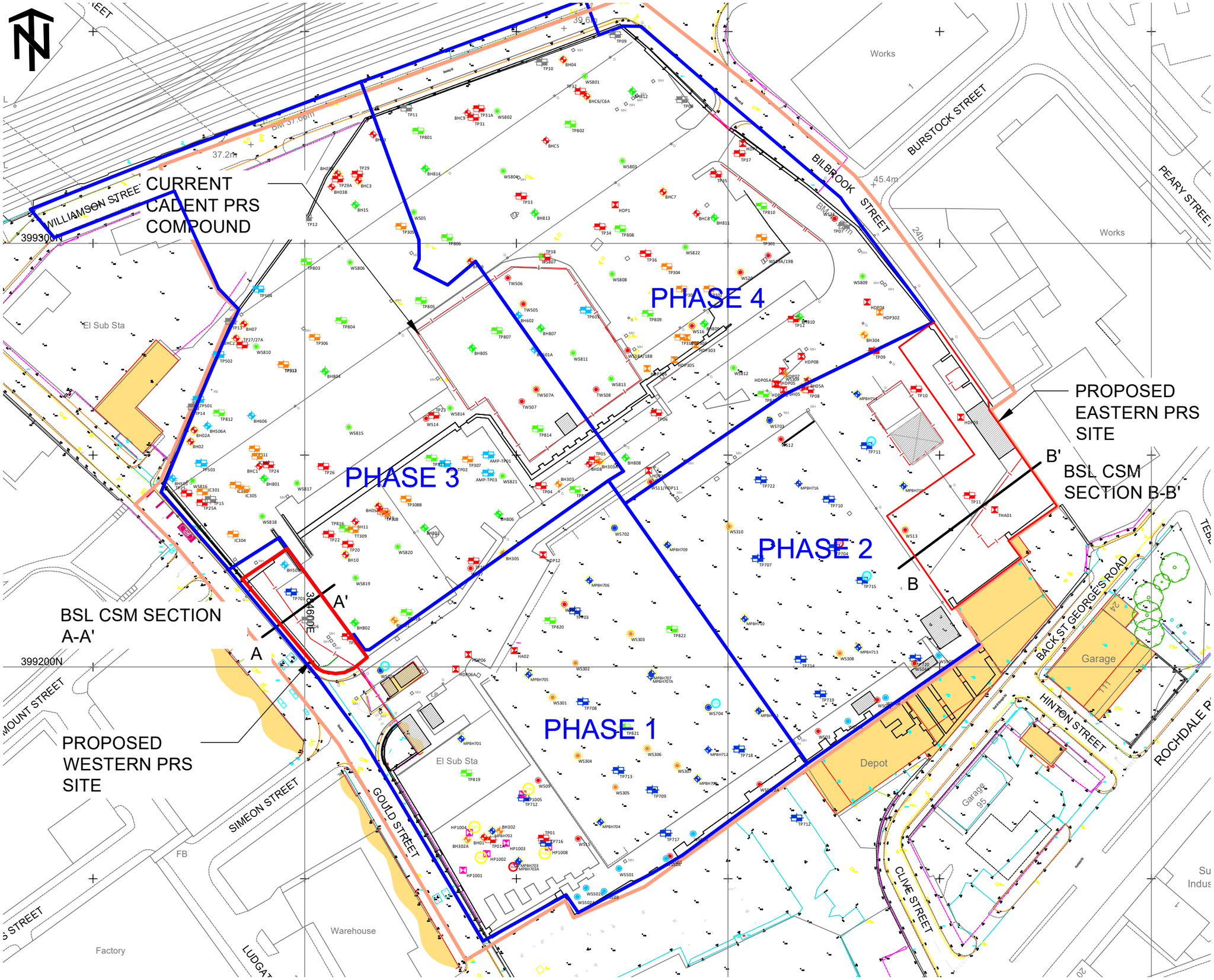
Drawing Title:

PREVIOUS EXPLORATORY HOLE LOCATIONS

Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
1:1,000	CM	23.11.20				

Project No.	Office	Type	Drawing No.	Revision
B024707	LDS	N	04	

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KEY	
	APPROXIMATE SITE BOUNDARY
TPXX	TRIAL PIT
WSXX	WINDOW SAMPLE BOREHOLE
BHXX	CABLE PERCUSSIVE BOREHOLE W/ ROTARY CORE FOLLOW ON
	BOREHOLE INSTALLATION
ASBESTOS RISK	
ASP	ASBESTOS IDENTIFICATION >0.001%
ASN	ASBESTOS IDENTIFICATION Not Quantified
ASP	ASBESTOS IDENIFICATION <0.001%
HYDROCK (2021)	
TP7XX	TRIAL PIT
WS7XX	WINDOW SAMPLE BOREHOLE
RCBH7XX	ROTARY CORED BOREHOLE
	BOREHOLE INSTALLATION
WYG (2014)	
HP100X	HAND DUG FOUNDATION PIT
AMEC (2011)	
TPXX AMP-TPXX	TRIAL PIT
WSXX	WINDOW SAMPLE BOREHOLE
BH6XX BHSXX	CABLE PERCUSSIVE BOREHOLE
ENTEC (2009)	
HDP3XX	HAND EXCAVATED TRIAL PIT
TP3XX	TRIAL PIT
TT3XX	TRIAL TRENCH
IC3XX	INSPECTION CHAMBER TRIAL PIT
WS3XX	WINDOW SAMPLE BOREHOLE
BH3XX	CABLE PERCUSSIVE BOREHOLE W/ ROTARY CORE FOLLOW ON
	BOREHOLE INSTALLATION
ENTEC (2002)	
HDPXX	HAND EXCAVATED TRIAL PIT
TPXX	TRIAL PIT
TWSXX WSXX	WINDOW SAMPLE BOREHOLE
BHXX BHCXX	CABLE PERCUSSIVE BOREHOLE
	BOREHOLE INSTALLATION
PARKMAN (2002)	
TPXX	TRIAL PIT

NOTES

1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT/ENGINEER FOR APPROVAL IN ADVANCE. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD
-	20/06/24	ORIGINAL ISSUE, PRIOR TO BSL INVESTIGATION (2024)	AH	XX
A	11/11/24	UPDATED FOLLOWING BSL INVESTIGATION (2024) AND EA MEETING 07/11/24	AH	TM

BROWNFIELD SOLUTIONS LTD

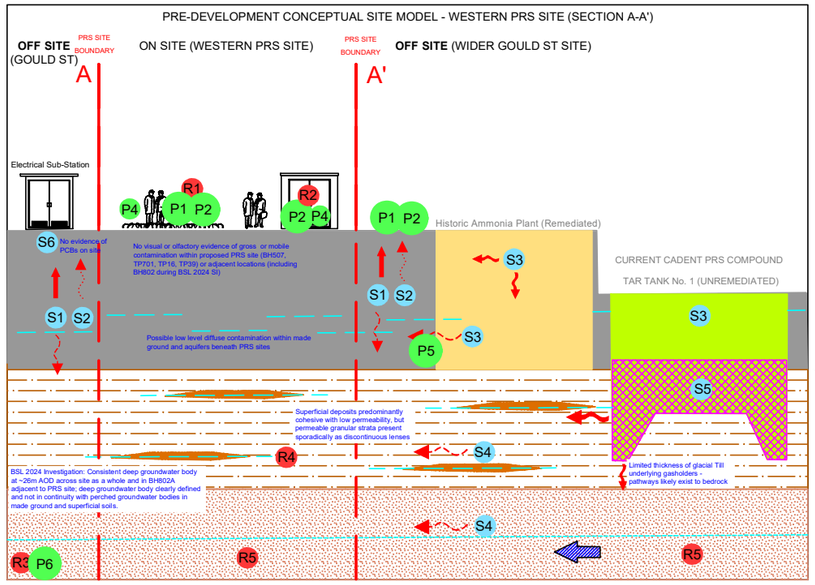
CLIENT
INTRO DEVELOPMENTS / MCR PROPERTY GROUP

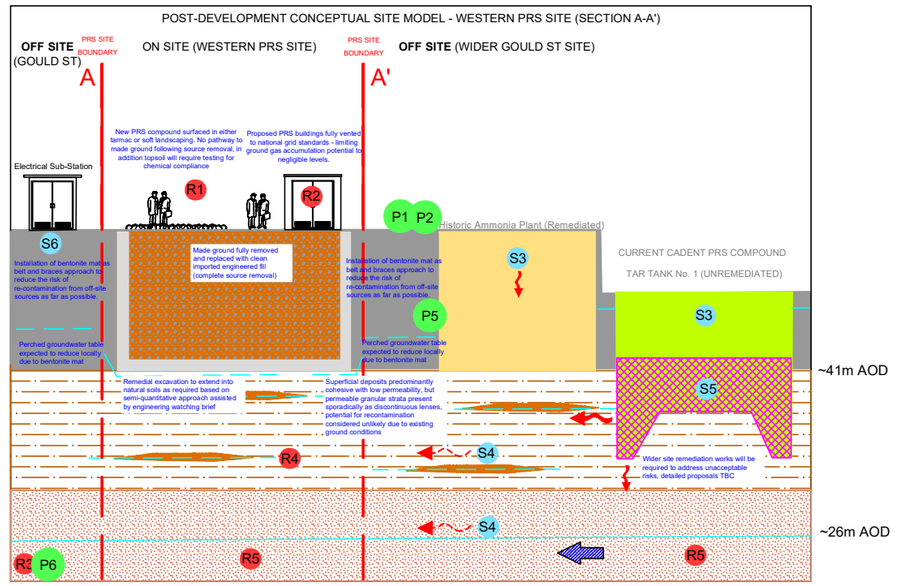
PROJECT TITLE
GOULD STREET, MANCHESTER

DRAWING TITLE
PRS SITES EXPLORATORY HOLE LOCATION PLAN

DRAWING No.	REVISION	SCALE	DATE
C5692/04	A	NTS	11/11/24

DRAWN BY	CHECKED BY
AH	TM





KEY

- HISTORICAL BELOW GROUND TANK (UNREMEDIATED)
- HISTORICAL BELOW GROUND FEATURE (PREVIOUSLY REMEDIATED)
- KNOWN OR SUSPECTED GROSS CONTAMINATION
- MADE GROUND
- GLACIAL TILL (CLAY, SILT, SAND AND GRAVEL)
- ISOLATED SAND BAND
- BEDROCK CHESTER FORMATION (PRINCIPAL AQUIFER)
- INDICATIVE GROUNDWATER LEVEL

POTENTIAL PATHWAYS

Dermal Contact, Ingestion, Inhalation; Leaching, Dissolution; Wind Blown Dusts/Fibres; Dissolved Phase; Vapour

Groundwater Flow Direction

SOURCES OF CONTAMINATION

- S1 Elevated PAHs, metals, petroleum hydrocarbons, phenols, benzene, VOCs/SVOCs, inorganic compounds inc asbestos within made ground (note: contaminants above nonubiquitous)
- S2 Ground Gas (carbon dioxide, methane, carbon monoxide, hydrogen sulphide)
- S3 Localised gross and potentially mobile organic and inorganic contamination associated with made ground within historical gasworks structures
- S4 Elevated PAHs, SVOCs, metals, petroleum hydrocarbons, phenols, benzene, and inorganic compounds within groundwater
- S5 Free-Phase Contamination - Viscous Tar
- S6 Poly-chlorinated bi-phenyls (PCBs)

POTENTIAL PATHWAYS

- P1 Ingestion
- P2 Inhalatio / asphyxiation
- P3 Direct Contact (Building / Utilities)
- P4 Inhalation of VOC
- P5 Migration of contamination via baseflow within groundwater
- P6 Future abstraction
- P7 Migration through pathways formed in the soils from piling

POTENTIAL RECEPTORS

- R1 Commercial End users
- R2 Development end-use. (buildings, utlilites and landscaping
- R3 River Irk (Surface Waters)
- R4 Secondary (Undifferentiated) Aquifer
- R5 Principal Aquifer

NOTES

1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
INTRO DEVELOPMENTS / MCR PROPERTY GROUP

PROJECT TITLE
GOULD STREET, MANCHESTER

DRAWING TITLE
CONCEPTUAL SITE MODEL (PROPOSED CADENT PRS SITES)

DRAWING No.	REVISION	SCALE	DATE
C5692/20	-	NTS	13/11/2024

DRAWN BY	CHECKED BY
TM	AJS

APPENDIX A

Chemical Specification for Soils

OBJECTIVE

COMPLETE REMOVAL OF MADE GROUND (SOURCE REMOVAL) TO NATURAL STRATA +100MM INITIAL SCRAPE.

REPLACEMENT WITH CHEMICALLY SUITABLE FILL.

PREVENT RE-CONTAMINATION OF IMPORTED FILL.

HANDOVER TO CADENT TO ALLOW PRS RELOCATION.

ASSUMING ALL RELEVANT APPROVALS, PERMITS AND DOCUMENTATION IN PLACE - COMMENCE EXCAVATION OF HARDSTANDING AND REMOVAL OF MADE GROUND FOR OFF SITE DISPOSAL TO SUITABLE FACILITY..

EXCAVATE DOWN TO NATURAL +100MM SCRAPE UNDER WATCHING BRIEF OF GEO-ENV ENGINEER.

INITIAL EXCAVATIONS COMPLETED

USE V/O EVIDENCE AND PID TO DETERMINE IF ADDITIONAL EXCAVATION AND REMOVAL OF NATURAL IMPACTED IS REQUIRED

PID >50PPM OR V/O EVIDENCE OF FREE PHASE?

YES

CONDUCT FURTHER SOIL REMOVAL

NO

OBTAIN SUFFICIENT FREQUENCY OF REPRESENTATIVE SOIL SAMPLES AND TEST AS PER APPENDIX A OF REMEDIAL STATEGY

EXCAVATIONS REMAIN OPEN IN SAFE MANNER WHILST AWAITING RESULST ON FAST T/A or TEMPORARILY INSTALL MARKER LAYER AND SURVEY EXCAVATION EXTENTS SHOULD FURTHER REMOVAL BE REQUIRED

ASSESS RESULTS AGAINST REMEDIAL TARGET VALUES

RESULTS > TARGET VALUES AT BASE?

YES

RETURN TO SITE

CONDUCT FURTHER SOIL REMOVAL IN AREAS OF EXCEEDANCES

NO

SURVEY AND RECORD FINAL EXCAVATION FOR VALIDATION REPORTING

INSTALL BENTO-MAT AND COMMENCE IMPORT OF CHEMICALLY SUITABLE FILL TO DESIRED LEVELS

COMPLETE VALIDATION REPORT FOR FORMAL SUBMISSION AND REGULATORY SIGN OFF

OBJECTIVES ACHIEVED

NB: INDICATIVE FLOW PROCESS SUBJECT TO APPROVALS AND HEALTH AND SAFETY REQUIREMENTS

NOTES

1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

CLIENT
INTRO DEVELOPMENTS / MCR PROPERTY GROUP

PROJECT TITLE
GOULD STREET, MANCHESTER

DRAWING TITLE
PRS SITES REMEDIATION FLOW CHART

ASSOCIATED DOCUMEMT REF.	SCALE	DATE
LC/C5692/13238 C	NTS	14/11/24

DRAWN BY	CHECKED BY
AJS	TM

Controlled Waters Remedial Target Values

For soils remaining in situ or to be imported, they shall comply with the below target values:

Determinand	Remedial Target Values – Soils (mg/kg)	Notes and Justification
Naphthalene	190	Taken from LQM S4UL based on Commercial human health screening criteria (1% SOM) – this value is lower than the Entec DQRA value which was generated from a controlled waters risk assessment.
Benzene (BTEX)	5	Entec Clean Up Target. Value is lower than LQM S4UL commercial criteria (1% SOM) and has therefore been adopted for conservatism.
Ammonium	200 (adopting most conservative)	Conservative approach based on Entec Clean Up Target.
Phenol	760	Entec DQRA considered contaminant to not pose a risk. Total phenols were mainly detected in, and, only exceeded the EQS in shallow groundwater in made ground during Entec SI. This suggests that phenols are not likely to pose a risk for the deep groundwater receptor. Suggested value taken from LQM S4UL Based on Commercial (1% SOM)
Free Cyanide	373	Entec DQRA considered contaminant to not pose a risk. Based on ATKINS ATRISK Commercial criteria in lieu of site wide DQRA.
Visual/Olfactory Evidence	Observations of gross contamination – impacted materials to be removed.	Professional judgment. Entec DQRA considered contaminant to not pose a risk.
PID Readings	<50ppm – removal of soils exceeding this value to be undertaken.	Proposed based on wider site indicative data and professional judgment.

Human Health Remediation Targets - Soils			Import - Based on human health without homegrown produce (1% SOM)	Soils to Remain In situ Criteria based on Human health - Commercial (1%) - NOTE CONTROLLED WATERS COC HIGHLIGHTED RED
Source	Contaminant	Unit		
LQM S4UL	Arsenic	mg/kg	40	640
LQM S4UL	Cadmium	mg/kg	85	190
LQM S4UL	Chromium (III)	mg/kg	910	8600
LQM S4UL	Chromium (VI)	mg/kg	6	33
LQM S4UL	Copper	mg/kg	7100	68000
C4SL	Lead	mg/kg	330	2300
LQM S4UL	Mercury, Elemental	mg/kg	1.2	58
LQM S4UL	Nickel	mg/kg	180	980
LQM S4UL	Selenium	mg/kg	430	12000
LQM S4UL	Zinc	mg/kg	40000	730000
Atkins ATRISK / ENTEC	Cyanide (free)	mg/kg	34	373
LQM S4UL / ENTEC	Phenol (total)	mg/kg	440	760
LQM S4UL	Acenaphthene	mg/kg	3000	84000
LQM S4UL	Acenaphthylene	mg/kg	2900	83000
LQM S4UL	Anthracene	mg/kg	31000	520000
LQM S4UL	Benz(a)anthracene	mg/kg	11	170
LQM S4UL / C4SL	Benzo(a)pyrene	mg/kg	3.2	35
LQM S4UL	Benzo(b)fluoranthene	mg/kg	3.9	44
LQM S4UL	Benzo(ghi)perylene	mg/kg	360	3900
LQM S4UL	Benzo(k)fluoranthene	mg/kg	110	1200
LQM S4UL	Chrysene	mg/kg	30	350
LQM S4UL	Dibenz(a,h)anthracene	mg/kg	0.31	3.5
LQM S4UL	Fluoranthene	mg/kg	1500	23000
LQM S4UL	Fluorene	mg/kg	2800	63000
LQM S4UL	Indeno(1,2,3,cd)pyrene	mg/kg	45	500
LQM S4UL / ENTEC	Naphthalene	mg/kg	2.3	190
LQM S4UL	Phenanthrene	mg/kg	1300	22000
LQM S4UL	Pyrene	mg/kg	3700	54000
Professional Judgement	Total TPH	mg/kg	<1000	<1000
LQM S4UL / ENTEC	Benzene	mg/kg	0.38	5
LQM S4UL	Toluene	mg/kg	880	56000
LQM S4UL	Ethyl Benzene	mg/kg	83	5700
LQM S4UL	Xylene - o	mg/kg	88	6600
LQM S4UL	Xylene - m	mg/kg	82	6200
LQM S4UL	Xylene - p	mg/kg	79	5900
CL:AIRE 2010	MTBE (methyl tert-butyl ether)	mg/kg	49	7900
Professional Judgement	Asbestos	% w/w	Not Detected	≤0.001
pH	BS3882	pH Units	NA	5 - 8.2
ENTEC	Ammonium	mg/kg	NA	200

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Atkins ATRISK Soil SSVs March 2017.

See LQM/CIEH S4ULs for Human Health Risk Assessment and Atkins ATRISK Soil SSVs documents for notes regarding derivation.

Criteria for PAH and TPH assumes a conservative SOM of 1% - adjustmnets may be made for higher SOM where considred appropriate.

*Soil matrix should contain no free product.

All imported material to have chemical concentrations less than the above levels for the site, with the exception of pH which is a range.

Test results to be provided to the engineer prior to placing soils, where appropriate.

All tests result to be undertaken by a UKAS Laboratory holding accrediation for the relevant tests.

Should be read in conjuntion with any asbestos depth re-use CSM where applicable in corresponding Remedial Strategy.

Reviewed July 2024

Quality Control Methodology for Imported and Re-used Soils

Prior to Importation and Re-use

In order to prove soils/materials are chemically suitable for the intended use, reliable testing results should be provided, or samples should be obtained at the source and tested prior to either importation or re-use on site of origin as early as possible.

The frequency and scope of testing will vary depending on the source. The required testing of which for both controlled waters and human health is provided below.

These rates are based on a combination of guidance from the National Contained Land Officers Groupe (NCLOG) "A Regulator's Guide to Cover Systems and their Verification", YALPAG "Verification Requirements for Cover Systems" alongside other similar local authority guidance documents, the professional judgement of BSL and acceptance of similar criteria used on similar sites to the satisfaction of the local regulatory authority. Results should be compared to the acceptance criteria appended.

Material Use	Testing Frequency*	Suite of Analysis					
		1	2	3	4	5	6
Validation of In-Situ Materials							
Made ground removal and removal of impacted natural soils	1 sample per 20m of linear excavation to sidewall and 100m^2 base	■	■	■			■
Topsoil							
Greenfield Source including Site Won (Top 600mm)	*1 per 50m^3	■	■				
Brownfield/Recycled Source including Site Won (Top 600mm)	**1 per 50m^3	■	■	■			
Subsoil							
Greenfield Source (Top 600mm)	*1 per 150m^3	■	■				
Brownfield/Recycled Source (Top 600mm)	**1 per 150m^3	■	■	■			
Site Won (Top 600mm)	*1 per 150m^3	■	■	■			
First Generation (i.e. quarried sand)	No testing required. Certificate of material provenance is required.						
Physical Stone Break Layers as Part of Cover System							
First Generation (i.e. quarried stone)	*1 per 1000m^3	■					
Site Generated / Imported 6F Type Material	*1 per 500m^3	■	■	■			
General Fill* **							
First Generation (i.e. quarried stone)	*1 per 1000m^3	■	■				
Site Generated / Imported 6F Type Material	*1 per 1000m^3	■	■				
Site Won Made Ground	*1 per 250m^3						■
	*1 per 1000m^3	■	■	■			

Material Use	Testing Frequency*	Suite of Analysis					
		1	2	3	4	5	6
Site Won Natural Arisings on Brownfield Site	*1 per 1500m^3	■	■				■
Site Win Natural Arisings on Greenfield Site	*1 per 2000m^3	■	■				

Notes
1 – BSL Default Suite - *Arsenic, Cadmium, Chromium (total and hex), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter and pH**, in addition to ammonium, phenol, cyanide (free and total).***
2 – Asbestos ID (and Quantification if detected).
3 – TPH Analysis - *Speciated Total Petroleum Hydrocarbons (TPH CWG) including BTEX and MTBE.*
4 – VOC Analysis - *Volatile Organic compounds (VOCs) by GC-MS (ex TIC).*
5 – SVOC Analysis - *Semi-Volatile Organic compounds (SVOCs) by GC-MS (ex TIC).*
6 – Visual Inspection & on-site screening for VOC using calibrated PID.
* - Minimum of 3 samples per source.
** Minimum of 6 samples per source.
***To be used at depths >600mm bgl or below building/hardstanding.

