

CBRE
Radcliffe Town Centre
Constraints Desk Study

RAD-ARP-RP-CG-0001

Issue 2 | 12 April 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Executive Summary

Ove Arup and Partners Ltd (Arup) has been commissioned by CBRE Ltd (CBRE) to provide specific civil and geotechnical/ geoenvironmental engineering support related to the proposed regeneration of an area of Radcliffe town centre. In particular, Arup's commission includes identification of below ground constraints to help in the refinement of the development masterplan which is being developed by AEW Architects & Designers Ltd (AEW) on behalf of Bury Council.

The site has a long history involving several periods of redevelopment. This has resulted in a complex arrangement of utilities and potential for buried obstructions (such as old foundations, infrastructure, roads), soft or loose ground and voids. Contamination associated with made ground is unlikely to be present at concentrations which are unsuitable for the proposed predominantly commercial development. There is potential to generate significant volumes of soil waste as a result of the proposed redevelopment, in particular where deep excavations are required for the swimming pools. Earthworks modelling would help to minimise the volume of soil disposal and associated cost.

Given the known site history, existing contamination is likely to pose a very low risk to groundwater and the River Irwell and therefore remediation (other than earthworks validation testing) is not expected to be required. Gas protection measures were required for the adjacent Lidl site and are likely to be required for new buildings on this site.

The site is adjacent to the River Irwell. With the exception of a small area just north of the market building, the site is not located within an area mapped as being at risk of river flooding. Topographic survey in that area may confirm this is not a real risk. However, the flood risk mapping does not consider flooding to the basement which requires further attention (see below).

It is proposed to retain the existing basement to the market which is known to flood and structural surveys have identified defects which require remediation. Further work is required to understand the cause of the flooding which is known to include inflow through windows and drains in the basement but could also be caused by groundwater seepages and the combined sewer nearby. The extent of remedial works to prevent basement flooding should be informed by the intended use for the basement. It may be possible to reduce the volume and impact of flooding by undertaking repairs to cracks, replacing windows and sealing of redundant drainage. More robust flood prevention would involve higher cost and could include installation of new drainage or full remedial works to the basement if a permanent or higher quality use of the basement is proposed.

Several utilities pass through the site, mainly within the footpaths along Dale Street and Blackburn Street and along the footpath north of the market building. Of particular note are:

- **Blackburn Street:** The footprint of the proposed library, retail and café units may impact SSE fibre telecommunications cables, BT kiosk and chamber, 18" low pressure gas main, 6 to 6.6kV line and LV cables and Virgin Media

cables. It is recommended that the location of these are investigated as a priority in order to understand the potential constraint posed to development in this area and/or the costs associated with diversions.

- **Dale Street:** Contains a high number of utilities. If Dale Street is pedestrianised while remaining as adopted highway then the impact to the existing utilities would be through the inclusion of vehicle access control structures (bollards etc).
Arup understands that an option to build over Dale Street to connect the northern and southern blocks is also being considered. Given the large amount of significant utilities and drainage within Dale Street, it will be vital that the cost to divert this infrastructure is considered as part of this decision.
- **Market northern frontage:** There are several utilities which pass in the footpath north of the market which would be impacted if the masterplan is modified to extend the market footprint northwards.
- **Leisure facility west and north boundary:** The footprint of the proposed leisure facility extends further north and west of the existing buildings (i.e. into the footpath) which has the potential to impact 11kV and 6 to 6.6kV cables, 18" low pressure gas main, UU combined sewer, Virgin Media cables. There is also an existing ENWL substation within the proposed footprint.

Further investigations are recommended to provide data to further quantify the level of risk posed by the constraints identified in this assessment, these include:

RIBA Work Stage	Recommendation
Work Stage 2 - Concept design	Basement structural monitoring and review remedial measures implemented Internal survey of the basement Topographic survey Utility surveys (GPR and investigate the sewer drainage (such as CCTV survey)) Transport and access study/assessment Discussions with the Lead Local Flood Authority to agree surface water management approach Discussion with Bury Council Environmental Health department Further evaluation of past coal mining (geotechnical risk and mine energy potential) Low carbon energy feasibility study
Work Stage 3 - Developed design	Utility inspection pits Basement investigation Ground investigation (and assessments) Earthworks levels optimisation

1 Introduction

1.1 Commission

Ove Arup and Partners Ltd (Arup) has been commissioned by CBRE Ltd (CBRE) to provide specific civil and geotechnical/ geoenvironmental engineering support related to the proposed regeneration of an area of Radcliffe town centre.