The testing should be undertaken at a UKAS accredited laboratory, be MCERTS accredited where available, and all results should be below the remedial target values appended.

Waste Legislation

Prior to the excavation, stockpiling, movement and placement of soils/materials, appropriate exemptions should be in place (e.g. an MMP or other suitable exemption/permit).

Topsoil/Subsoil

For topsoil and subsoil suitability as a growing medium, reference should be made to BS3882:2015 Specification for Topsoil and BS 8601:2013 Specification for Subsoil and Requirements for Use. These standards should be adopted where feasible, especially for recycled/manufactured soils, but it should be noted that this standard is often difficult to apply to existing greenfield topsoil/subsoil which has shown no prior issue as a growing medium (i.e. no vegetative stress prior to stripping/stockpiling).

In consideration of promoting soils sustainability, a view should be taken on the suitability of topsoil/subsoil if it does not fully comply with the standards and agreed with the LPA. For example, on a site whereby sensitive peat/acid soils are present, but site won topsoil does not comply with the standard, it would potentially be more sustainable and appropriate to retain and re-use such soils as opposed to removal and replacement.

In addition to the above sampling frequencies and testing, all imported topsoil/subsoil should also confirm to the following criteria:

- Have a maximum stone size of 75mm.
- Be clean and free of foreign debris including building waste materials or contaminants e.g. brick, glass, asbestos and plasterboard, etc.

For imported soils, approval should be obtained from the Local Authority prior to importing to site.

Site Won Crushed Hardcore/Concrete (for use below building/hardstanding only)

In addition to the above sampling frequencies and testing; for re-use of hardcore/concrete (Grade 6) on the site of origin, BSL proposes the following inspection criteria:

- No visual contamination (oil staining etc).
- Limited deleterious material (organics, wood, etc).
- Limited metal.
- No visible asbestos containing material (ACM).
- Quantifiable Asbestos at or <0.001 w/w%.

Production of Grade 6 materials should be done under WRAP quality protocols or similar. Inspections and sampling would need to be carried out by a qualified geo-environmental engineer. For geotechnical performance, reference should be made to Series 600 Earthworks Guidance.

If the above criteria for asbestos is exceeded, then further consideration and assessment will be required. Works would need to be undertaken in compliance with the Control of Asbestos Regulations (CAR) 2012 and an Asbestos Plan of Works may be required.

Post Importation

The imported soils should be inspected on site to confirm it is the same material inspected at source and it is suitable for use. Once imported to site, tests should also be undertaken to confirm the batch is suitable prior to use and has not been contaminated in transit.

A management plan should be in place on site for storage and transportation. The material should be stockpiled separately and well segregated on site to prevent cross contamination in accordance with good site practice.

Accurate records of movement of soils should be kept in order to be incorporated in the final verification report.

Approval should be obtained from the Local Authority prior to use on site.

Validation and Verification Report

Site
A final verification report should be issued to the Local Authority/Warranty Provider (e.g. NHBC) detailing records of the re-use and importation of soils, alongside their use on the site.

Cover Layer
Once the chemical suitability of soils used for a cover system in soft landscaping and garden areas has been confirmed, the material can be placed in these areas.

The depth of the cover layer should be recorded, and photographs taken as evidence to be issued to the Local Authority/warranty provider in the verification report.

Approval for the placement of the cover layer should be obtained from the Local Authority/Warranty Provider.

APPENDIX B

BSL Guidance – Re-use and Disposal of Waste

Re-Use Of Waste - Guidance Note

Definition of Waste
The Environment Agency considers waste to be *"...any material that is discarded, or intended to be discarded..."* This includes any soil from trenches, footing, site strip etc. It is no longer required in its original location, therefore it is considered to be waste.

CL:AIRE: Code of Practice
Where materials are excavated for construction purposes, wherever possible these should be retained on site for engineering purposes if they are suitable for use. This can be implemented under the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE DoWCoP), also commonly referred to as a "Materials Management Plan".

The developer/contractor is advised to complete all works under the DoWCoP.

Potential scenarios where soils may be able to be re-used:

- Material capable of being used in another place on the same site without treatment.
- Material capable of being used in another place on the same site following ex-situ treatment on site.
- Material capable of being used in another development site without treatment (Direct Transfer).
- Material capable of being used in another development site following ex-situ treatment on another site eg Hub site.

The Code of Practice requires 4 No. Factors to be addressed:

1. Protection of human health and protection of the environment.
2. Suitability of use, without further treatment.
3. Certainty of use.
4. Quantity of material.

In order to satisfy these requirements the following are required:

i) Consultation/approval with Local Authority & Environment Agency to confirm they have no objections to the proposed re-use of waste soils, or the risk assessments for the site.
ii) Risk Assessments to demonstrate that the site does not present an Environmental Hazard.
iii) Remediation Strategy for contaminated sites (or Design Statement for non-contaminated sites).
iv) Materials Management Plan (MMP) which details material generated stockpiles and the end use.
v) Volume calculations.
vi) Planning permission for the development.
vii) Contractual details to be clear, regarding who steps in is a contractor goes into administration/liquidation.

The use of the CoP is effectively industry regulated, there is a requirement to appoint an independent Qualified Person (QP) who checks all the requirements have been met and registers the documentation with the Environment Agency. This person must not have had any involvement with the preparing of the risk assessments or remedial strategy on the site.
Soils which require treatment on site (eg bioremediation, stabilisation) will require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use.
Site management procedures need to be in place to ensure that material is tracked through from excavation stockpiling, treatment and remediation processes. Should the process of material tracking be considered non-robust, or not adhered to, this may fail the test whether excavated materials may be considered non-waste.

Alternatives include the EA U1 exemption (soils and stones <1000 tonnes and aggregates <5000 tonnes) and the Waste Framework Directive, which applies to naturally occurring soils used on site of origin only. Aggregates can also fall under the EA WRAP Quality Protocols.

Waste Classification For Soils

Introduction
Waste producers have a duty of care to classify the waste they are producing:

- before it is collected, disposed of or recovered.
- to identify the controls that apply to the movement of the waste.
- to complete waste documents and records.
- to identify suitably authorised waste management options.
- to prevent harm to people and the environment.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. Where this is not possible there are three main options for the disposal of soils:

1. Disposal to a permitted waste recycling facility.
2. Re-use on another site (subject to the suitability).
3. Disposal to a landfill site.

The disposal to a permitted facility will be subject to the **specific conditions of the permits for each individual facility** and will vary dependent on location and environmental sensitivity of the receiving site. Re-use on another site will also be subject to the acceptability criteria of that site.

The guidance below relates to disposal to **landfill sites only**.

Background for Landfill Disposal
In July 2005 the United Kingdom implemented the European Directive 1999/31/EC (The Landfill Directive), this introduced the current regime for waste and waste disposal to landfill. The Landfill Directive places controls on waste disposal. These controls include requirements to follow the waste acceptance procedures and criteria that have been agreed by the Council of the European Union and are laid out in Council Decision 2003/33/EC.

Before a waste can be accepted at a landfill site, the landfill **operator** must be satisfied that the waste meets his permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

If disposal to landfill is the best management option for the waste soils, these procedures **must** be followed or the operator may refuse to accept the waste.

Key Points

- Not all waste can be landfilled
- Landfills are classified according to whether they can accept **hazardous**, **non-hazardous** or **inert** wastes.
- Wastes can only be accepted at a landfill if they meet the waste acceptance criteria (WAC) for that class of landfill.
- Most wastes must be treated before you can send them to landfill.
- There are formal processes for identifying and checking wastes that must be followed before wastes can be accepted at a landfill site.

Classification
Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste types. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not i.e the hazard assessment. The most common EWC waste codes related to soil are:

17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**
17 05 03*	soil and stones containing dangerous substances
17 05 04	soil and stones other than those mentioned in 17 05 03

Soils may contain certain contaminants (eg asbestos, oil,) which have prescribed concentration thresholds, that if breached will render the material hazardous waste. These are based on specific "hazardous properties" which include hazards such as carcinogenicity, flammability and toxicity.

In the first instance the concentrations of plausible contaminants within the soil should be identified and wastes should be **classified based on their total concentrations**.

Waste Definitions

Inert	• Will not undergo any significant physical, chemical or biological transformations. • Will not dissolve. • Will not burn. • Will not physically or chemically react. • Will not biodegrade. • Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. • Has insignificant total leachability and pollutant content. • Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate).
Non-Hazardous	Is not inert (see above) Is not hazardous (see below)
Hazardous	Soil has hazardous properties as defined in WM3 (Guidance on the classification and assessment of waste (1st edition 2015)- Technical Guidance)
Stable Non-reactive hazardous waste#	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents either: in the waste alone (for example, by biodegradation), under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) or by the impact of other wastes (including waste products such as leachate and gas).

This option allows hazardous waste that is stable and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes.

WAC Testing

The purpose of WAC analysis is to confirm that the waste complies with the relevant WAC for the receiving landfill. If the waste has any disposal route other than a landfill site (e.g. recycling facility, incineration etc) the **WAC is not relevant.** Furthermore the WAC limits **cannot be used to make an assessment of whether a waste is hazardous**. WAC testing does however define if a non-hazardous waste is suitable for an inert landfill.

Classification based on Total Concentrations[1]	Non-Hazardous Waste		Hazardous Waste	
WAC testing	Below inert WAC limit values:	Above inert WAC limit values:	Below hazardous WAC limit values	Above hazardous WAC limit values
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill[2]	HAZARDOUS landfill	PRE-TREATMENT[3]

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).
2 Individual sites may have certain limit values pre-determined in their licence.
3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

Hydrocarbons in Soils

WM3 uses the term Oil or Waste Oil to cover hydrocarbons products such as fuel oil, petrol or diesel. These are defined by WM3 as hazardous under an absolute entry in the List of Wastes. However hydrocarbons in soils are a mixture rather than a pure product and are therefore not absolute entries.

Known Oils

The simplest scenario is where the identity of the contaminating oil is known or can be identified. If the oil is known the manufacturer's or supplier's REACH compliant safety data sheet for the specific oil can be obtained and the hazard statement codes on that Safety Data Sheet can be used for the hazardous waste assessment.

Where the identity of the oil can only be identified down to a petroleum group level (i.e. the contaminating oil is known to be diesel, but the specific type/brand is unknown), then the classification of that petroleum group should be used in the assessment. The marker compounds associated with that petroleum group may be used to confirm carcinogenicity.

Oils may contain a range of hydrocarbons, so the presence of for instance Diesel Range Organics (DRO) does not enable the assessor to conclude that diesel is present. These hydrocarbons may have arisen from other oils, the laboratory needs to provide an interpretation of the chromatograph to determine if it is consistent with diesel or weathered diesel as a whole.

The concentration of known oils should be determined using a method that as a minimum spans the range in which the carbon numbers for that known oil fall.

Unknown Oils
Where hydrocarbons are contaminating soils it is likely that the oil will be unknown or cannot be determined.

WM3 states that:

> For contaminated land specific consideration must be given to the following before proceeding;
>
> - The presence of other organic contaminants, for example solvents or coal tar that could be detected as hydrocarbons. Coal Tar is not an oil and is considered separately in WM3 example 2. Where the site history or investigation indicates the presence of hydrocarbons from oil and other sources (e.g. coal tar), and the origin of the hydrocarbons cannot reliably be assigned to either, then a worst case approach of considering the hydrocarbons both as waste oil (in accordance with this example) and from other sources, for example coal tar should be taken.
> - The presence of diesel, or weathered diesel, should be specifically considered by the laboratory and where this is confirmed by the hydrocarbon profile the oil should be assessed as a known or identified oil (diesel).

The use of **marker compounds** is optional; however it is recommended that where possible the marker compounds should be used. WM3 states:

> If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:
>
> - The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.1 of the CLP for BaP)
> - This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3, and
> - The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

For example:

TPH Concentration (mg/kg)	Petrol or Diesel	BaP (mg/kg)	Classification
10,000	No	0.9	Non- Hazardous
1,000	No	Not available	Hazardous
1,000	Yes	Not relevant	Hazardous

References

1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert Waste on Land" 2009.
3. Environment Agency "Waste acceptance at landfills - Guidance on waste acceptance procedures and criteria" Nov 2010.
4. Environment Agency "Guidance on the classification and assessment of waste (Technical Guidance WM3)".
5. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).
6. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
7. 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament
8. Environmental Permitting Guidance The Landfill Directive For the Environmental Permitting (England and Wales) Regulations 2010 Updated March 2010 Version 3.1
9. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).

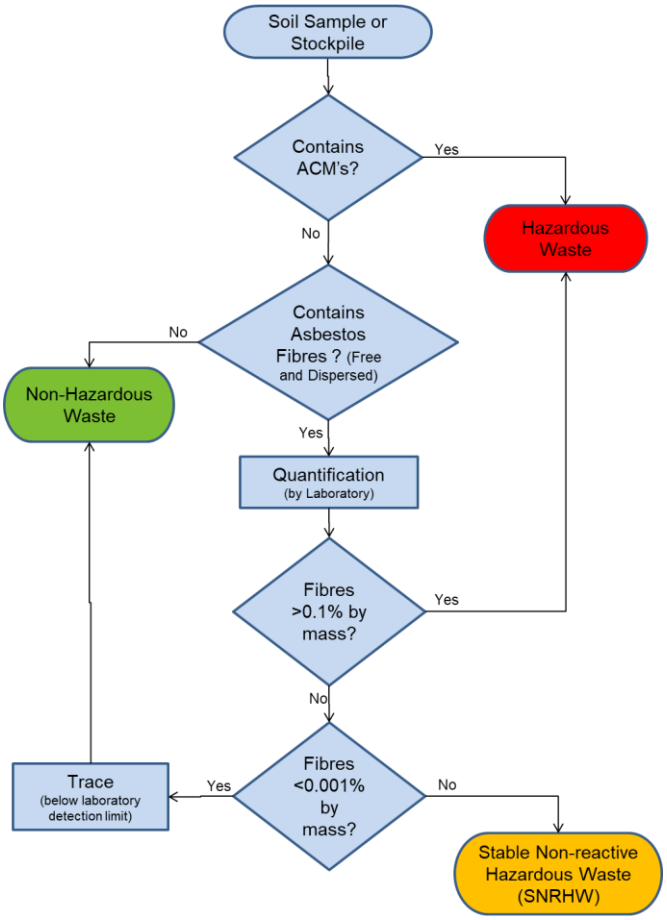
Additional Asbestos Guidance Notes

Disposal

The 1st Edition of WM3 "Guidance on the classification and assessment of waste", details the way in which Asbestos is assessed within soils.

The assessment of asbestos containing waste is dependent on whether the asbestos is present as:

- Fibres that are free and dispersed, or
- Identifiable pieces of asbestos containing materials (ACM's)



Identifiable pieces of asbestos are any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. The result is that commonly soils with visible ACM's are sorted and the ACM's removed by hand picking and separate disposal.

Asbestos concentrations below 0.001% by mass are below standard laboratory detection limits and are not currently regarded as containing asbestos for the purposes of disposal and may be disposed of to an inert landfill site[1]. These levels are often termed "trace" by laboratories.

Asbestos concentrations between 0.001% and 0.1% are stable non-reactive hazardous waste (SNRHW)[1]. Waste transfer stations where soil recycling takes place may be able to take SNRHW, but are unlikely to take soils containing asbestos above trace concentrations.

The following codes should be assigned to the asbestos waste as appropriate:

17 06	**Insulation materials and asbestos-containing construction materials**
17 06 01	Insulation materials containing asbestos
17 06 03	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05	Construction material containing asbestos

WM3 indicates that 17 06 05 would normally be used in preference to 17 06 01 for the asbestos in asbestos contaminated soil and stones.

Construction materials containing asbestos and "*other suitable materials*" may be landfilled at landfills for non-hazardous waste in accordance with the Landfill Directive without testing.

This means that wastes that are only hazardous because of their asbestos content can be disposed of at landfills for non-hazardous waste in separate landfill cells that only accept asbestos wastes and other suitable materials. The Landfill Directive requires that stable non-reactive hazardous waste shall not be deposited with biodegradable waste (for example organic material, household waste, paper etc..) and must meet the waste acceptance criteria set out in accordance with Annex II.

Construction

Health and Safety Executive (HSE) guidance on asbestos is not directly related to soil and much of the guidance focuses on the removal of asbestos from buildings. The overarching legislation is the Control of Asbestos Regulation (CAR 2012). However where work involves (or is likely to involve) contact with asbestos then CAR 2012 requires a risk assessment including whether or not the work is licensed or notifiable non-licensed work and may require an Asbestos Management Plan. Work becomes notifiable if it is considered that the control limit could be exceeded.

Brownfield sites frequently have soils that contain asbestos and the presence of asbestos needs to be considered within the context of construction, particularly in relation to groundworks. The exposure of soils and the use of excavators and plant to move soil around increases the possibility of fibres becoming airborne. However it is good site practice to not generate dusts and to employ dust suppression on all sites regardless of the presence of asbestos.

The legal control limit for asbestos is 0.1f/ml over a continuous four hour period. The control limit is not a '*safe*' level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

Clearly the higher the concentrations in the soil the greater potential there is for fibres to be released, however IOM publication TM/88/14 "the release of dispersed asbestos fibres from soil" 1988 concludes that:

- Mixtures of asbestos in dry soils with asbestos content as low as 0.001% can produce airborne respirable asbestos concentrations greater than 0.1f/ml in dust clouds where the respirable dust concentrations are less than 5mg/m^3.
- An action limit is recommended of no higher than 0.001% asbestos in soils above which steps should be taken to minimise exposure to airborne fibres (eg by wetting).
- The addition of relatively small quantities (10%) of water can reduce the airborne fibre concentrations by an order of magnitude.

Where asbestos has been identified at concentrations above 0.001% as free and dispersed fibres in the soil precautions need to be adopted. Concentrations below this are considered to be normal background, although good site practice dictates that the generation of dusts should be avoided and therefore any fugitive fibre release from minor concentrations should be kept to a practical minimum.

End Use

The use of materials containing asbestos and material containing asbestos is prohibited under EU legislation. There is currently a Joint Industry Working Group (JIWG) tasked with producing a Code of Practice for Asbestos in Soil, Made Ground and Construction & Demolition Material that will clarify in due course the position of the various government agencies.

Asbestos containing materials can remain in situ under a suitable cover system which may be hardsurfacing or soft landscaping (with or without hard dig layers and markers).

There is a risk that future maintenance may compromise such systems and details of the presence of asbestos should be kept in the Health and Safety File.

Preliminary publications from JIWG (April 2015) provide guides for decision making in relation to construction. These are at a "Beta" test stage and further publications will be provided in due course.

The re-use of waste soils should be undertaken in accordance with the CL:AIRE Code of Practice and is subject to suitable risk assessments demonstrating low risk . There is nothing that specifically excludes the re-use of soils containing asbestos as fill to raise levels. However the movement of materials increases the risk of fibres becoming airborne and suitable precautions will be required.

The re-use of soils containing asbestos at concentrations above hazardous waste levels is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be feasible where there is a long program for implementation.

APPENDIX C

UXO Risk Assessment Report

EOD CONTRACTS LTD

Unexploded Ordnance Risk Mitigation

Explosive Ordnance Desk Top Study for:

GOULD STREET, MANCHESTER, M4 4BH

PROJECT 24210

On behalf of

BROWNFIELD SOLUTIONS



www.eodcontractsltd.com

Tel: 01386 578 405

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Company Registration Number 4483560

ISOQAR REGISTERED

UKAS MANAGEMENT SYSTEMS 0026

Institute of Explosives Engineers
VOICE OF THE EXPLOSIVES INDUSTRIES

EXPLOSIVE ORDNANCE DESKTOP STUDY

For

GOULD STREET, MANCHESTER, M4 4BH

Conducted by **EOD Contracts Limited**

On behalf of **BROWNFIELD SOLUTIONS**

Document Control & Enquiries

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TERMS AND DEFINITIONS

Anti-Aircraft Shells (AA)
Small High Explosive Shells (HE) shells ranging up to 100mm in diameter.

Air Raid Precautions (ARP)
An organisation in the United Kingdom set up in 1937 dedicated to the protection of civilians from the danger of air raids. It included the Raid Wardens' Service that was to report on bombing incidents.

Battlefield Area Clearance (BAC)
The systematic clearance of munitions from military property or old battle sites e.g., ranges, airfields etc.

Borehole Search
The placing of boreholes in a set pattern, then using a magnetometer to take readings at specific depths along each borehole. When used with a geophysical survey system this will give a magnetic signature of the area. The depth of the borehole and the pattern will depend upon the type of Unexploded Bombs (UXB) and the geology of the ground.

Doodle Bug (See Pilotless Aircraft)

Explosive Ordnance (EO)
All munitions containing explosives, nuclear fission/fusion materials and or biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket, and Small Arms Ammunition (SAA); all mines, torpedoes, and depth charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices (IED); and all similar or related items or components explosive in nature.

Explosive Ordnance Clearance (EOC)
See BAC.

Explosive Ordnance Disposal (EOD)
The detection, identification, field evaluation, render safe, recovery and disposal of **UXO**.

Geophysical Survey
The survey of an area using a Magnetometer and geophysical gathering device, after interpretation, this will produce a geophysical map and an object list for any metallic anomalies.

High Explosive (HE)
High explosives burn/detonate at rates of up to 9,000 m/per second.

Incendiary Bomb (IB)
Incendiary bombs ranged from 1kg in size to 500kg the larger sizes were sometimes called Oil Bombs. Fills range from thermite mixtures, phosphorus to kerosene.

Intrusive Survey
The use of a cone penetrometer (MagCone) or drilled boreholes (MagDrill) to take magnetometer test in a set pattern (see borehole search), or to prove pile positions.

Land Service Ammunition (LSA)

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LSA is defined as “All items containing explosives or pyrotechnic compounds which are placed, thrown, or projected so as to cause damage to men and equipment during land warfare.

Long Range Rocket (LRR)
The long-range rocket sometimes codenamed Big Ben is the V2 rocket designed to deliver an approximate payload of 1000 kg.

Oil Bomb (OB)
A bomb containing a flammable liquid, normally the KC 250 Flam or the C 500 flam.

Pilot less Aircraft (PAC)
A flying bomb (Fly) or doodlebug is the V1 rocket, or predecessors designed to deliver an explosive payload of approximately 500kg - 800kg.

Parachute Mine (PM)
Air dropped mine may have been used as a blast effect bomb maximum explosive content 1600lb always fitted with anti-handling and anti-stripping equipment.

Unexploded Bomb (UXB)
Any air dropped bomb that has failed to operate.

Unexploded Ordnance (UXO)
Explosive ordnance that has been primed, fused, armed, or otherwise prepared for use or used. It may have been fired, dropped, launched, or projected yet remains unexploded either through malfunction or design or for any other cause.

Vengeance Weapons (V)
V1 see Pilotless Aircraft.
V2 see Long Range Rocket.

WWI
World War 1 (1914 – 1918)

WWII
World War 2 (1939 – 1945)

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EXECUTIVE SUMMARY

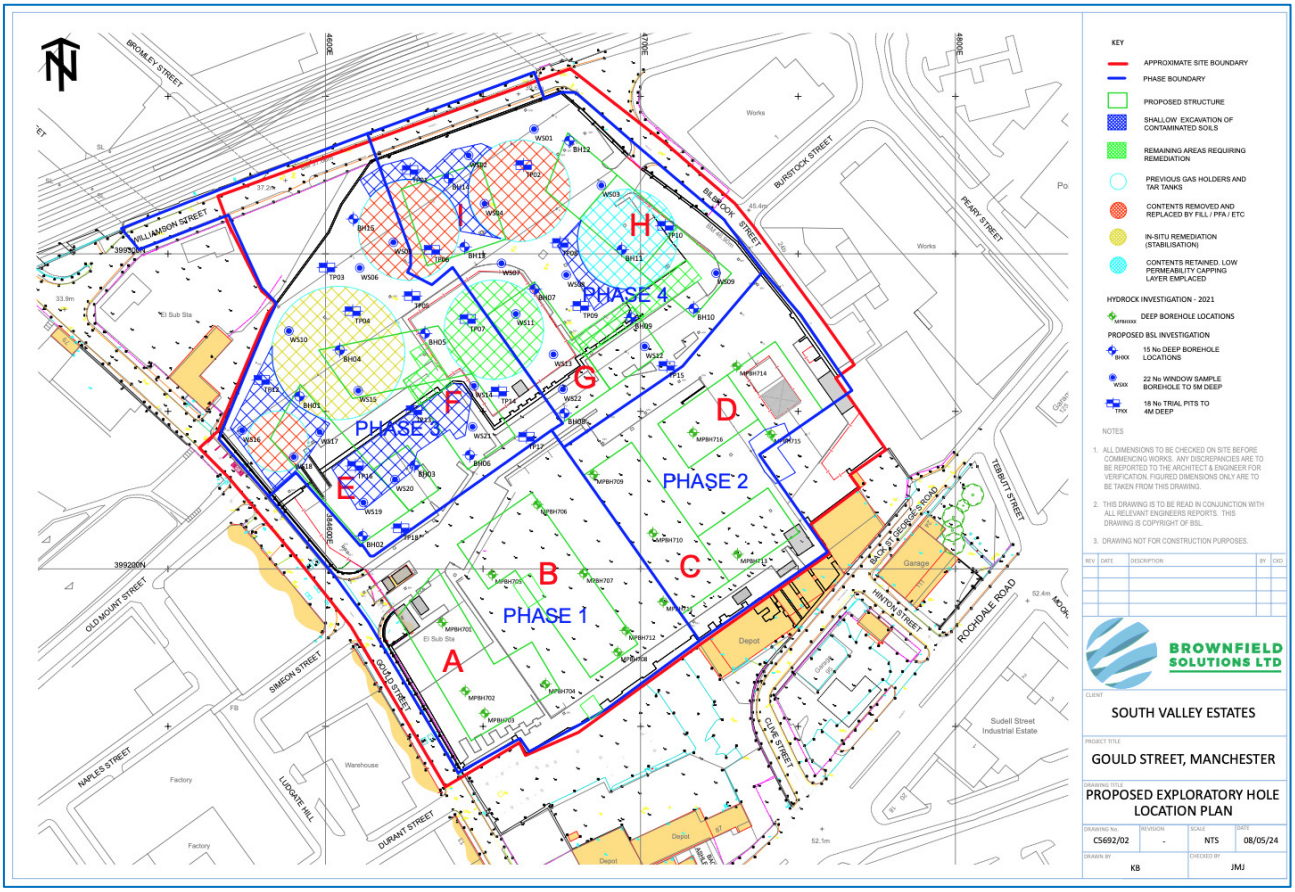
INSTRUCTION

EOD Contracts Ltd, have been commissioned by Brownfield Solutions to undertake a Provisional Desktop Study (PDTS) for potential historic Unexploded Ordnance (UXO) contamination for the future works at Gould Street, Manchester, M4 4BH, hereafter referred to as the Site.

SCOPE OF WORK

The scope of this EO Risk Assessment/Desk Study is to assess the likelihood of buried EO/UXO within the environs of The Site (See Figure 1.1), in view of further development. A further aim was to evaluate the implication from UXO contamination during any future intrusive land use.

Figure 1.1: Clients Supplied Site Diagram, This DTS will be covering the area bordered in RED.

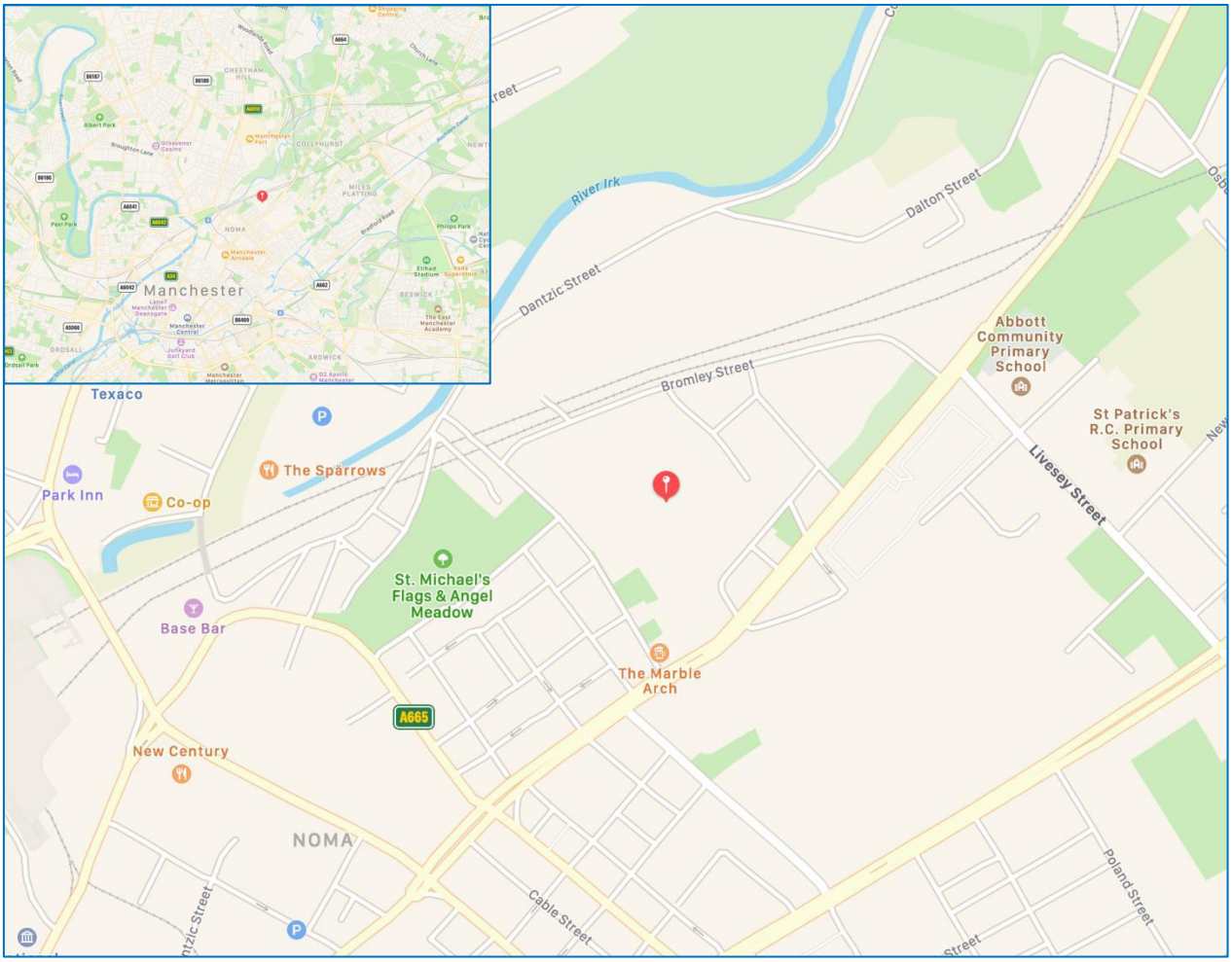


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LOCATION

Site Location (red flag). An exact meeting point will be determined by the Client should the need arise.

Table 3.1 Site Location.



Title	Description
Address	Gould Street, Manchester,
Post Code	M4 4BH
Nat Grid Reference	SJ 846992 / SJ 8468599234
what3words	mirror.cars.hotel

SOURCES OF UXO CONTAMINATION

The main sources of potential UXO contamination that have been researched for the site are:

- Buried or discarded items of ordnance.
- Air delivered ordnance bombs and sub-munitions/incendiaries.

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KEY FINDINGS

Based on the information researched by EOD Contracts Ltd for the proposed scope of works being carried out within the given Site area, the following conclusions have been reached:

- The Site area is situated within Manchester, which is off historic fact was bombed on several occasions throughout WW2, the worst of which being the Christmas raids. However, despite this it is situated away from the centre of Manchester which is where the focus of the raids took place.
- The Site was subjected to bombing throughout WW2 as can be seen in Annex D.
- The Site area was fully utilised throughout WW2.
- The Site would have been considered a viable and strategic target throughout this period.
- There have been several phases of construction and remediation works that have taken place within the Site boundary post WW2. However, it cannot be guaranteed that these remediation works went to protentional bomb penetration depth.

Risk Level

The prevailing risk level has been determined to be **LOW** for some areas within the Site boundary and **MEDIUM** for others (see risk map).

Historical UXO Contamination

The indicators for UXO contamination are:

Bomb Strikes	There are no recorded incidents of the site being the subject of bombardment throughout WW1. Manchester was targeted heavily throughout WW2. The Site would have been considered a strategic target throughout this period. Known bomb strikes within the Site boundary. There have been several phases of construction and remediation works that have taken place within the Site boundary. The Site was fully utilised throughout WW2.
Bomb Damage	Difficult to ascertain.
Reconstruction	No obvious signs
Military Usage	No obvious signs.
Explosive/Munition Factory	No obvious signs

Risk Level	Therefore, so far as reasonably practicable the risk level on Site has been deemed as both a **LOW** risk and **MEDIUM** risk for some areas. See risk map.
Risk Depth	7.062 for areas deemed a **MEDIUM** risk

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PART 8: RECOMMENDATIONS

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **LOW** risk.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **MEDIUM** risk.

Communicating the risks, all stakeholders should be made aware of the UXO situation on the site and the possible impact it may have on the project works and day to day running of the district. Clients have a legal duty under the Construction Design & Management Regulations (CDM) and Health & Safety at Work legislation to provide Designers and Contractors with project specific information needed to identify hazards and risks associated with the design and construction work. The possibility that UXO may be encountered on site falls within the category of a significant risk and as such it should be addressed as early as possible in the lifecycle of the project.

Further planning: the risks posed by UXO should be brought to the attention of the Project CDM Coordinators and other individuals with a responsibility for project safety and operations at the site. The matter of UXO should be considered critical to project safety and one requiring high priority action.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

Project overview and the responsibilities of those working on site with regard to duty of care and public safety.

UXO recognition and safety procedures to be followed on discovery of a suspicious object or the alarm being sounded.

Emergency procedures to be followed in the event of an explosion. Evacuation routes, muster stations and accounting for personnel.

Work permits, works methodology and specific UXO risk mitigation methods. Post-incident inspections and returning to normal works.

Prior to any intrusive piling or drilling commencing, UXO safety testing and appropriate clearance certification into the ground to sufficient depth to provide clearance from UXO. This can be done using a progressive drilling process or (where large numbers of piles are to be placed and ground permitting)

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using a vehicle borne hydraulic system to push a magnetometer into the ground to test for the presence of UXO prior to piling.

UXO safety monitoring of all "at risk" excavations, including geotechnical or archaeological trial pits to be conducted during the project. This should be provided by a UK Home Office Authorised EOD/UXO Contractor using qualified EOD Engineer with specialist locators and detectors to scan the ground ahead of the excavation wherever possible.

9.0: SPECIFICALLY

Geotechnical investigations, percussive drilling/trial pits/window/samples, require an EOD Engineer over watch.

The removal of all buildings within the site footprint can be removed down to ground level (including basements)

New foundations with piling should be mitigated by the insertion of a magnetometer to encompass the pile position, this would be carried out using a CPT rig (magcone), the expected radius of the magcone is 1.5m therefore multiple piles could be checked.

Non-Intrusive Magnetometer surveys generally prove inconclusive on "Brownfield sites", this is due to the high ferromagnetic background, therefore this methodology is not recommended for this site and shallow excavations should be overseen by a qualified EOD Engineer.

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10: RISK MAP

Due to the Site being subjected to several known bomb strikes throughout WW2, areas of the northern half of the Site has been deemed a **MEDIUM** risk. This area has been subjected to post war excavation works however, it cannot be guaranteed to at a depth below potential bomb penetration depth.





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EOD Contracts Ltd can supply a turnkey solution to your UXO requirements. Therefore, the following mitigation strategies can be supplied for land or water-based operations:

Intrusive survey using CPT *(Cone Pressure Testing)* or borehole equipment, *supplying risk mitigation to all Borehole and Pile locations, down to a maximum bomb penetration depth determined within this document.*

Non-Intrusive Survey using multiple array system with DGPS *(Differential Global Positioning System).*

Offshore, near-shore, estuarine and freshwater water environments magnetic, side scan and bathymetric supported by state-of-the-art DGPS.

The aforementioned surveys are supported with post processing of data and intrusive investigations if required.

EOD Engineer over watch using Suitably Qualified and Experienced Personnel, normally former British Army, Navy, or RAF Bomb Disposal specialists.

Explosive Ordnance Safety Presentations.

Bibliography

The significant published documents referred to during this study are listed below:

- HO 193 series from National Archives
- HO 198 series from National Archives
- The Blitz Then and Now Volumes 1 to 3
- AA Command Colin Dobinson
- German Air Raids on Britain 1914-1918
- English Heritage
- Bombing Britain Database
- https://luna.manchester.ac.uk/luna/servlet/view/search?q==%22GB127.MISC%2F1192%2F1%22
- https://www.ashremediation.co.uk/portfolio/gould-street-gasworks-2/
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- https://manchesterhistory.net/manchester/gone/gouldgasworks.html
- https://aboutmanchester.co.uk/work-has-begun-on-site-of-former-gasworks-on-rochdale-road/
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PART 1: INTRODUCTION

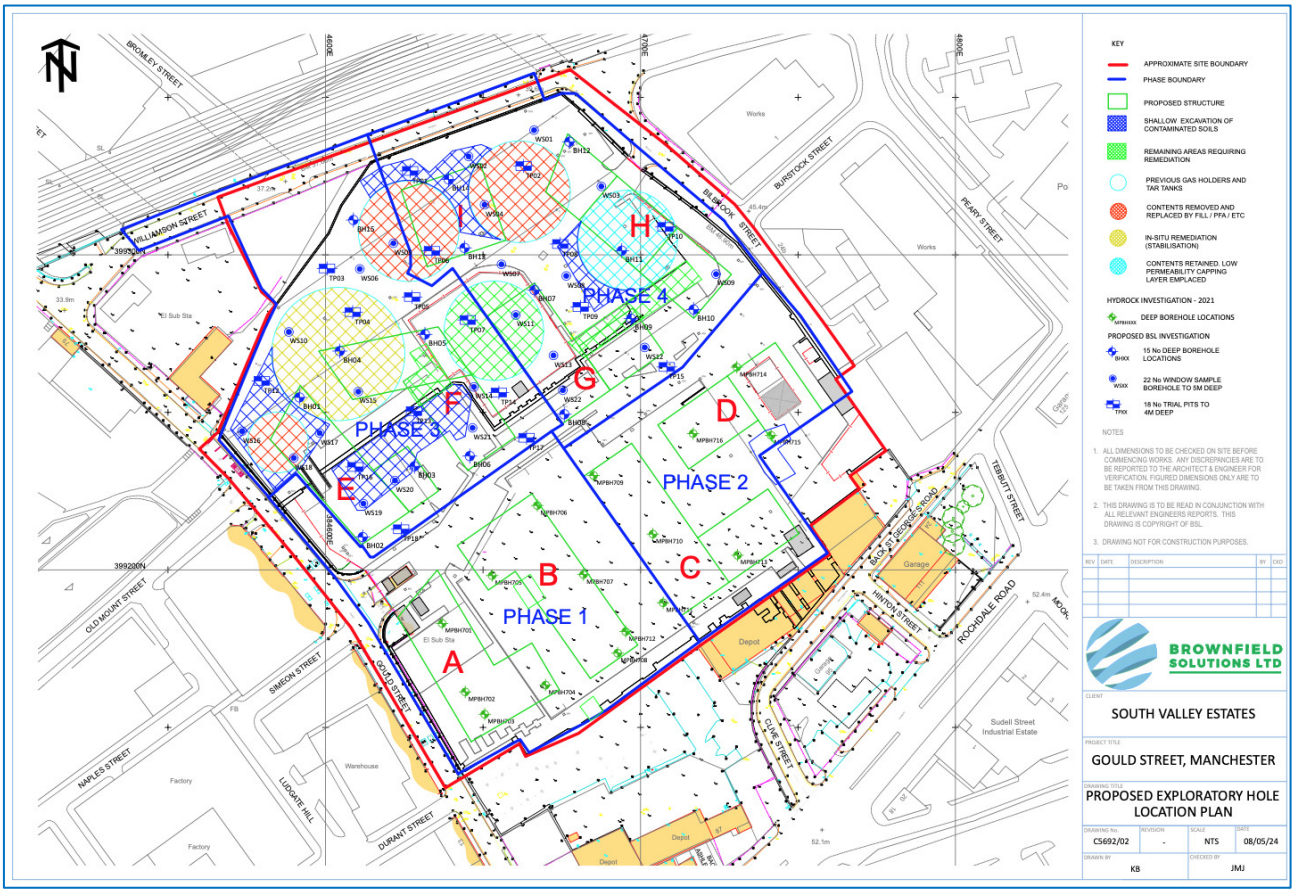
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Figure 1.1: Clients Supplied Site Diagram, This DTS will be covering the area bordered in RED.



Restrictions

It must be emphasized that a desk study can only indicate the potential for UXO to be present on the site. This study was written with the site conditions prevailing at the time of the study and no liability can be accepted for any change in the condition of the area.

Please note that our appraisal relies on the accuracy of the information contained in the documents consulted and that EOD Contacts Ltd will in no circumstances be held responsible for the accuracy of such information or data supplied.

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Sensitive Documentation

Information may be classified, restricted, or deemed to be confidential in nature to EOD Contracts Limited, where such material has been gained a summary of the documentation has been approved.

Objective

The objective of this document is to define the UXO contamination routes as defined in Unexploded ordnance (UXO) A guide for the construction industry (C681) dated July 2009 and offer remediation methodologies if required.

CIRIA Framework

The CIRIA report is intended to provide good practice guidance (code of practice) on how to identify whether a site is likely to be at significant risk of UXO encounter and, if so, to set-out a process that will allow this risk to be managed. To be effective this process must start early in the life of the project (usually before intrusive works commence) and have involved Clients, Advisors and Principal Contractors. Therefore, the ground contractor should be provided with a systematic appraisal of the UXO risk when they become involved. The CIRIA report recommends the following stages be undertaken as part of the risk management process:

- Phase 1 Preliminary Risk Assessment
- **Phase 2 Detailed Risk Assessment (Completed and updated in this document)**
- Phase 3 Risk Mitigation (The act of ameliorating the risk, the clearance methodology)
- Phase 4 The UXO Risk Management and Implementation Plan

PART 2: SOURCES OF INFORMATION

Research of the site's history, with regard to military usage, bombing raids and bomb impacts has been undertaken to establish the following:

- Frequency and intensity of enemy bombing raids for the site and immediate vicinity up to 500m.
- Bomb impacts and associated damage on the Site and in the immediate vicinity.
- The potential for UXO to remain on the Site and in the vicinity.
- Records of UXO removal activities for the Site and immediate vicinity.
- The main sources of information consulted include:
    a. EOD Contracts Ltd company records
    b. Ministry of Defence records
    c. Central and Local Government Records
    d. Public Records Office (Kew)
    e. Historic Maps and Air Photography
    f. Open-Source information (Internet)

Ministry of Defence (MOD) Records

33 Engineer Regiment (Explosive Ordnance Disposal) Royal Engineers is the unit responsible for maintaining the records concerning conventional Bomb incidents, reports, clearances and related UXO

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matters. These records are known to be incomplete and are no longer supplied. Based on in-house information released by the MOD previously, it is considered unlikely that any information released will have any significant impact on the findings of this study.

Attack Record Keeping

In general, the quality and accuracy of bombing and shelling records prior to 1942 varied greatly from one region to another. Records relating to the limited air attacks on the United Kingdom are considered to be sufficiently accurate in urban areas to provide a reasonable level of confidence in determining the likelihood that an area was or was not bombed during this period. Wartime records, maps etc held within the civil archives are considerably more comprehensive than those still in existence within the MOD, where it is acknowledged that large numbers of records have been disposed of since 1945. Records from some areas, particularly rural districts or near large bodies of water should still be regarded as an incomplete picture of the extent and effect of the bombing campaign.

Attack Record Accuracy

While an Air Raid was in progress it was inevitable that mistakes would be made in the transcription of rushed verbal reports into the written records. Discrepancies did occur between the total of bombs dropped against detonations witnessed. In some cases, records were made several hours after the event and mistakes were inevitable. Some reports were drafted before the full extent of the raid had been determined which has led to significant omissions in the records. Reports of raids on rural areas were often witnessed and submitted by untrained individuals and passed through third parties before being recorded. Suspect UXBs occasionally went unreported by local farmers and freeholders who saw the event as insignificant or were reluctant to report their findings for fear of valuable land or crops being destroyed by the authorities in their attempts to find the UXB. It should also be noted that bomb strikes in water were notoriously difficult to spot, particularly if the bomb had failed to detonate. As a result, bomb record accuracy in areas containing large bodies of water or marshland is considered to be questionable.