In particular Arup's commission includes identification of below ground constraints (ground conditions, utilities and flooding) to help in the refinement of the masterplan which is being developed by AEW Architects & Designers Ltd (AEW).

Bury Council propose to regenerate Radcliffe town centre, including the consolidation of leisure and retail space into a central leisure and civic hub, whilst maintaining heritage where possible. Current proposals include the retention of the market basement, which has a history of flooding.

1.2 Limitations

This report was prepared by Arup on behalf of CBRE. It also takes into account our Client's particular instructions and requirements and addresses their priorities at the time. This report was not intended for, and should not be relied on, by any third party and no responsibility is undertaken to any third party in relation to it.

All reasonable skill, care and diligence have been exercised within the timescale available and in accordance with the technical requirements of the brief.

This report has been produced from a large volume and variety of data sources, primarily provided by data purchased for the site as well as published literature.

Notwithstanding the efforts made by the professional team in preparing the report it is possible that other ground contamination or conditions as yet undetected may exist and consequently reliance on this report must be limited accordingly.

1.3 Sources of data

In preparing this report Arup has reviewed the following sources of data:

- Historical Ordnance Survey mapping provided by Groundsure [1]
- Geological and environmental data searches provided by Groundsure [2],
- Desktop utility search provided by Groundwise [3];
- British Geological Survey (BGS) borehole records [4];
- Ground investigation and assessment for the adjacent Lidl site [5];
- Structural inspection of existing basement structure [6]);
- Official Coal Mining Search provided by Groundsure [7]; and
- Coal Authority online mapping [8].

2 Site details

2.1 Site location

The site is located within Radcliffe town centre, covering two blocks of commercial land with a total area of around 0.95 hectares. The approximate site boundary is presented in Figure 1 below.

The northern block is centred at National Grid reference SD784070 (378493, 407007). It is bounded to the north by Railway St, to the east by Blackburn St, to the south by Dale St and to the west by commercial buildings.

The southern block is centred at National Grid reference SD785069 (378552, 406931). It is bounded to the northwest by Dale St, to the northeast by Church St, to the southwest by Lidl car park and to the southeast by the River Irwell.