Errors and Omissions

The accuracy of bombing records has been shown to vary greatly; this may have been a result of the individual record keeper's expertise. Additionally, in some cases, errors occurred as a result of poor or incomplete transcription and copying. Some "errors and omissions" were intentional, designed to serve as dis-information to confuse German intelligence. So long after the event, official verification of such incidents has often proven to be impossible to obtain. At present, UXBs are found on construction sites and other locations where there had been no documentary evidence to suggest their presence. These events, although infrequent, do serve as confirmation that records cannot be considered definitive.

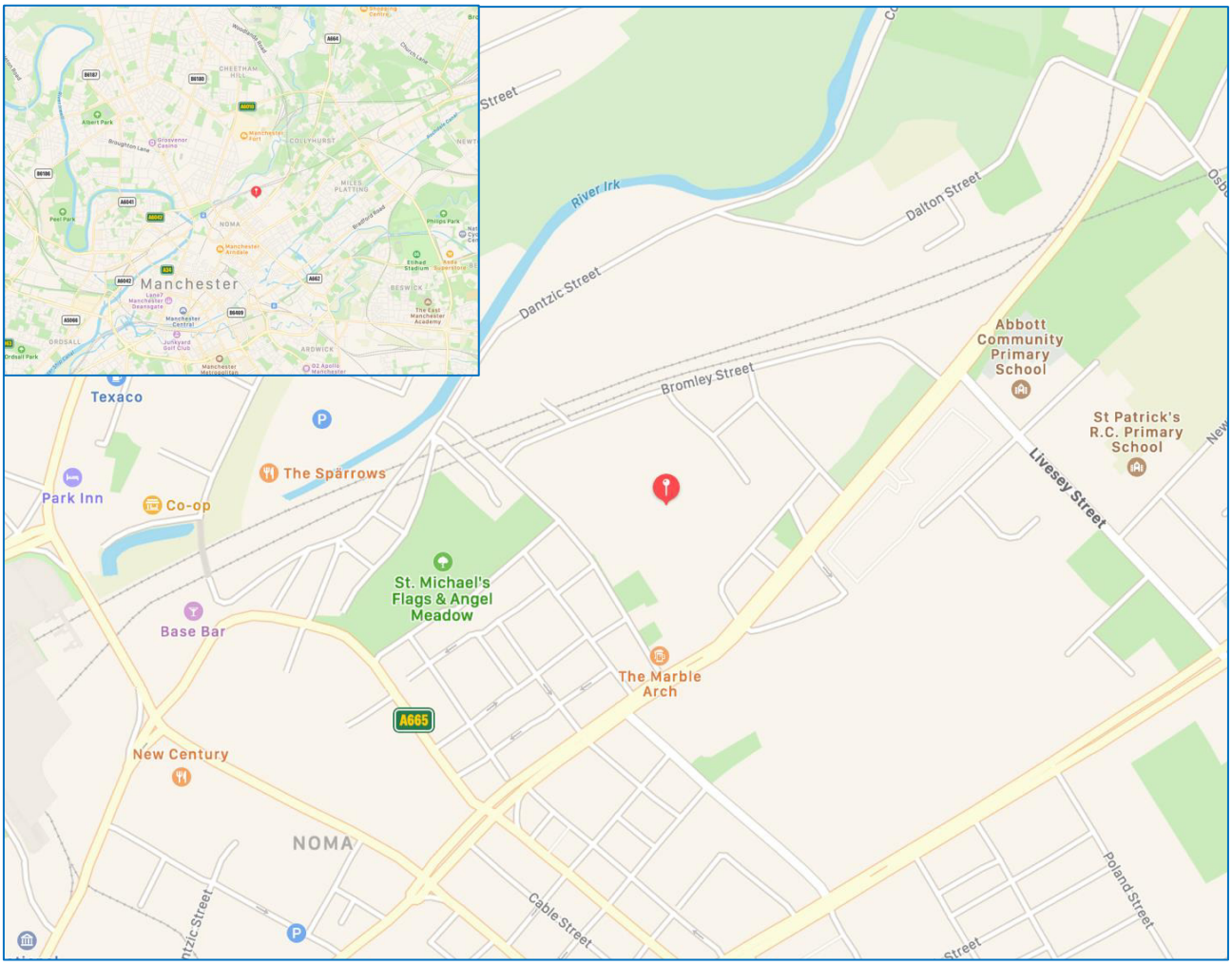
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PART 3: SITE DESCRIPTION AND DETAILS

Location

The Location (red flag). An exact meeting point will be determined by the Client should the need arise.

Table 3.1 Site Location.



Title	Description (Centre of Site)
Address	Gould Street, Manchester,
Post Code	M4 4BH
Nat Grid Reference	SJ 846992 / SJ 8468599234
what3words	mirror.cars.hotel

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Description and Current Usage

PHOTO 3.1: The Site at present is still fully utilised. However, its only use is as a "off street" carpark. All former buildings have been demolished to ground level.



Geology

BGS (British Geological Survey) indicates the following geology.

Wilmslow Sandstone Formation - Sandstone. Sedimentary bedrock formed between 252.2 and 247.1 million years ago during the Triassic period.

Future Works

At the time of writing this report it is understood that the site will be subjected to some form of redevelopment (the exact scope of works is not known at this time). The supplied requirement is usually for, geotechnical investigations, possibly percussive drilling/trial pits/window/samples.

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PART 4: HISTORICAL REVIEW

Historical Mapping

The historical maps in Annex B have been reviewed and a brief synopsis is in Table 4.1:

Table 4.1 Historical Map Synopsis

Date	Scale	Description/Remarks
1922 - 1933	1:2,500	The Site pre-WW2 lies within a well-established built-up area and is both residential and Industrial in nature. Within the Site boundary lies "Rochdale Road Gas Works" which includes three gas holders as well as four large sheds with rail lines used for loading/offloading. There are also several smaller ancillary buildings whose exact usage cannot be determined but can be assumed to form part of the infrastructure required for the Gas Holders.
1948 - 1949	1:1,250	For the most part the Site remains unchanged except for the southeast corner where one of the sheds has been removed and replaced with a conveyor.
1968 - 1990	1:1,250	There has been post war development that has taken place within the Site boundary. The three gas holders remain unchanged. However, the three sheds/conveyor and rail lines have been removed and replaced with one large building which occupies the entire southern half of the Site area.
1992	1:1,250	Further development has taken place within the Site boundary. The Site is now titled as a "depot". It appears that the entire Site has undergone change, this includes both the large building that occupied the Southern half of the Site and the removal of the three Gas Holders.
2024	1:10,000	Further changes have taken place within the Site boundary. All former buildings have been reduced to ground level. The Site at present is being utilised as an "off road" carpark.

Post War Construction/Works

There have been several stages of post WW2 construction as previously stated. Additionally, there has also been post war remediation works carried out in order to clear contaminated ground, particularly in and around the former gas holders.

SOURCE: https://www.ashremediation.co.uk/portfolio/gould-street-gasworks-2/

WWI

Although many people associate wartime bombing with The Blitz during World War II, the first airborne terror campaign in Britain took place during the First World War. Air raids in World War One caused significant damage and took many lives. German raids on Britain, for example, caused 1,413 deaths and 3,409 injuries.

Site Specific Bombing Information

There is no evidence to suggest that the Site was targeted throughout this period.

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WWII

Bombing started as early as October 1939, by the end of the WWII the Luftwaffe had dropped approximately 50,000 tonnes of high explosive bombs and 110,000 tonnes of incendiary bombs, this caused over 40,000 UXBs, killed 43,000 people and over 250,000 homes were destroyed.

Manchester (the Site) Throughout WW2

Manchester and its surrounding area were a major centre of industry during the Second World War. Many large firms were concentrated in the Trafford Park area, making it an important target for the Luftwaffe. Major producers included the aircraft manufacturers A V Roe that produced Manchester and Lancaster Bombers; Ford also employed 17,000 workers making aero engines in a huge new factory complex. During the raids on 22nd – 24th December 1940, the Metropolitan-Vickers works in Mosley Road was just one of the areas factories that was badly damaged. In a later raid 1n 1941 Manchester United's Stadium was hit by a bomb and remained out of action till 1949.

Manchester was attacked on the night of 22nd – 23rd December and again the following night of 23rd – 24th December 1940 (the Christmas raids). On the first night of the raids over 272 tons of HE Bombs was dropped, followed the next night by a further 195 tons. In cooperation to this the Luftwaffe also dropped around 2000 Incendiary bomblets across the city.

Additionally, to these raids, Manchester also suffered smaller attacks, including one in June 1941 when the Blitz was thought to be over. The city had three major raids over the Blitz period (a major raid being defined when over 100 tons of HE Bombs have been dropped) in total, more than 578 tons of explosives were aimed at the city making it the 11th most heavily raided city in Britain.

During the Christmas Raids over 600 fires were started by Incendiary bombs, unfortunately the majority of these were allowed to burn causing further damage. This was due to the cities 3,500 full and part time fire fighters had not returned from Liverpool where they had been sent several days before to help fight fires caused by previous raids. In some cases, the Army was utilised to demolish surrounding buildings to stop the fire from spreading further. Some of the fires continued to burn throughout the day on the 23rd December, providing a beacon for the German Luftwaffe upon its return that night.

So far as the city's infrastructure was concerned, following the Christmas raids both of Manchester's railway stations had been hit, as were the major bus stations. Deansgate and Oxford Road were blocked by debris from damaged buildings; bomb craters and UXBs meant that whole sections of the city had to be cordoned off. Water supplies were also affected, and electricity was rationed.

As can be seen within the Bomb Map in Annex D there does appear to have been at least four bomb strikes within the Site boundary itself, including strikes on the Gas holders themselves.

Abandoned Bombs/UXO

EOD Contracts records could find no evidence of any abandoned Bombs in or around the subject Site.

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Anti-Aircraft Artillery

There is no recorded evidence of the site being utilised for this purpose.

Explosive or Munition Factories

No explosive or munition factories were noted.

Military Usage

No records that indicate that the site has served any military purpose other than as a supply depot, as previously highlighted.

Prior Clearance Operations

EOD Contracts could find no evidence to suggest that there have been any prior UXO clearance operations in or around the site footprint.

PART 5: SOURCES OF UXO CONTAMINATION

The main sources of UXO contamination that have been researched for the site are:

Air delivered ordnance bombs and sub-munitions/incendiaries.

- Anti-Aircraft Ammunition (AA)
- Air delivered ordnance bombs and sub-munitions/incendiaries.

General

UXO contamination pathways from:

- Air delivered ordnance bombs between 100m and 200m.
- The nearest Anti-Aircraft Weapons (AA) is over 3km.
- No recorded use as an Explosive or Munition Factory
- Has had no Military Usage

UXOs are essentially dangerous; therefore, further information on UXO and Safety is detailed in Annex D.

Bomb Penetration Depths

The weapon penetration depths have been assessed as part of the tables in Annex D.

Factors Affecting Penetration

The penetration of sub-surface bombs will be affected by the following:

- Height of release
- Weight, shape, and design of bomb
- Aerodynamic qualities
- Angle of flight and impact
- Nature of impact surface
- Nature of sub soil

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The expected bomb depths for the site assuming the following criteria:

- 15,000 feet, the vast majority of bombs were dropped from height to avoid AA fire and balloons.
- General Purpose Bombs of 50kg to 1000kg
- Near Vertical impact 80 to 90 degrees
- Surface geotechnical conditions are made ground.
- Subsurface geotechnical conditions are generally clays.

Therefore, the expected depths for Air dropped UXBs on site are indicated in RED in the following table:

TABLE 5.1: Bomb Penetration Depths

	Bomb Weights			
Sub-Soil Type	50kg	250kg	500kg	1000kg
Soft Rock	2.442	5.016	6.006	7.062
Gravel	2.442	5.016	6.006	7.062
Sand	2.442	5.016	6.006	7.062
Chalk	3.7	7.6	9.1	10.7
Shingle	3.7	7.6	9.1	10.7
Dry Clay	3.7	7.6	9.1	10.7
Wet Sand	5.55	11.4	13.65	16.05
Wet Clay	5.55	11.4	13.65	16.05
Average Offset (m)	0.8-1.6	1.6-3.7	3-4.5	3.4-5.3

PART 6: RISK ASSESSMENT

Risk Assessment

Assessing both the likelihood of occurrence and the consequences of the encounter has derived the overall risk for the site from unexploded ordnance. Review of the Site's history and geographic location can provide an overall likelihood of encounter factor, which is used in the subsequent determination of a risk level when a Figure can be determined for the consequence.

Likelihood of Encounter

Given the study findings and other criteria (see Annex E Tables) it is considered that there is a **LOW**/ **MEDIUM** risk of encountering UXO within the Site footprint. This finding is based on assessment of all of the available information and taking account of the following factors:

- The Site area is situated within Manchester, which is off historic fact was bombed on several occasions throughout WW2, the worst of which being the Christmas raids. However, despite this it is situated away from the centre of Manchester which is where the focus of the raids took place.
- The Site was subjected to bombing throughout WW2 as can be seen in Annex D.
- The Site area was fully utilised throughout WW2.
- The Site would have been considered a viable and strategic target throughout this period.

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- There have been several phases of construction and remediation works that have taken place within the Site boundary post WW2. However, it cannot be guaranteed that these remediation works went to protentional bomb penetration depth.
- Encounters of UXO are not uncommon, recent UXO finds are in Annex E.

Consequence of Encounter

The consequence (see Annex D) of an uncontrolled encounter with UXO, given its lethal design and its unpredictable nature could be catastrophic and warrants a high severity factor. With regards to the consequences, the following factors were considered:

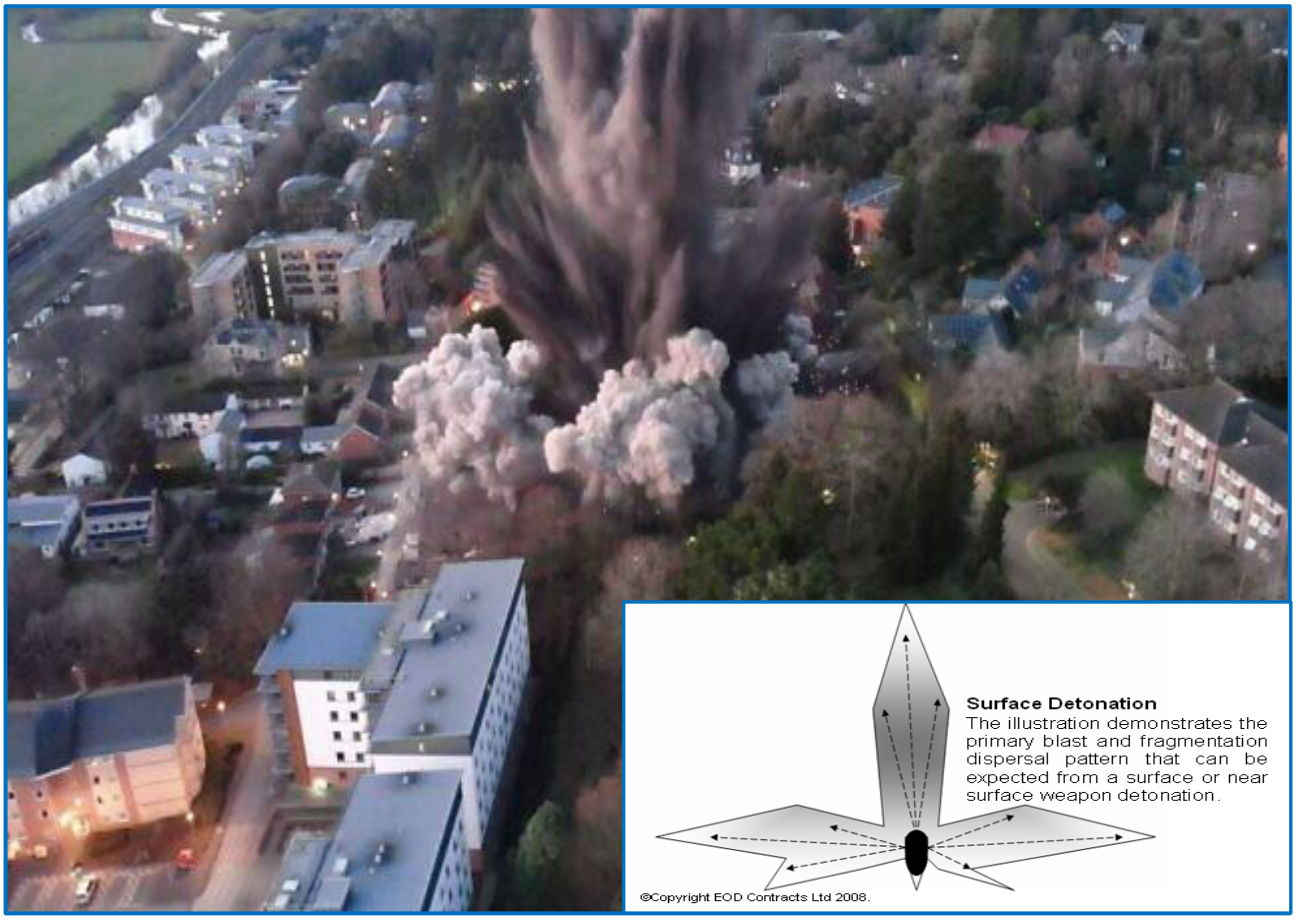
The project works may make use of a number of common ground investigation and construction techniques in its methodology during the project. Any intrusive groundwork has the potential to encounter UXO.
Intrusive earthwork, piling driving and dynamic ground compaction are by nature, aggressive, significant force (kN) is often required to achieve the desired results. As a precaution it is prudent to assume that any external stimulus, no matter how slight, may result in an unstable weapon detonating.

Records of encounters with UXO, particularly where plant machinery has been involved have resulted in detonations of the items with varying degrees of consequence; ranging from slight injuries sustained to piling contractors when a bomb detonated at 6.0m bgl to fatal injuries sustained to a construction worker while conducting near surface machine works on a motorway.

Detonation on land; the effects of a detonation at depth will be more localised and less destructive than one occurring on the surface. Figure 6.1 shows an illustration of the primary blast and fragmentation dispersal from explosive ordnance when it detonates on the surface. The weapon's design, and other key factors such as the ratio of explosive charge weight to total weapon weight (CWR) and the Net Explosive Quantity (NEQ) will determine the size and effects of a blast. The effects will also be enhanced or reduced by a number of factors including, the presence of other energetic materials in close proximity to the blast or if the weapon is buried or exposed on the surface. As a guide Annex E Table 1 gives an indication of the likely blast radius for common types of UXO.

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Figure 6.1: Primary Blast & Fragmentation on Land



In addition to the dangers of explosion, many common chemicals used in the manufacture of explosive ordnance fillings are in sufficient quantity, and level of exposure, toxic or poisonous. Although it is unlikely that such chemicals would be encountered in significant quantity to represent a significant risk to personnel, leakage or venting could pose a risk to the local marine environment. In addition to heavy metals, copper, lead, zinc etc used in the weapon body and fuze, hydrocarbon propellants such as Kerosene may also be present.

Risk Level

The prevailing risk level has been determined to be **LOW** within the Southern half of the Site area and a **MEDIUM** risk in the northern half. (See Risk Map)

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PART 7: CONCLUSIONS

Based on the information researched by EOD Contracts Ltd for the proposed scope of works being carried out within the given site area, the following conclusions have been reached:

Historical UXO Contamination

The indicators for UXO contamination are:

Bomb Strikes	There are no recorded incidents of the site being the subject of bombardment throughout WW1. Manchester was targeted heavily throughout WW2. The Site would have been considered a strategic target throughout this period. Known bomb strikes within the Site boundary. There have been several phases of construction and remediation works that have taken place within the Site boundary. The Site was fully utilised throughout WW2.
Bomb Damage	Difficult to ascertain.
Reconstruction	No obvious signs
Military Usage	No obvious signs.
Explosive/Munition Factory	No obvious signs

Risk Level

The overall risk has been determined to apply to all ground works within the site footprint.

Risk Level	Therefore, so far as reasonably practicable the risk level on Site has been deemed as both a **LOW** risk and **MEDIUM** risk for some areas. See risk map.
Risk Depth	7.062 for areas deemed a **MEDIUM** risk

PART 8: RECOMMENDATIONS

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **LOW** risk.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **MEDIUM** risk.

Communicating the risks, all stakeholders should be made aware of the UXO situation on the site and the possible impact it may have on the project works and day to day running of the district. Clients have a legal

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duty under the Construction Design & Management Regulations (CDM) and Health & Safety at Work legislation to provide Designers and Contractors with project specific information needed to identify hazards and risks associated with the design and construction work. The possibility that UXO may be encountered on site falls within the category of a significant risk and as such it should be addressed as early as possible in the lifecycle of the project.

Further planning: the risks posed by UXO should be brought to the attention of the Project CDM Coordinators and other individuals with a responsibility for project safety and operations at the site. The matter of UXO should be considered critical to project safety and one requiring high priority action.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

Project overview and the responsibilities of those working on site with regard to duty of care and public safety.

UXO recognition and safety procedures to be followed on discovery of a suspicious object or the alarm being sounded.

Emergency procedures to be followed in the event of an explosion. Evacuation routes, muster stations and accounting for personnel.

Work permits, works methodology and specific UXO risk mitigation methods. Post-incident inspections and returning to normal works.

Prior to any intrusive piling or drilling commencing, UXO safety testing and appropriate clearance certification into the ground to sufficient depth to provide clearance from UXO. This can be done using a progressive drilling process or (where large numbers of piles are to be placed and ground permitting) using a vehicle borne hydraulic system to push a magnetometer into the ground to test for the presence of UXO prior to piling.

UXO safety monitoring of all “at risk” excavations, including geotechnical or archaeological trial pits to be conducted during the project. This should be provided by a UK Home Office Authorised EOD/UXO Contractor using qualified EOD Engineer with specialist locators and detectors to scan the ground ahead of the excavation wherever possible.

9.0: SPECIFICALLY

Geotechnical investigations, percussive drilling/trial pits/window/samples, require an EOD Engineer over watch.

The removal of all buildings within the site footprint can be removed down to ground level (including basements)

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New foundations with piling should be mitigated by the insertion of a magnetometer to encompass the pile position, this would be carried out using a CPT rig (magcone), the expected radius of the magcone is 1.5m therefore multiple piles could be checked.

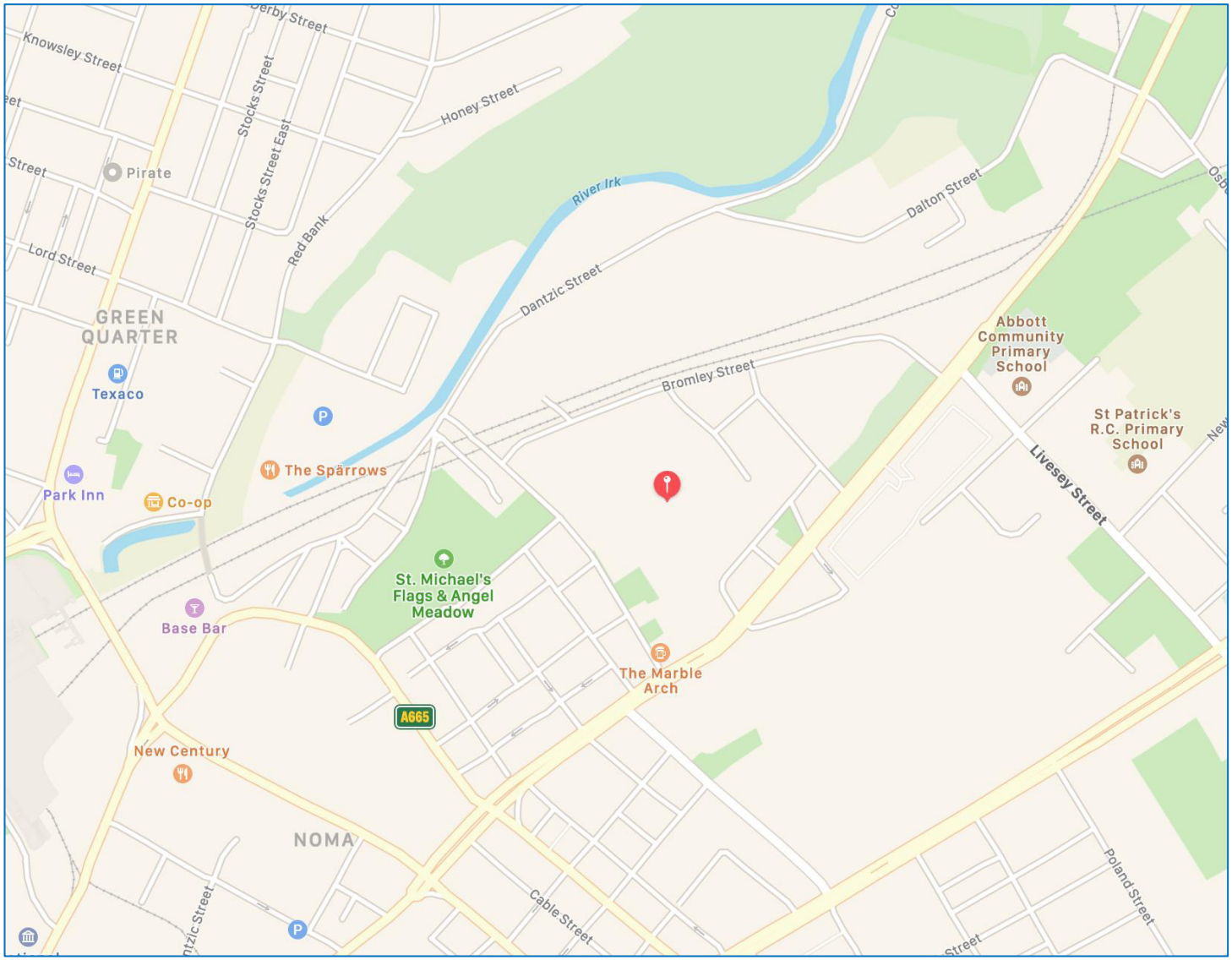
Non-Intrusive Magnetometer surveys generally prove inconclusive on "Brownfield sites", this is due to the high ferromagnetic background, therefore this methodology is not recommended for this site and shallow excavations should be overseen by a qualified EOD Engineer.

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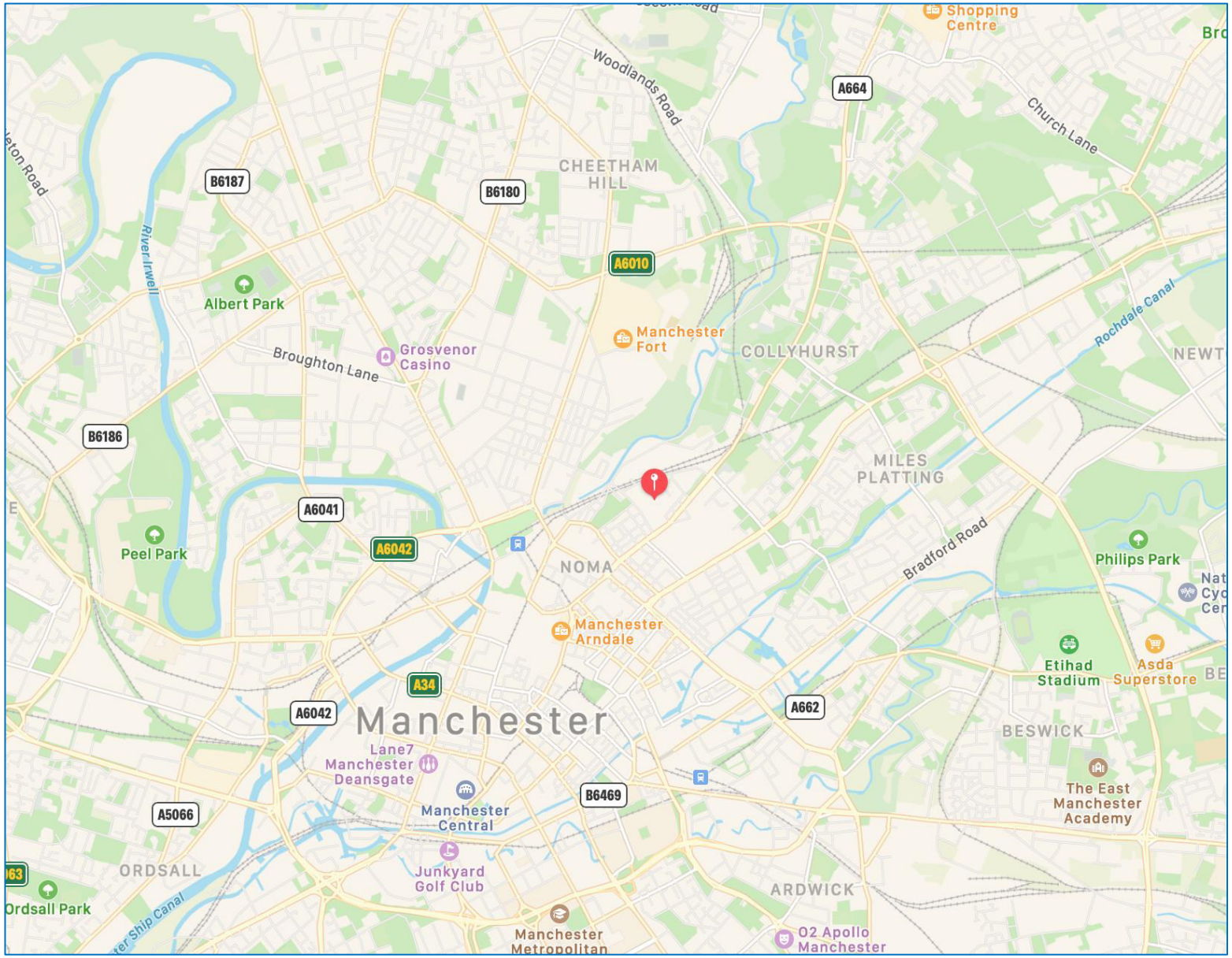
Annex A

SITE LOCATION

The Site Location (red flag). An exact meeting point will be determined by the Client should the need arise.



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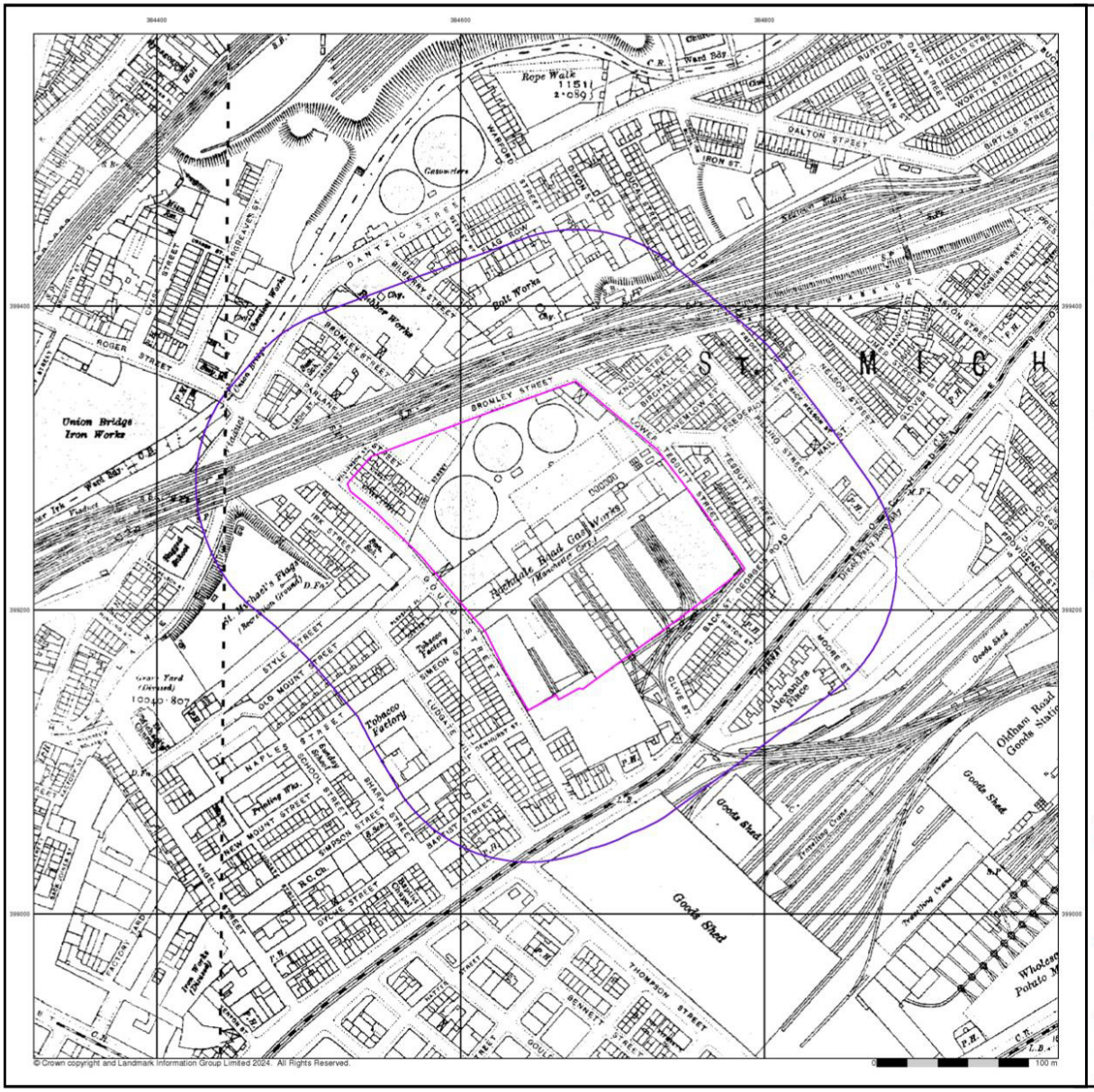
Annex B

HISTORIC MAPS

Index of Historical Maps

Page No.	Date	Scale	Description/Remarks
B-2	1922 - 1933	1:2,500	The Site pre-WW2 lies within a well-established built-up area and is both residential and Industrial in nature. Within the Site boundary lies "Rochdale Road Gas Works" which includes three gas holders as well as four large sheds with rail lines used for loading/offloading. There are also several smaller ancillary buildings whose exact usage cannot be determined but can be assumed to form part of the infrastructure required for the Gas Holders.
B-3	1948 - 1949	1:1,250	For the most part the Site remains unchanged except for the southeast corner where one of the sheds has been removed and replaced with a conveyor.
B-4	1968 - 1990	1:1,250	There has been post war development that has taken place within the Site boundary. The three gas holders remain unchanged. However, the three sheds/conveyor and rail lines have been removed and replaced with one large building which occupies the entire southern half of the Site area.
B-5	1992	1:1,250	Further development has taken place within the Site boundary. The Site is now titled as a "depot". It appears that the entire Site has undergone change, this includes both the large building that occupied the Southern half of the Site and the removal of the three Gas Holders.
B-6	2024	1:10,000	Further changes have taken place within the Site boundary. All former buildings have been reduced to ground level. The Site at present is being utilised as an "off road" carpark.

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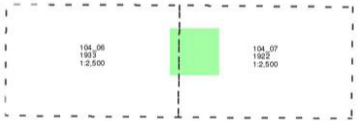
Lancashire And Furness

Published 1922 - 1933

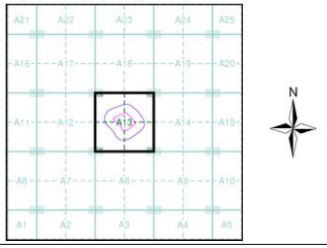
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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National Grid Reference:	384660, 399250
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Site Area (Ha):	3.05
Search Buffer (m):	100

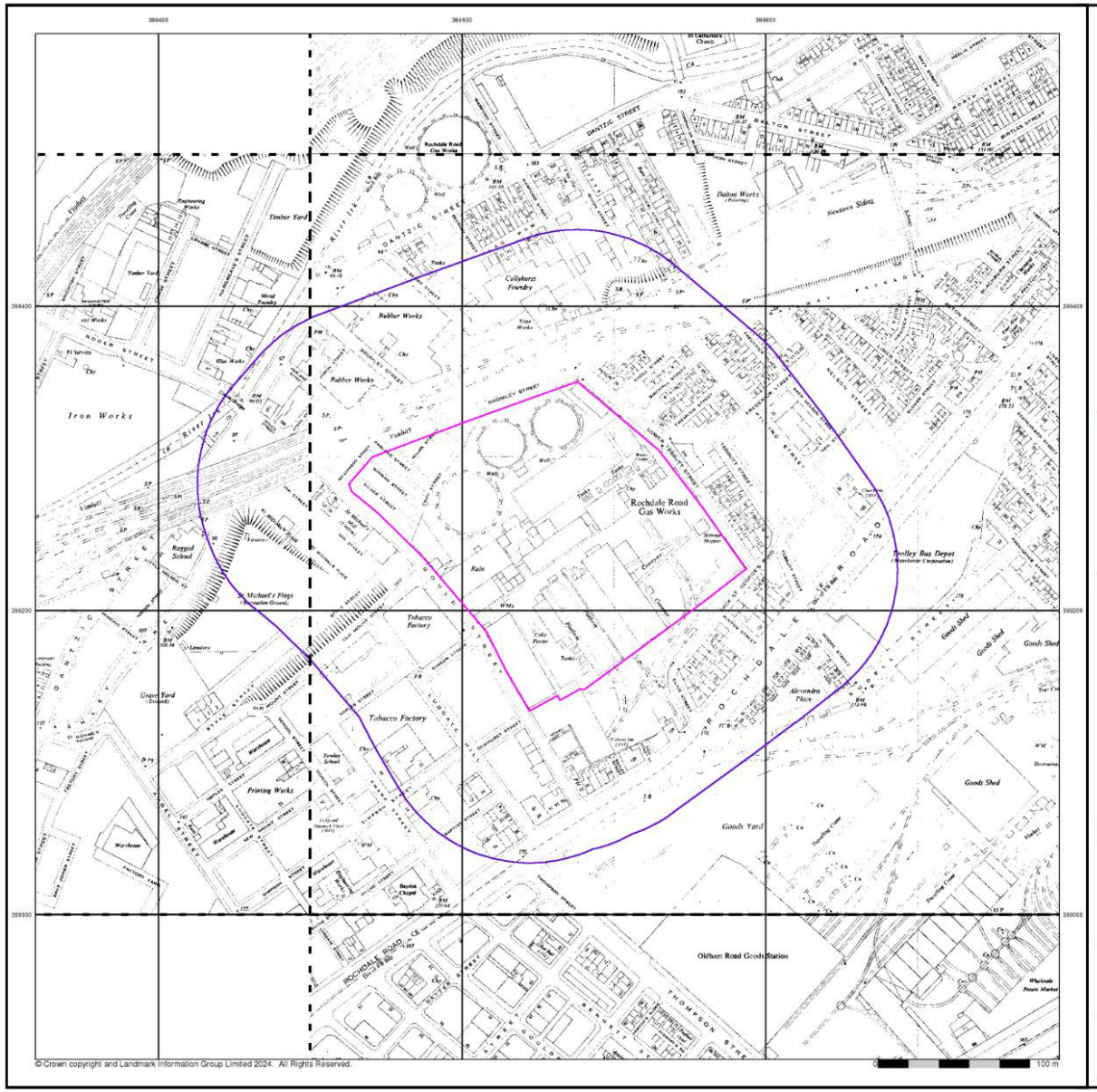
Site Details

Gould Street, Manchester, M4 4BH

Landmark INFORMATION GROUP

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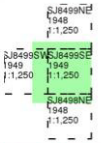
Ordnance Survey Plan

Published 1948 - 1949

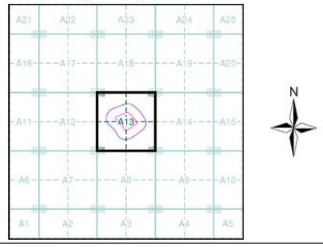
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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Historical Map - Segment A13



Order Details

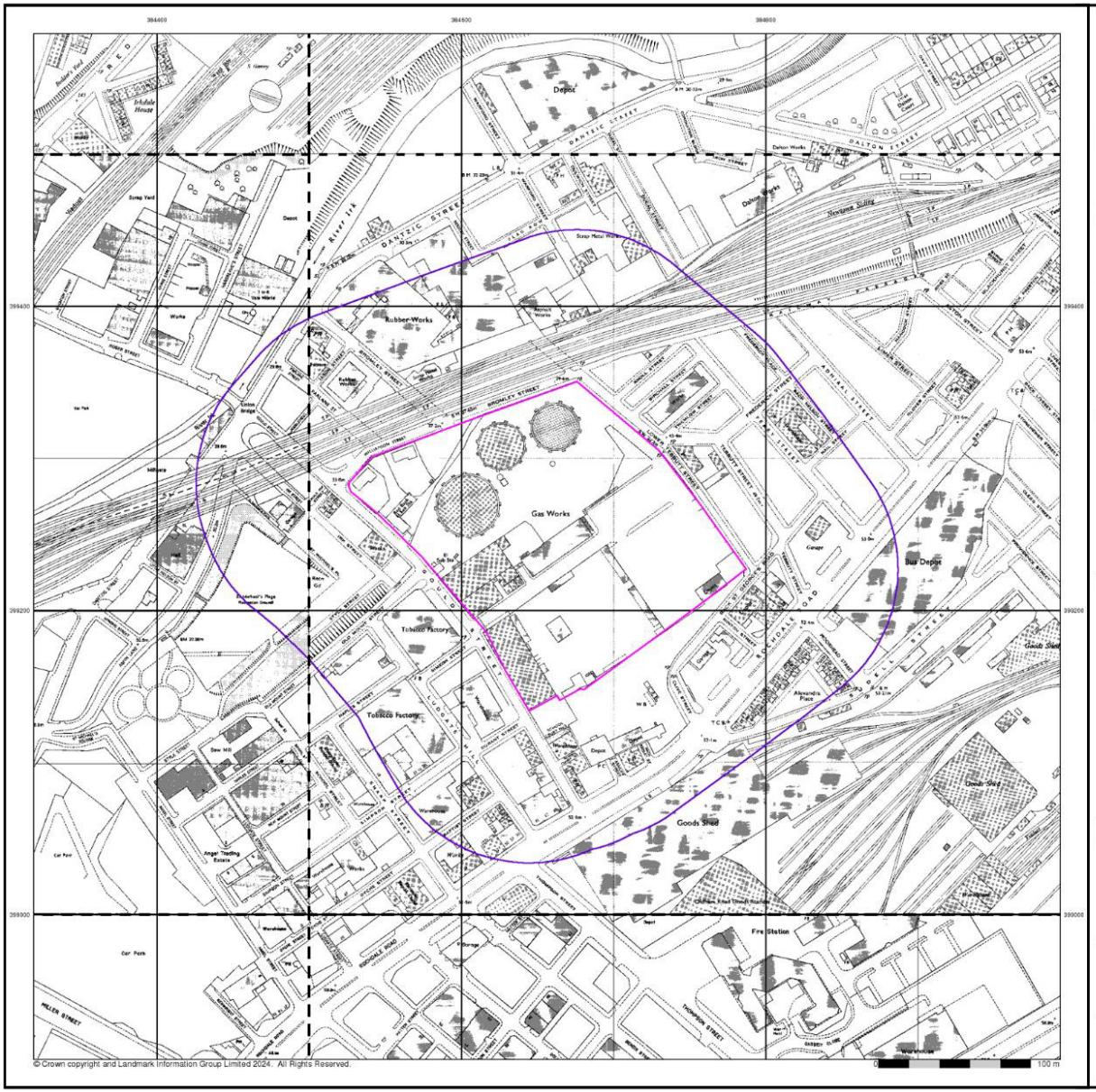
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National Grid Reference:	384660, 399250
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Search Buffer (m):	100

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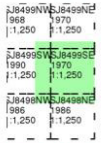
Ordnance Survey Plan

Published 1968 - 1990

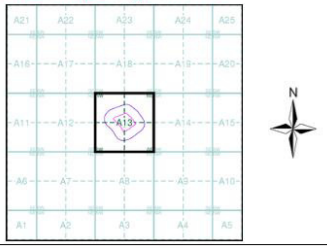
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



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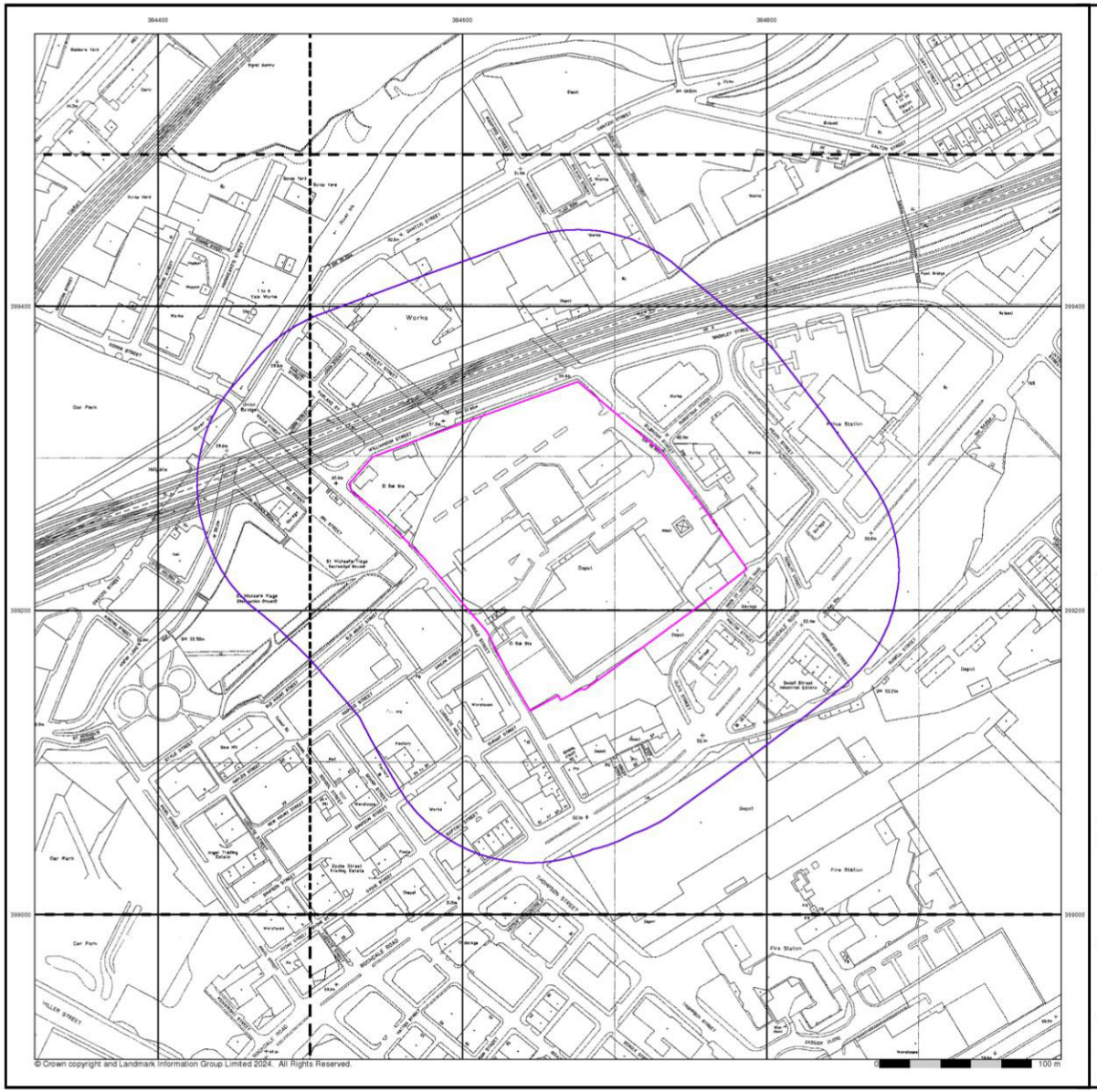
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Site Area (Ha):	3.05
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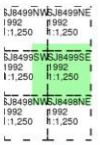
Large-Scale National Grid Data

Published 1992

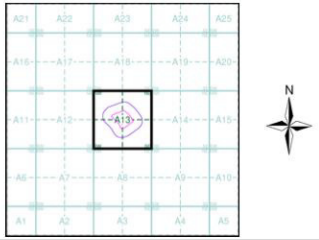
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	349249836_1_1
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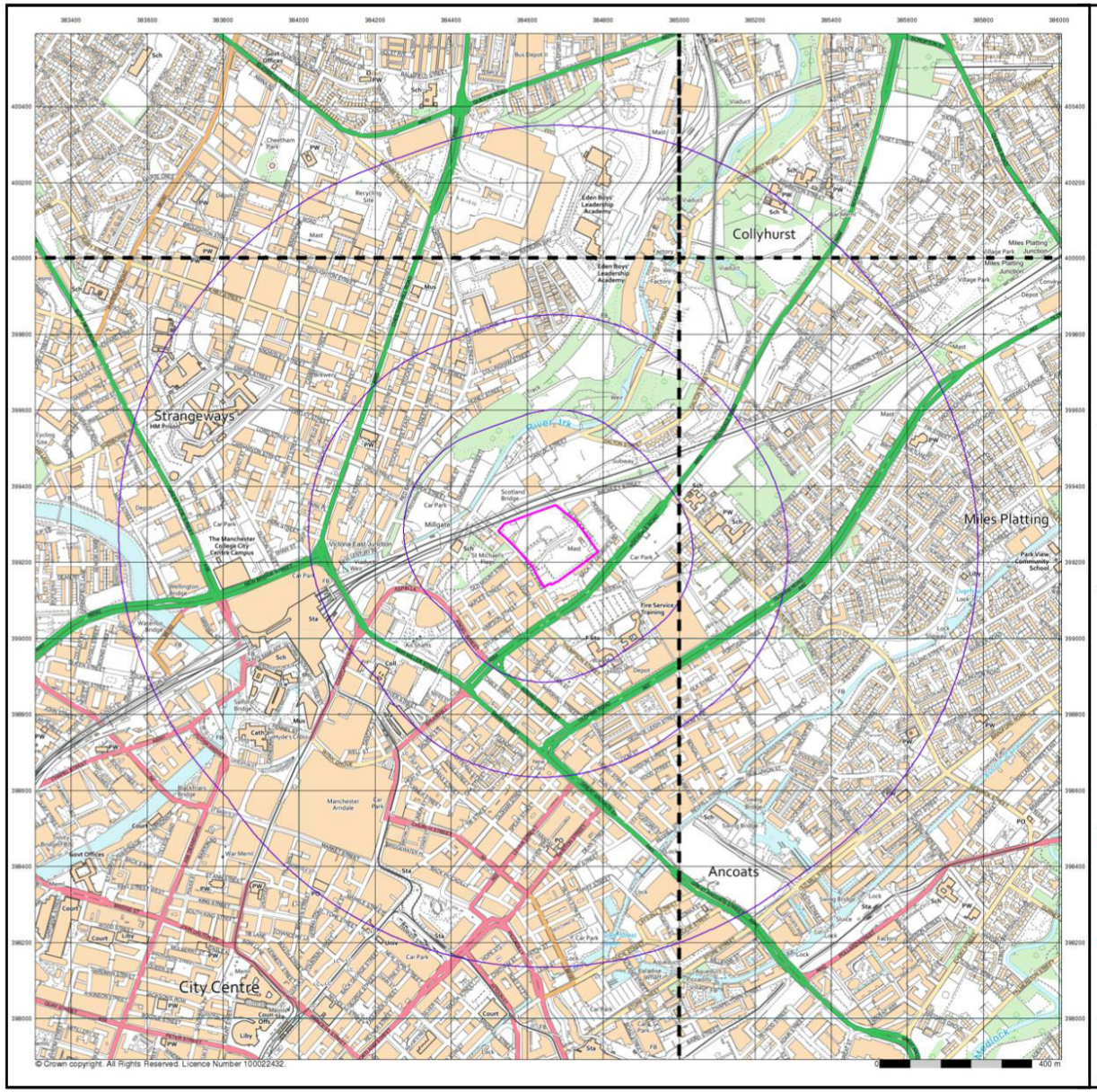
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VectorMap Local

Published 2024

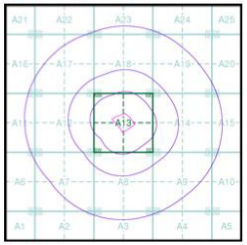
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

SD80SW 2024 Variable	SD80SE 2024 Variable
SJ89NW 2024 Variable	SJ89NE 2024 Variable

Historical Map - Slice A



Order Details

Order Number:	349249836_1_1
Customer Ref:	24210 Gould Street BROWNFIELD
National Grid Reference:	384660, 399250
Slice:	A
Site Area (Ha):	3.05
Search Buffer (m):	1000

Site Details

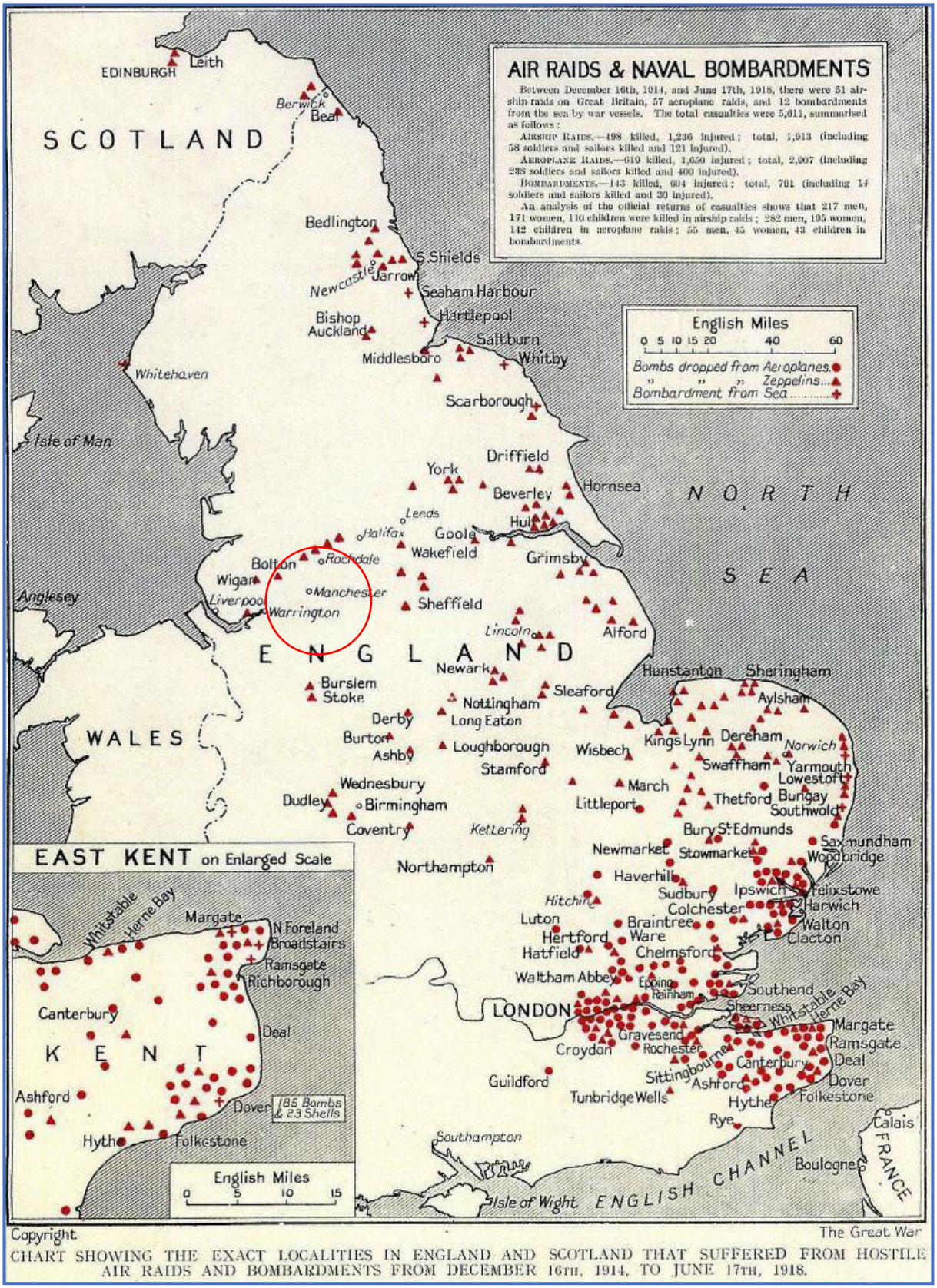
Gould Street, Manchester, M4 4BH

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

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Annex C

BOMB RAIDS WWI



Copyright The Great War

CHART SHOWING THE EXACT LOCALITIES IN ENGLAND AND SCOTLAND THAT SUFFERED FROM HOSTILE AIR RAIDS AND BOMBARDMENTS FROM DECEMBER 16TH, 1914, TO JUNE 17TH, 1918.

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Annex D

BOMB IMPACT MAPS

PHOTO D-1(accumulation map): Extracted Manchester Archives. The Site (approximate, red arrow) – This map highlights both bomb strikes as well as bomb damage. As can be seen there are at least four bomb strikes within the Site boundary.



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Annex E



Source:	Kent Online
Date:	15th November 2023
Description:	**Dig uncovers V2 Nazi rocket in Halstow Marshes, Hoo – 78 years after it was fired at London from German occupied Holland.** Remains of a Nazi V2 rocket fired at Britain during the Second World War have been unearthed in a Kent field. The 12.5-tonne German missile was launched towards London from The Hague in occupied Holland 78 years ago but fell short of its target instead landing in the Halstow Marshes on Medway's Hoo Peninsula. The force also noted: "The Warwickshire Police goalkeeper won't be happy. it was blown up in the six-yard box of the pitch." Researchers have pinpointed the exact date and time of its explosion as February 17, 1945, at 2pm. Hitler used the missiles – the world's first ballistic missiles – as part of his terror weapons programme in an effort to force Britain into surrender. Around 100 of these "Vengeance Weapons" were fired towards Britain each week between 1944 and 1945, in the hopes of causing maximum destruction of the V2's weight, 8.5 tonnes was made up of fuel, three tonnes comprised the missile's body, and one tonne made up the weapon's warhead. The find is the second V2 rocket found in Kent in the past few years, with the team at Research Resource Archaeology previously digging up a missile at St Mary's Platt near Sevenoaks back in 2021.

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Source:	BBC
Date:	10th February 2023
Description:	**Army bomb disposal experts have carried out a controlled explosion after World War Two ordnance was found in the River Leam in Leamington Spa.** Warwickshire Police closed part of Willes Road around the Mill Gardens Park during Sunday's operation. A group called the Peaky Dippers, that trawls the river with magnets to hunt for metal, said on social media that it made the find. The roads and the park reopened by 19:00 GMT. A member of the Peaky Dippers group claimed on Facebook: "There wasn't just one bomb found, there [were] numerous WW1 and WW2 guns, grenades and artillery tips..." Warwickshire Police confirmed magnet fishers made the find and said the 18-pound British shell was taken back to its Leek Wootton headquarters for safe disposal. It said the 80-year-old shell "was clearly very well made" and still had the power to "produce one almighty boom and shake the ground after decades under water". The force also noted: "The Warwickshire Police goalkeeper won't be happy... it was blown up in the six-yard box of the pitch."

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Source:	BBC
Date:	10th February 2023
Description:	**A World War Two bomb found in Great Yarmouth has detonated while work was being done to defuse it, causing a huge blast that was heard for miles.** Army specialists were attempting to disarm it when there was an unplanned detonation at about 17:00 GMT. People on social media said they heard a loud bang and felt buildings shake 15 miles (24km) away. There have been no reports of injuries among the Army, emergency services or the public, Norfolk Police said. Cordons were put in place when the bomb was first discovered close to two gas pipes on Tuesday, and work began to make it safe. The cordons, at 200m (656ft) and 400m (1,312ft) from the bomb, were lifted on Friday evening. Most roads have been reopened and residents have been allowed to return to their homes.

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Source:	BBC
Date:	24 July 2021
Description:	A live World War Two bomb unearthed by builders on a housing development has been destroyed in a controlled explosion. The 500lb (227kg) device was found on the new-build estate in Goole, East Yorkshire, on Thursday. Eight homes were evacuated and the M62 was shut between junctions 35 and 37 as a safety precaution. Humberside Police said the device was successfully detonated at 16:22 BST on Saturday. All residents have been able to return to their homes and local business are no longer being asked to remain closed. The force also said a no-fly zone and the closures of the M62 and other roads nearby had since been lifted. John Sharpe, site manager of the Beal Homes development, said he received a call from workers just after midday on Thursday. "They didn't know what they'd dug up at first and a guy went down into the hole because we thought it was a metal pipe. "As he uncovered it he realised it was a bomb and got out pretty quickly," he said.

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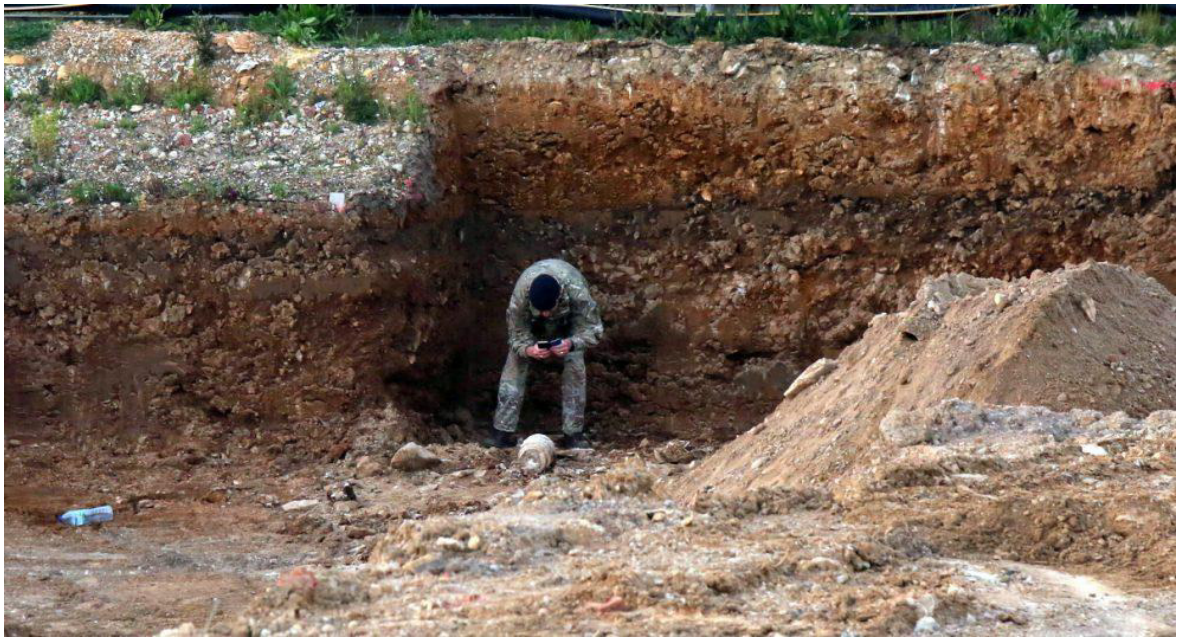






Source:	The Sun
Date:	27 February 2021
Description:	A WORLD War II bomb which sparked a mass evacuation in Exeter has been detonated by army experts leaving a crater the "size of a double decker bus." The noise from the huge blast - which sent debris flying more than 250 metres - could be heard five miles away with some residents claiming the aftershock rattled their windows. Personnel from the Army's Royal Logistics Corps took over from Royal Navy bomb disposal experts this morning. They used 400 tonnes of sand to create an enclosing "box" before it was "made safe" at around 6.10pm. He added: "Around 400-tonnes of sand was transported to the site of the device, which is at a building site on private land, and walls were erected... to mitigate the impact of the detonation. "Trenches were also dug to prevent ground shock. Despite these mitigation measures, the impact of the blast has been significant and debris has been thrown at least 250-metres away. "The crater is around the size of a double decker bus.

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Source:	UKNIP
Date:	04 May 2020
Description:	Officers from Kent Police are working with Army Bomb Disposal officers after the discovery of two unexploded WW2 bombs were located in Kings Hill, Kent. Police were called just after 4:30pm Monday afternoon to Warwick Way after the discovery of an unexploded ordnance. The Army Bomb disposal service were called in to action to attend the scene to evaluate the discovery and make it safe. Shortly after a second ordnance was found in the adjacent road Gibson Drive. Officers have placed a cordon on the area whist the Army investigate and decide if a controlled explosion is needed.

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Source:	The Bolton News
Date:	10 February 2020
Description:	A worker who found an unexploded bomb in a back garden has spoken about the discovery. Aram Mahmoud found the item while putting fence posts in for a house on Bradford Road, and said he recognised the explosive instantly due to growing up in Iraq. Mr Mahmoud said: "We were putting up concrete posts and we were digging and we found a rocket. "We called the police immediately and they came round. The bomb disposal team told Mr Mahmoud that the device was "very very dangerous". Bradford Road was closed between Green Lane and Bishops Road, and Oakleigh Avenue was also shut off with residents evacuated. Both roads have now reopened and the police have left the scene.

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Source:	Sky News
Date:	4 February 2020
Description:	London's Soho Evacuated as World War Two Bomb Discovered A large part of central London's busy Soho area was evacuated after an unexploded Second World War bomb was found at a building site. Police were called at 1.42pm on Monday to Dean Street, connecting Oxford Street to Shaftesbury Avenue, which they cordoned off after the device was discovered near the Soho Hotel. A Royal Engineers bomb disposal unit was called in and removed the half-tonne device. The Metropolitan Police's Soho team said the cordons in Oxford Street, Charing Cross Road, Shaftesbury Avenue, Lexington Street and Poland Street had been lifted shortly after 8:30pm.

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Source:	Express and Star
Date:	May 17, 2019
Description:	Second World War Bomb Detonated in Bilston. A Second World War bomb was detonated by the army in Bilston last night following a discovery by a workman. The detonation took place on what appeared to be a building site at around 8.30pm. A West Midlands Police spokesman said: "We were called to reports of an unexploded World War 2 bomb at a building site on Coseley Road, Bilston, at 3.40pm. A controlled explosion was carried out."

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Sip Grenades



Aftermath of Demolition



Source:	The Beach https://www.thebeach.co.uk/news/local-news/bomb-squad-called-after-dozens-of-second-world-war-grenades-discovered/
Date:	28th May 2019
Description:	Army bomb disposal teams have detonated 24 grenades found in a field in East Suffolk. The 'SIP grenades' - which stands for 'self-igniting phosphorus' - were discovered in the village of Sifton, which is near Yoxford, yesterday. The bombs, which were designed during the 1940s, were glass bottles filled with phosphorus and petrol. Unlike traditional Molotov cocktails, they would ignite spontaneously when the glass shattered, and the phosphorus became exposed to air. The grenades were issued to Home Guard units in the event of a German invasion as that never happened crates of them have been left buried in unregistered hiding places.

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Source:	BBC News
Date:	19th May 2019
Description:	A suspected German wartime bomb which was caught in a fishing net off the coast of the Isle of Wight has been detonated. A fishing vessel reported picking up the 7ft-long sea mine, which was "most likely an old German wartime sea mine", about a mile from the Needles at around 8am on Saturday, the Maritime, and Coastguard Agency (MCA) said. Bomb disposal experts from the Royal Navy's Portsmouth base were called in to detonate the device, while warnings were issued to ships and public in the area. Divers placed the mine back on the seabed and blew up the bomb – found to contain 2,000lb of explosives – at 10.51am on Sunday, the Ministry of Defence said.

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Annex F

Risk Assessment Tables

Table 1: Summary of Potential Contamination Sources

Source	Applicable	Not Applicable
Enemy Attack & Counter Measures		
Bombing WW1		☒
Manned Aircraft Bombing WW2	☒	
Unmanned V1 & V2 Rocket Attack		☒
Shelling		☒
Anti-Shipping Mines & Depth Charges		☒
Anti-Aircraft Shells & Rockets		☒
Beach Mines & Coastal Defences.		☒
Airfield/Key Point Defensive Mines/Charges		☒
Abandoned Unexploded Bomb (A/UXB)		☒
Migration of UXO		
UXO Migration in Rubble & Infill		☒
UXO Migration by Tide & River Current		☒
UXO Migration by Marine Dredging		☒
Shipwrecks		☒
Dispersal by Explosion, Fire & Accident		☒
Aeroplane Crash		☒
Private Collections		☒
MOD Facilities		
Bombing Range		☒
Artillery, Mortar & Tank Range		☒
Grenade Range		☒
Small Arms Firing Range		☒
Weapon Research & Development Facilities		☒
Ammunition Burial Grounds		☒
Docks & Harbour Facilities		☒
Offshore Ammunition Dumping Grounds		☒
Ammunition Storage & Manufacture Sites		☒
Airfields & Air Stations (Close Proximity)		☒
Bombing Decoy Site		☒
Army Barracks & Camps		☒
MOD Training / Concentration Areas		☒
Home Guard & SOE Weapon Caches		☒

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Table 2: Airdropped Weapon Strike Indicators (UK)

Item	Increasing Potential level ⇨			
Site Location	Rural	Small Town	**Brown Field Large Towns**	Cities
Site Description and Use	Greenfield or Agricultural Land	**Near Strategic Target**	Adjacent to Strategic Target	Strategic Target
Site History	No history of Attack	**Near area of Attack**	Immediate Area Attacked	Direct Attack
Strategic Target: Military Installation, Industrial or Munitions Manufacturer, Power Station, Gas or Water Works, Port, Dock, Railway Yard, Decoy Site.				

Table 3: Weapon Strike Records (UK)

Source	Availability			
Archive	None	Non-specific	**Specific**	Extensive
In-house	None	Non-specific	**Specific**	Extensive
Anecdotal	None	Non-specific	**Specific**	Confirmed

Table 4: Anti-Aircraft Weapon Strike Indicators (UK)

Item	Increasing Potential level ⇨			
Site Location	Rural	Town	**City**	Military Site
Fixed Battery Location	None	General Area	**Nearby**	Onsite
Mobile Battery	Rural	Town	**City**	Military Site
Military Site: Airfield, Port, Radar, Barracks, Depots, Arsenal or Similar.				

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Table 5: Abandoned Bomb Records (UK)

Item	Increasing Potential level ⇨		
In-house	**None**	Yes	On-site
Other	**None**	Yes	On-site

Table 6: Bomb Strike Density Assessment

Bombs & Mines	Placed at less than 100 - 149 per 100 hectares.

Table 7: Opportunity to have detected Bomb or Shell Strikes (UK)

Increasing Potential level
No KNOWN recorded bombs or damage
Good ARP cover
Significant development
No significant ground cover
Light bombing or damage
Moderate ARP cover
Moderate development
Frequent public access
Little ground cover
Significant bombing or damage (Surrounding Area)
Poor ARP cover
Minimal development limited to shallow excavations (within some areas of the Site)
Infrequent public access
Moderate ground cover
Heavy bombing or damage (surrounding area)
No ARP cover
Development limited to site clearance
Controlled private access
Heavy ground cover, vegetation, ploughing or body of water

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Table 8: Post Contamination Development Indicators (UK)

	Increasing Potential level
Nature of Post Contamination Development	100% excavations of the entire site to below contamination depth.
	Significant development
	Moderate development
	Minimal development (within some areas of the Site)
	No development

Table 9: Construction Activities Encounter Indicators

	Increasing Potential level
Activities	**Borehole Drilling**
	Dynamic Sampling
	Shallow Trial Pit
	Services Trenching
	Bored (CFA) Piling
	Sheet Piling
	Shallow Excavations over extended area
	Deep Excavations over a limited area
	High Density Piles
	Deep Excavations over extended area
	Bulk Excavations

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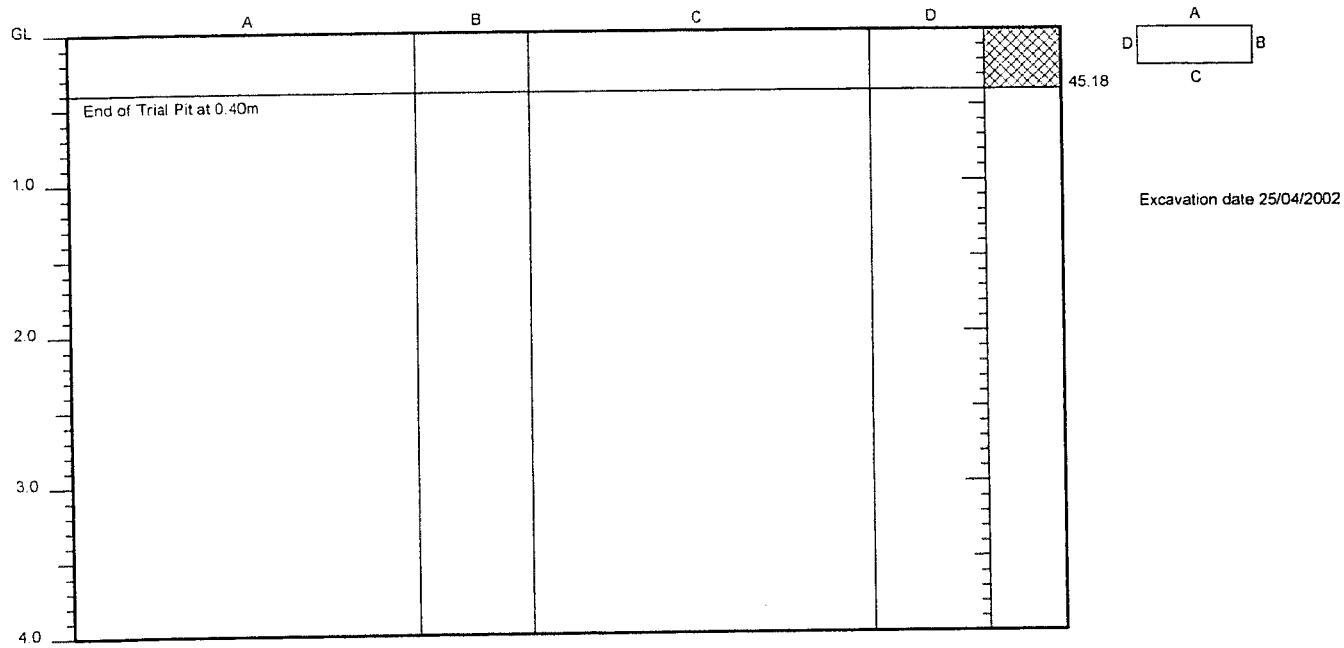
APPENDIX D

Exploratory Hole Logs

Trial Pit Log

Exploration Associates

Logged by PM Checked by	**Equipment and Methods** Trial Pit/Trench from 0.00m to 0.40m.	**Ground Level** +45.58 m OD **National Grid Coordinates** E 384762.65 N 399236.82



Excavation date 25/04/2002

Samples and Tests

Depth (m)	Type & No.	Records
0.20	D1	
0.40	D2	

Strata

Depth (m)	No.	Description
0.00-0.40	1	MADE GROUND. Loose chippings over slightly clayey sandy ash and clinker fragments. Occasional red brick, slag and concrete fragments. Rare green staining mainly in slag fragments. Rare timber and roots

Groundwater
None Encountered

Remarks
Trial pit terminated at 0.40m on red brick foundation

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project GOULD STREET

Project no. 122303

Carried out for Lattice Peoperty Holdings

Trial Pit THA1

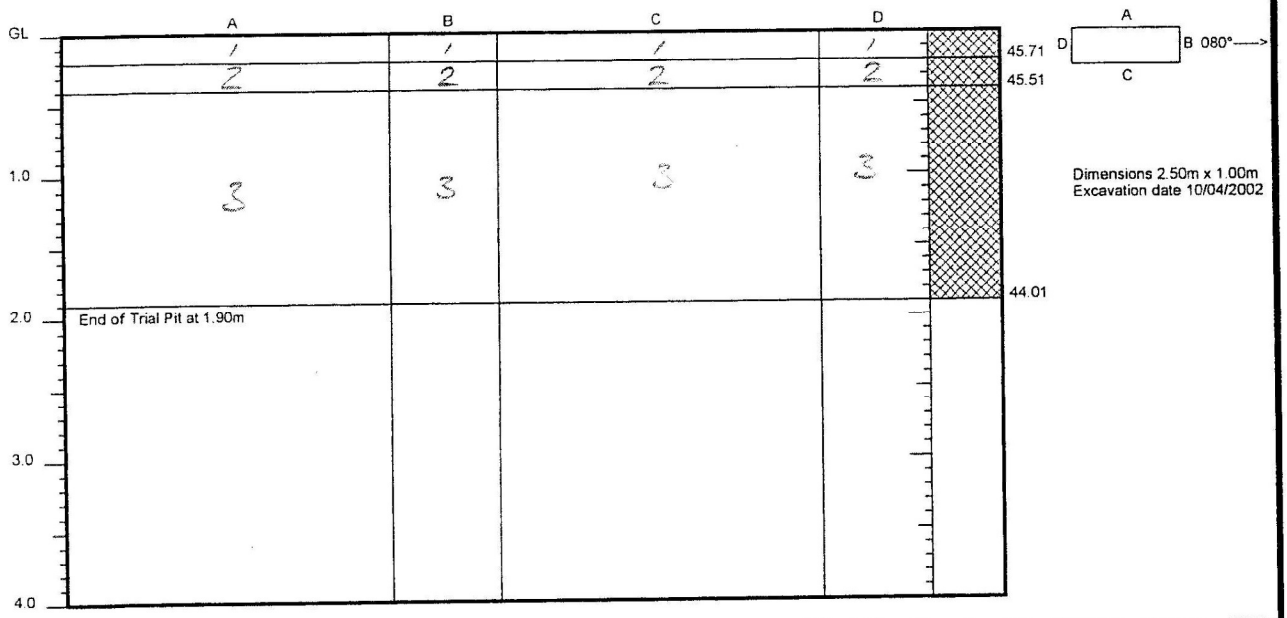
Sheet 1 of 1

11/07/2002 13:43:17 ESGLog v2.11

Trial Pit Log

Exploration Associates

Logged by CRH Checked by	**Equipment and Methods** Trial Pit/Trench from 0.00m to 1.90m.	**Ground Level** +45.91 m OD **National Grid Coordinates** E 384756.08 N 399239.37



Samples and Tests

Depth (m)	Type & No.	Records
0.40-0.50	D1	PID = 34ppm
0.90-1.20	D2	PID = 6ppm

Strata

Depth (m)	No.	Description
0.00-0.20	1	MADE GROUND: Two layers of asphalt
0.20-0.40	2	MADE GROUND: Sandy clayey gravel, orange brown and moist
0.40-1.90	3	MADE GROUND: Sandy gravel of ash and brick rubble to whole brick. Some curved bricks. Vertical 30mm diameter pipe noted At 1.90m bgl: concrete

Groundwater
No. Struck Behaviour

Remarks
Stability : stable, Shoring : no

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project GOULD STREET

Project no. 122303

Carried out for Lattice Peoperty Holdings

Trial Pit TP11

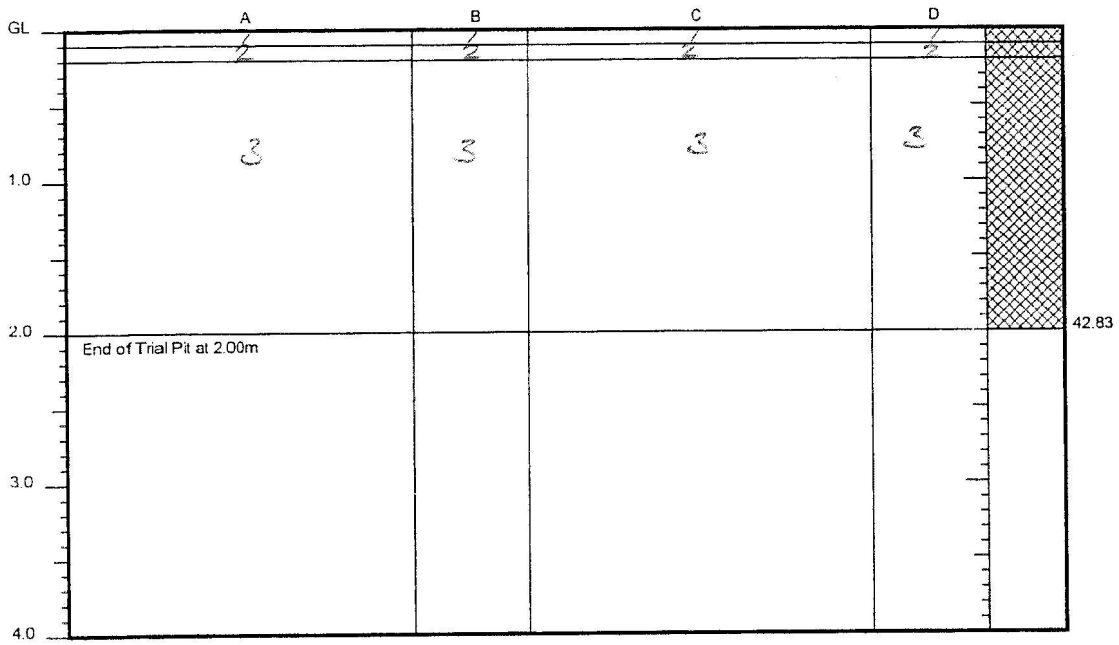
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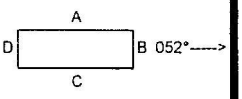
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Trial Pit Log

Exploration Associates

Logged by CRH Checked by	Equipment and Methods Trial Pit/Trench from 0.00m to 2.00m.	Ground Level +44.83 m OD National Grid Coordinates E 384609.29 N 399206.71





Dimensions 2.00m x 1.00m
Excavation date 19/04/2002

Samples and Tests

Depth (m)	Type & No.	Records
0.30-0.40	D1	PID= 0ppm
0.95-1.00	D2	PID= 0ppm
1.70-1.80	D3	PID= 0ppm

Strata

Depth (m)	No.	Description
0.00-0.10	1	MADE GROUND: Tarmac
0.10-0.20	2	MADE GROUND: Clayey gravel grey brown (hardcore)
0.20-2.00	3	MADE GROUND: Clayey gravel, light brown, brick and concrete rubble, minor ash At 0.95m: some ash/dust with large sandstone block, pieces of linoleum, tiles, large sandstone plinth and fire bell

Groundwater
No. Struck Behaviour

Remarks
Stability : spalling from 0.80m, Shoring : no

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project	GOULD STREET
Project no.	122303
Carried out for	Lattice Peoperty Holdings

Trial Pit
TP39
Sheet 1 of 1

30/08/2002 13:04:22 ESGLog v2.11

Inspection Pit Log

Exploration Associates

Drilled by	Equipment and Methods	Ground Level +46.07 m OD
Logged by SMJ	Inspection Pit from 0.00m to 1.10m.	National Grid E 384754.96
Checked by CRH		Coordinates N 399258.89

Samples and Tests

Depth	Type & No.	Records	Date / Casing	Time / Water
0.50 - 0.60	D1	PID = 53.2 ppm.	03/04/2002	
			03/04/2002	

Strata

Description	Depth,Level (Thickness)	Legend
MADE GROUND: Tarmac	0.10 +45.97	a
MADE GROUND: (Rough base course tarmac)	0.30 +45.77	
MADE GROUND: (Buff brown fine to coarse angular to subangular gravel of limestone / sandstone and sand)	0.50 +45.57	
MADE GROUND: (Dark grey slightly clayey sand and gravel with ash and cobbles of bricks)	0.70 +45.37	
MADE GROUND: (Buff coarse sand)	0.80 +45.27	
MADE GROUND: (Bituman coated steel. Intermediate pressure gas mark running 345 degrees)	(0.30pen)	
EXPLORATORY HOLE ENDS AT 1.10 m	1.10 +44.97	

Groundwater
No Groundwater encountered.

Remarks
Hole backfill : 0.00m to 1.10m Arisings (a).

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project GOULD STREET
Project no. 122303
Carried out for Lattice Peoperty Holdings

Inspection Pit
HDP3
Sheet 1 of 1

30/08/2002 13:01:43 ESGLog v2.11

Entec UK

Borehole	**BH507**
Sheet	1 of 2
Project:	**Gould Street Remediation**
Client:	**National Grid**
Project No:	**05760**
Ground Level	m AOD
Contractor :	
Diameter:	
Method :	**Cable Percussion**
Rig Type:	
Co-Ordinates:	E N
Date Drilled:	-

Depth mbgl	Borehole Log: Strata Description	Legend	(Thick-ness)	mAOD	Water Strikes	Sample: Type	Sample: Data	Monitoring Well
0	MADE GROUND: Tarmac.		(0.10)					
	MADE GROUND: Dark brown/black/red sandy GRAVEL of concrete, brick and spent coke/coal.							
1								
			(3.20)					
2								
3					▼			
	Firm to stiff brown sandy CLAY.							
4								
5								
6			(5.60)		▼			
7					▽			
8	... with sand lenses from 8.4m bgl.							
9	Firm to stiff slightly sandy slightly gravelly brown CLAY. Gravel is coarse sized grey siltstone, occasional cobble.							
10								

General Remarks: **Groundwater strikes:**
3.3mbgl rising to 3.25mbgl after 20 minutes.
7.3mbgl rising to 5.9mbgl after 20 minutes.

Logged By: **LUSHM**	All Dimensions in Metres	Scale: **1:50**

Entec UK

Borehole	**BH507**
Sheet	**2** of **2**
Project:	**Gould Street Remediation**
Client:	**National Grid**
Project No:	**05760**
Ground Level	m AOD
Contractor :	
Diameter:	
Method :	**Cable Percussion**
Rig Type:	
Co-Ordinates:	E N
Date Drilled:	-

Depth mbgl	Borehole Log – Strata Description	Legend	(Thick-ness)	mAOD	Water Strikes	Sample Type	Sample Data	Monitoring Well
11			(2.60)					
12	Soft grey brown very sandy SILT. Occasional fine subrounded gravel.		(0.90)					
13	Firm to stiff grey slightly sandy CLAY with occasional gravel sized sandstone lenses from 12.5m bgl.		(0.90)					
14	Red brown fine and medium SAND. (Weathered sandstone).		(1.70)					
15	Borehole completed at 15.0m bgl.							
16								
17								
18								
19								
20								

General Remarks: **Groundwater strikes:**
3.3mbgl rising to 3.25mbgl after 20 minutes.
7.3mbgl rising to 5.9mbgl after 20 minutes.

Logged By: **LUSHM**	All Dimensions in Metres	Scale: **1:50**

	Project: Gould Street	Trialpit No TP701 Page No. 1 of 1
Method: Trial Pit	Date(s): 29/11/2021	Logged By: LH / Checked By: DL
Client: Crowning Developments Limited	Co-ords: 384596.82, 399217.69	Stability: Unstable / Dimensions: 1.60m x 0.70m / Scale: 1:20
Hydrock Project No: 21353	Ground Level: 43.58m OD	Plant: JCB 3CX

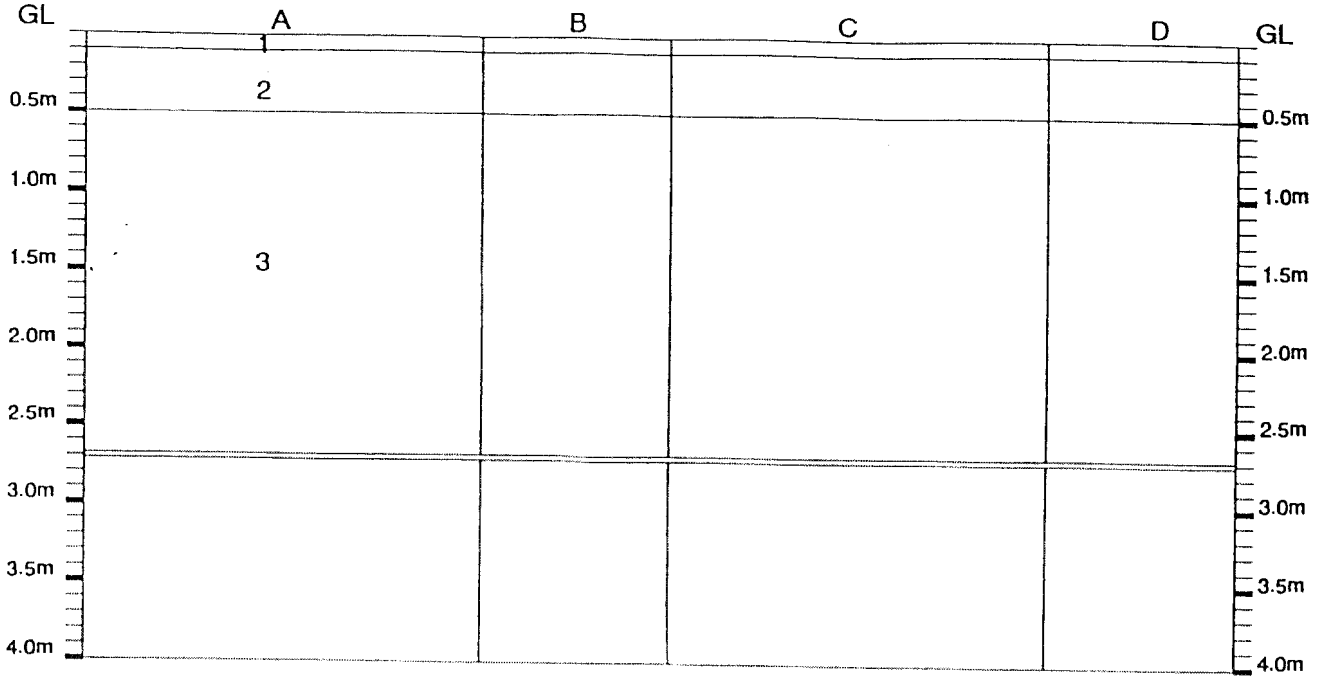
Samples / Tests			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend
Depth (m)	Type	Results						
				ASPHALT HARDSTANDING. (BITUMINOUS MATERIAL)	0.20	(0.20)	43.38	
0.20 - 0.40	B			Dark brown sandy angular to sub-angular,fine to coarse GRAVEL with high cobble content. Gravel is of brlck, coal, limestone, concrete, sandstone with rare wire and fragments of floor tile. Cobbles are subangular of brick. Boulders are sub-angular of concrete. (MADE GROUND)	1.10	(0.90)	42.48	
0.40	ES			Base of Excavation at 1.10m				

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Machine dug trial pit from 0.20m to 1.10m bgl. 3. Terminated at 1.10m bgl due to instability. 4. Backfilled with arisings on completion.

Logged in general accordance with BS5930:2015

Client. British Gas North Western.	Project. Gould Street, Manchester.	Job Ref. 12278	Trial Pit. 16
Office Liverpool / Telephone no. 051 236 6066	Date. 03/12/92	Description by. S.M.Pettitt	Ref. Drawing No. Figure 3.
Pit Dimensions (m). 2.5 x 1.0 x 2.7		Plant. JCB 3CX	Ground Level.(approx.). - - - m A.O.D.

SKETCH



Sample: Depth (m)	Sample: No.	Strata No.	Description.	Vane. Test.
		1	Tarmac	
0.5-1.0	S1	2	Base and sub- base, consisting of grey/brown, orange/brown F.M.C. gravel with much sand.	
1.5-2.0	S2	3	Brick and concrete rubble fill, with F.M.C. gravel and sand, occasional pieces of metal, wood, plastic and polythene.	

Water Observations. Pit dry	Stability. Sides collapsing due to large concrete blocks

PARKMAN CONSULTING ENGINEERS.

Window Sampler Hole Log

Exploration Associates

Drilled by JB Logged by Checked by	Equipment and Methods Window Sampler from 0.00m to 2.00m.	Ground Level +45.84 m OD National Grid Coordinates E 384741.57 N 399232.58

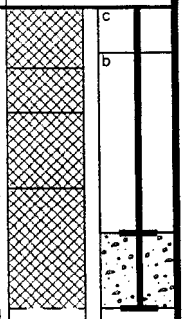
Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
1.20 - 2.00	D1		12/04/2002 12/04/2002	

Strata

Description	Depth,Level (Thickness)
MADE GROUND; Tarmac.	(0.40)
MADE GROUND; Roadstone.	0.40 +45.44 (0.30)
MADE GROUND; Compact cobbles of brick, some gravel and sand of ash and clinker.	0.70 +45.14 (0.50)
MADE GROUND; Loose dark grey brown sand and fine to medium gravel of ash and clinker, fine brick, cobbles of brick and fire brick, timber, copper wire. Strong napthalene odour stronger at base of hole.	1.20 +44.64 (0.80pen)
EXPLORATORY HOLE ENDS AT 2.00 m.	2.00 +43.84

Legend



Groundwater

No. Struck Behaviour

Remarks

Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 1.50m Bentonite (b). Surface protection : Stop Cock Cover Standpipe installed, 50mm diameter, response zone from 1.50m to 2.00m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project GOULD STREET

Project no. 122303

Carried out for Lattice Peoperty Holdings

Window Sampler
WS13
Sheet 1 of 1

30/08/2002 13:05:25 ESGLog v2.11

Hydrock	Project: Gould Street	Trialpit No TP701 Page No. 1 of 1

Method: Trial Pit	Date(s): 29/11/2021	Logged By: LH	Checked By: DL
Client: Crowning Developments Limited	Co-ords: 384596.82, 399217.69	Stability: Unstable	Dimensions: 1.60m x 0.70m; Scale: 1:20
Hydrock Project No: 21353	Ground Level: 43.58m OD	Plant: JCB 3CX	

Samples / Tests			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend
Depth (m)	Type	Results						
				ASPHALT HARDSTANDING. (BITUMINOUS MATERIAL)	0.20	(0.20)	43.38	
0.20 - 0.40	B			Dark brown sandy angular to sub-angular,fine to coarse GRAVEL with high cobble content. Gravel is of brlck, coal, limestone, concrete, sandstone with rare wire and fragments of floor tile. Cobbles are subangular of brick. Boulders are sub-angular of concrete. (MADE GROUND)	1.10	(0.90)	42.48	
0.40	ES			Base of Excavation at 1.10m				

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Machine dug trial pit from 0.20m to 1.10m bgl. 3. Terminated at 1.10m bgl due to instability. 4. Backfilled with arisings on completion.

Logged in general accordance with BS5930:2015

Hydrock

Project: Gould Street

Borehole No
MPBH715
Page No. 1 of 3

Method: Dynamic/Rotary Open/Rotary Cored	Date(s): 03/12/2021 - 07/12/2021	Logged By: RS	Drilled By: DMW Drilling
Client: Crowning Developments Limited	Co-ords: 384741.41, 399242.64	Checked By: DL	Flush: Water/Air
Hydrock Project No: 21353	Ground Level: 45.87m OD		Scale: 1:50

Sample/Core Run (m) Smpl. Ø (mm) Smpl. rec. %	Samples / Tests			Mechanical Log				Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
	Depth (m)	Type	Results	TCR	SCR	RQD	If: Min Mean Max							
									Black ASPHALT HARDSTANDING (BITUMINOUS MATERIAL)	0.20	(0.20)	45.67		
	0.50	D							Loose black sandy ashy angular to subangular, fine to coarse GRAVEL of coal, brick, limestone and sandstone. Low cobble content of brick and sandstone. (MADE GROUND)					
	0.50 - 0.60	ES												
	1.20	SPT	N=8 (1,1,1,1,3,3)								(2.10)			
	1.20 - 1.65	D												
	1.20 - 1.70	B												
	2.00	SPT	N=22 (3,6,4,5,6,7)											
	2.00 - 2.45	D												
	2.00 - 2.50	B								2.30		43.57		
	2.50	ES							Very stiff very high strength dark brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of coal, sandstone, mudstone and siltstone. (GLACIAL TILL)					
	3.00 - 3.45	U	(35,100%)											
	3.50	D												
	4.00	SPT	N=15 (3,3,3,4,4,4)											
	4.00 - 4.45	D												
	4.00 - 4.50	B												
	5.00 - 5.45	U	(39,55%)											
	5.50	D												
	6.00	SPT	N=21 (3,3,4,4,5,8)											
	6.00 - 6.45	D												
	6.00 - 6.50	B									(9.70)			
	7.50 - 7.95	U	(45,77%)											
	8.00	D												
	9.00	SPT	N=40 (6,7,9,10,10,11)											
	9.00 - 9.45	D												
	9.00 - 9.50	B												

Continued on Next Sheet

Progress and Observations

Rig	Date	Time	Borehole Depth (m)	Casing Depth (m)	Casing Diam.(mm)	Water Depth (m)	Flush Type	Returns (colour)
Dando Comacchio	03/12	1530	12.45	12.00	152		Water/Air	Dark brown Reddish orange
	07/12	1530	21.00	21.00	127			

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Hand dug inspection pit from 0.20m to 1.20m bgl. 3. Cable percussive drilling from 1.20m to 12.45m bgl. 4. Rotary open holing from 12.45m to 16.00m bgl. 5. Rotary coring from 16.00m to 21.00m bgl. 6. Complete at 21.00m bgl. 7. Installed on completion with a response zone between 14.00m and 21.00m bgl.

Groundwater: No groundwater encountered

Logged in general accordance with BS5930:2015

Hydrock	Project: Gould Street	Borehole No MPBH715 Page No. 2 of 3	
Method: Dynamic/Rotary Open/Rotary Cored	Date(s): 03/12/2021 - 07/12/2021	Logged By: RS	Drilled By: DMW Drilling
Client: Crowning Developments Limited	Co-ords: 384741.41, 399242.64	Checked By: DL	Flush: Water/Air
Hydrock Project No: 21353	Ground Level: 45.87m OD		Scale: 1:50

Sample/Core Run (m) Smpl. Ø (mm) Smpl. rec. %	Samples / Tests			Mechanical Log				Water Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
	Depth (m)	Type	Results	TCR	SCR	RQD	If: Min Mean Max							
	10.50	SPT	N=35 (6,7,7,8,9,11)						Very stiff very high strength dark brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of coal, sandstone, mudstone and siltstone. (GLACIAL TILL)					
	10.50 - 10.95	D												
	10.50 - 11.00	B												
	12.00	SPT	50/40mm (25,50)							12.00		33.87		
	12.00 - 12.45	D							Dense reddish orange gravelly slightly silty fine and medium SAND. Gravel is subangular to rounded, fine and medium of sandstone, mudstone and quartzite. (WEATHERED CHESTER FORMATION)		(1.00)			
										13.00		32.87		
									Light grey and light brown sandy subrounded fine to coarse GRAVEL of mudstone, sandstone, quartz and quartzite. (WEATHERED CHESTER FORMATION)		(3.00)			
16.00 - 17.00							30 10 111			16.00		29.87		
									Very soft light grey silty CLAY (WEATHERED CHESTER FORMATION)	16.30	(0.30)	29.57		
	16.60	ES		70	40	0			Extremely weak reddish orange medium to coarse SANDSTONE. Discontinuities; fractures are subhorizontal 10-15°, extremely closely to very closely spaced (10, 15, 20, 30), planar and undulating, smooth and rough, open with local sand smearing 2-4mm. (CHESTER FORMATION)		(0.70)			
17.00 - 18.50	16.67 - 16.70	C								17.00		28.87		
	16.87 - 16.90	C					0 0 0		No recovery: assumed highly fractured or extremely weak sandstone bedrock. (CHESTER FORMATION)					
	16.96 - 17.00	C		0	0	0								
18.50 - 20.00				0	0	0					(3.00)			
										20.00		25.87		

Continued on Next Sheet

Progress and Observations

Rig	Date	Time	Borehole Depth (m)	Casing Depth (m)	Casing Diam.(mm)	Water Depth (m)	Flush Type	Returns (colour)

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Hand dug inspection pit from 0.20m to 1.20m bgl. 3. Cable percussive drilling from 1.20m to 12.45m bgl. 4. Rotary open holing from 12.45m to 16.00m bgl. 5. Rotary coring from 16.00m to 21.00m bgl. 6. Complete at 21.00m bgl. 7. Installed on completion with a response zone between 14.00m and 21.00m bgl.

Groundwater: No groundwater encountered

Logged in general accordance with BS5930:2015

Hydrock	Project: Gould Street	Borehole No MPBH715 Page No. 3 of 3

Method: Dynamic/Rotary Open/Rotary Cored	Date(s): 03/12/2021 - 07/12/2021	Logged By: RS	Drilled By: DMW Drilling
Client: Crowning Developments Limited	Co-ords: 384741.41, 399242.64	Checked By: DL	Flush: Water/Air
Hydrock Project No: 21353	Ground Level: 45.87m OD		Scale: 1:50

Sample/Core Run (m) Smpl. Ø (mm) Smpl. rec. %	Samples / Tests			Mechanical Log				Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
	Depth (m)	Type	Results	TCR	SCR	RQD	If: Min Mean Max							
20.00 - 21.00	20.10	D		100	28	0	50		Extremely weak reddish orange medium to coarse SANDSTONE. Discontinuities; fractures are subhorizontal (5-10°), very closely spaced (40, 50) planar, rough, open with local sand smearing 2-4mm. (CHESTER FORMATION) *... Between 20.00m and 20.15m bgl: non-intact as very soft grey very sandy clay* *... Between 20.15m and 20.25m bgl: non-intact as reddish orange very gravelly medium to coarse sand.* *... Between 20.35m and 20.55m bgl: non-intact as reddish orange very gravelly medium to coarse sand.*	21.00	(1.00)	24.87		
	20.88 - 20.92	C												
	20.92 - 21.10	C												
									End of Borehole at 21.00m					

21 22 23 24 25 26 27 28 29 30

Progress and Observations

Rig	Date	Time	Borehole Depth (m)	Casing Depth (m)	Casing Diam.(mm)	Water Depth (m)	Flush Type	Returns (colour)

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Hand dug inspection pit from 0.20m to 1.20m bgl. 3. Cable percussive drilling from 1.20m to 12.45m bgl. 4. Rotary open holing from 12.45m to 16.00m bgl. 5. Rotary coring from 16.00m to 21.00m bgl. 6. Complete at 21.00m bgl. 7. Installed on completion with a response zone between 14.00m and 21.00m bgl.

Groundwater: No groundwater encountered

Logged in general accordance with BS5930:2015

Borehole Log

Cable Percussion with Rotary Core No.

BH802A

Sheet 1 of 3

PROJECT NO:	C5692	**CO-ORDS:**	384610E, 399214N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	44.62m OD
CLIENT:	MCR / INTRO DEVELOPMENTS LTD	**DATES:**	02/07/24 - 10/07/24

Hole Type: CP+RC

Scale: 1:51

Logged: PH **Checked:** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
		0.10-0.30	B		0.10	44.52		MADE GROUND: Tarmacadam.
		0.10-0.80	D					MADE GROUND: Brown gravelly sand. Sand is fine to coarse. Gravel is sub-angular fine to coarse of brick, concrete, sandstone, coal, and slag.
			ES					
		0.10	PID	0.2PPM				
		0.20	D					
		0.20-1.20	D					
		0.30-1.20	B					
		0.50	D					
		1.20-1.65	D					
			D					
		1.20	SPT	N=46 (25 for 95mm/16,8,10,12)				
		1.50-2.20	D					
			ES					
		2.00-2.45	D					
		2.00	SPT	N=39 (7,8/9,9,9,12)				
		3.00-3.45	D					
		3.00-3.50	D					
			ES					
		3.00	SPT	N≥50 (10,12/39 for 225mm)				
		3.60	B		3.60	41.02		Firm brown slightly gravelly CLAY. Gravel is sub-rounded fine to coarse of sandstone, mudstone, and coal.
		3.70-4.00	D					
			ES					
		4.00-4.45	D					
		4.00	SPT	N=13 (2,2/3,3,3,4)				
		5.00-5.45	D					
		5.00	SPT	N=17 (3,4/4,4,4,5)				
		6.00-6.45	U					
		6.45-6.70	D					
		7.00	D					
		7.50-7.95	U					
		7.95-8.20	D		8.00	36.62		NO RECOVERY due to boulder being pushed down through clay.
		9.00-9.50	D					
		9.50	SPT	N≥50 (75 for 20mm/0 for 0mm)				*SPT refusal likely due to cobble.*

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Groundwater encountered at 18.10m bgl.
3. Cable percussive to 15.00m bgl with rotary follow on to 24.00m bgl.
4. Installed to 24.00m bgl: 15.00m plain and 9.00m slotted HDPE 50mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

Cable Percussion with Rotary Core No.

BH802A

Sheet 2 of 3

PROJECT NO:	C5692	**CO-ORDS:**	384610E, 399214N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	44.62m OD
CLIENT:	MCR / INTRO DEVELOPMENTS LTD	**DATES:**	02/07/24 - 10/07/24

Hole Type: CP+RC

Scale: 1:51

Logged: PH **Checked:** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	TCR	SCR	RQD	Depth (m)	Level (m OD)	Legend	Stratum Description
		10.50-10.95 10.50	D SPT	N≥50 (12,13/50 for 285mm)							*SPT refusal likely due to cobble.*
		12.00-12.45 12.00	B D SPT	N=27 (4,5/5,6,7,9)				12.00	32.62		Recovery regained. Firm brown slightly gravelly CLAY. Gravel is sub-rounded fine to coarse of sandstone, mudstone, and coal.
		13.50 13.50-13.95 13.50	D D SPT	N≥50 (75 for 70mm/0 for 0mm)				13.50	31.12		Very weak disturbed reddish brown SANDSTONE, recovered as gravelly SAND. Sand is fine to coarse. Gravel is sub-angular fine to coarse of sandstone.
		14.80 15.00	D SPT	N≥50 (57 for 125mm/18 for 20mm)				15.00	29.62		NO RECOVERY assumed sandstone. *Becoming stiff from 15.00m bgl.* *15.00-16.00m bgl: Open holed.*
		16.00 - 18.00	NI 5 NI	100	90	73		16.00	28.62		Reddish brown SANDSTONE. *16.00-16.16m bgl: Non-intact recovered as sub-angular fine to coarse gravel and cobbles of sandstone.* *16.16-16.49m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.* *16.16-17.17m bgl: Discontinuities are very close to closely spaced, rough, and horizontal to sub-horizontal up to 45 degrees.* *16.49-16.52m bgl: Extremely weak, distinctly weathered fine to medium grained sandstone.* *16.52-17.00m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.* *17.00-17.17m bgl: Extremely weak, distinctly weathered fine to medium grained sandstone.* *17.17-17.21m bgl: Non-intact recovered as a reddish brown sandy gravel. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and quartz.* *17.21-18.00m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.* *17.21-18.00m bgl: Very close to closely spaced, rough and horizontal to sub-horizontal up to 10 degrees.*
		18.20 - 18.30	ES	100	98	85					*18.00-18.43m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.*
		18.00 - 21.00	15								*18.00-21.00m bgl: Discontinuities are extremely close to closely spaced rough and horizontal to sub-horizontal (up to 15 degrees) infilled with fine to coarse sand.* *18.43-19.77m bgl: Weak, partially weathered reddish brown fine to medium grained sandstone.* *19.77-19.85m bgl: Extremely weak, partially weathered reddish brown fine to medium sandstone.* *19.85-20.05m bgl: Weak, partially weathered reddish brown fine to*

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Groundwater encountered at 18.10m bgl.
3. Cable percussive to 15.00m bgl with rotary follow on to 24.00m bgl.
4. Installed to 24.00m bgl: 15.00m plain and 9.00m slotted HDPE 50mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

		Cable Percussion with Rotary Core No.	BH802A
			Sheet 3 of 3
PROJECT NO:	C5692	**CO-ORDS:** 384610E, 399214N	**Hole Type** CP+RC
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:** 44.62m OD	**Scale** 1:51
CLIENT:	MCR / INTRO DEVELOPMENTS LTD	**DATES:** 02/07/2024 - 10/07/2024	**Logged** PH / **Checked** TM

Well	Water Strike	Depth (m)	Type / FI	Coring TCR (%)	Coring SCR (%)	Coring RQD (%)	Depth (m)	Level (m OD)	Legend	Stratum Description
			5	77	75	52				*medium sandstone.* *20.02-22.05m bgl: Non-intact recovered as reddish brown slighly clayey slightly sandy gravel. Sand is fine to coarse sub-angular sandstone.* *20.05-21.00: Weak, partially weathered reddish brown fine to medium grained sandstone.*
			NR							*21.00-21.70m bgl: No recovery.*
		21.00 - 24.00	16							*21.70-21.76m bgl: Non-intact recovered as reddish brown angular fine to coarse gravel of sandstone.* *21.76-22.46m bgl: Weak, partially weathered reddish brown fine to medium gravel of sandstone.* *21.76-24.00m bgl: Discontinuities are extremely closely spaced to closely spaced, rough and horizontal to sub-horizontal up to 30 degrees.* *22.05-22.46m bgl: Weak, partially weathered reddish brown fine to medium sandstone.* *22.46-22.62m bgl: Extremely weak, partially weathered reddish brown fine to medium gravel of sandstone.* *22.62-24.00m bgl: Weak, partially weathered reddish brown fine to medium gravel of sandstone.*
							24.00	20.62		End of Borehole at 24.00m

21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Groundwater encountered at 18.10m bgl.
3. Cable percussive to 15.00m bgl with rotary follow on to 24.00m bgl.
4. Installed to 24.00m bgl: 15.00m plain and 9.00m slotted HDPE 50mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

PROJECT NO:	C5692	**CO-ORDS:**	384590E, 399236N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	42.82m OD
CLIENT:	MCR / Intro Developments Ltd	**DATES:**	03/07/24

Window Sampler No. WS818 — Sheet 1 of 1

Hole Type WS

Scale 1:30

Logged MB | **Checked** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
		0.10-0.50 0.10 0.20	ES PID D	0.3PPM	0.10	42.72		MADE GROUND: Tarmacadam.
		0.50-0.60 0.50	ES PID	0.7PPM				MADE GROUND: Brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and brick. *Black staining and hydrocarbon odour noted between 0.50-0.60m bgl.*
		1.20	SPT	N=48 (10,8/12,13,11,12)				
		2.00-2.50 2.00	ES SPT	N=20 (6,5/6,5,4,5)	2.00	40.82		MADE GROUND: Dark grey silty fine to coarse sand. Sand is of PFA (Pulverised Fly Ash). *Hydrocarbon odour between 2.00-5.m bgl.*
		2.30	PID D	0.4PPM				
	▼	3.00	SPT	N=9 (2,2/2,2,2,3)				
		4.00	SPT	N=4 (1,0/1,1,1,1)				
		5.00	SPT	N=5 (1,1/1,1,1,2)				
					5.45	37.37		End of Borehole at 5.45m

1.0 2.0 3.0 4.0 5.0 6.0

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Hand pit to 1.20m bgl to check for buried services
3. Small groundwater seepage encountered at 3.00m bgl.
4. Window sample completed at 5.45m bgl.
5. Installed to 5.00m bgl: 2.00m plain and 3.00m slotted PVC 35mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

PROJECT NO:	C5692	**CO-ORDS:**	384612E, 399221N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	44.68m OD
CLIENT:	MCR / Intro Developments Ltd	**DATES:**	04/07/24

Window Sampler No. WS819

Sheet 1 of 1

Hole Type WS

Scale 1:30

Logged MB | **Checked** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
		0.10-0.30 0.10 0.20	ES PID D	0.0PPM	0.10	44.58		MADE GROUND: Tarmacadam.
								MADE GROUND: Brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and brick.
		1.00-1.40 1.00 1.20 1.30	ES PID SPT D	0.0PPM N=25 (6,5/6,5,6,8)	1.00	43.68		MADE GROUND: Reddish brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and brick.
		1.80	SPT	N≥50 (25 for 70mm/50 for 225mm)				
					2.09	42.59		End of Borehole at 2.09m

1.0
2.0
3.0
4.0
5.0
6.0

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Hand pit to 1.20m bgl to check for buried services.
3. No groundwater encountered.
4. Window sample refused at 2.09m bgl.
5. Installed to 1.50m bgl: 0.50m plain and 1.00m slotted PVC 35mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

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