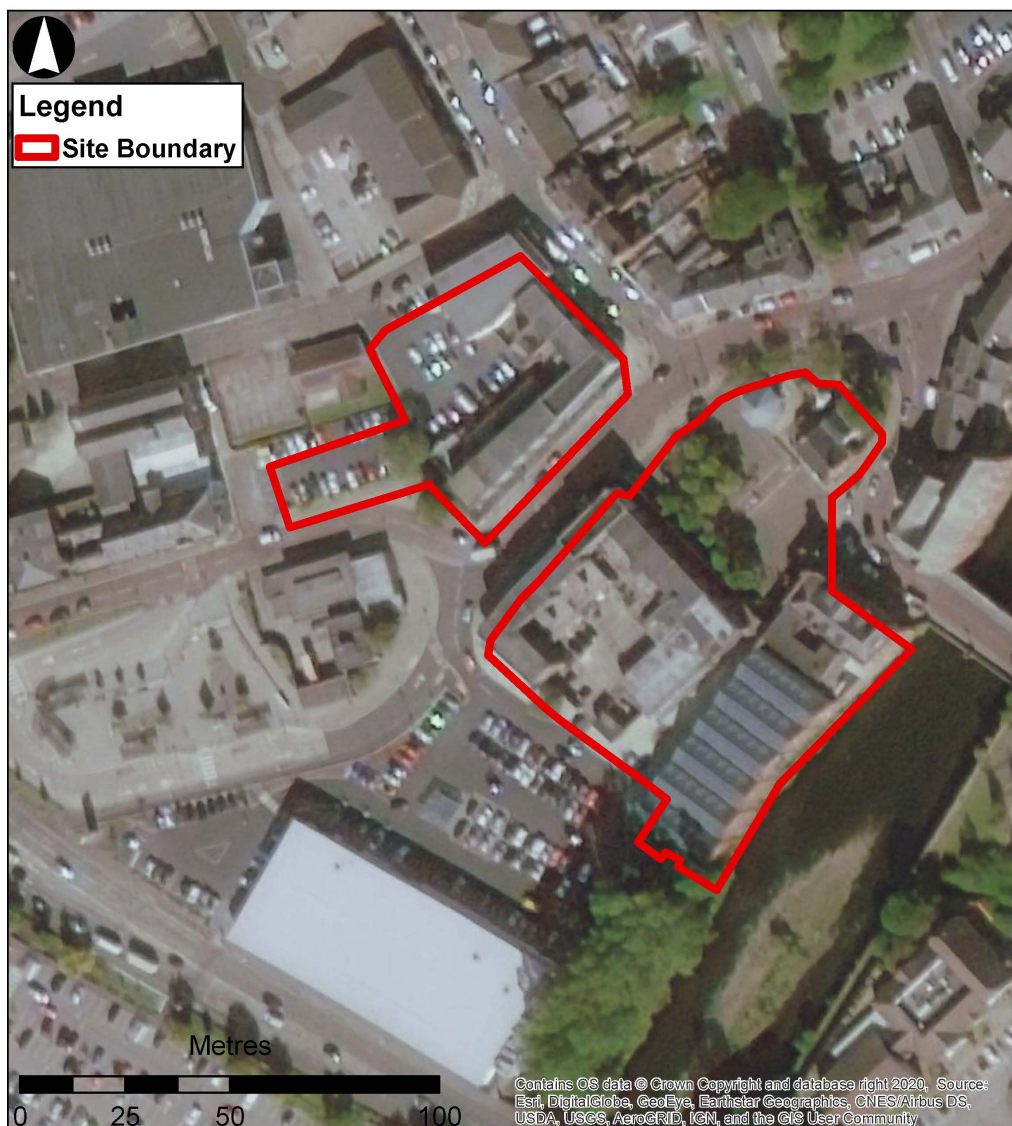


Figure 1: Site boundary within Radcliffe town centre

2.2 Current land use and key site features

In the mid-19th century Radcliffe expanded rapidly coinciding with growth of the textiles industry and coal mining. The site was predominantly used for retail, including a market which is shown on mapping dated 1891. Cotton mills, timber yards and other factories are also marked on historical maps on the site and adjacent land. In the late 1960s/ early 1970s parts of the site were remodelled which resulted in the construction of new retail units and modification of the road layout.

Current land use of the northern block includes Railway Street car park, a number of commercial units currently occupied by retail, food and beverage outlets and a dance studio. The southern block features Radcliffe Market Hall, commercial units including shops and food and beverage outlets, and an open space to the east featuring a bandstand and public house. An electrical transformer and substation is present in the west of the southern block.

2.3 Walkover survey

Arup conducted a walkover survey on 9th March 2021 which is summarised in Appendix A. The site comprises predominantly buildings, car parks and other hard landscaping. There are limited areas of soft landscaping in the eastern part of the southern block and on the southern edge of the Railway Street car park.

2.3.1 Observations from external areas

The market building and adjacent disused offices occupy the full river side elevation and are 2 to 3-storey brick structures. The basement underlies all sections of these buildings and the southern edge of this forms the river wall. Access to the disused commercial properties to the east of the market and the café area in the west of the market block were not possible on this visit but arrangements should be made to inspect these in the next work stage.

The remainder of the south development block comprises a 3-storey brick clad commercial block with single storey to the rear, an external public realm area with seating and the Bridge Tavern public house with associated external seating area. A bandstand type covered area is situated between the Bridge Tavern and the main commercial block. There is evidence of a probable access to a beer cellar on the western elevation of the pub. An electrical substation was noted on the south western corner of the commercial block.

The northern block is occupied by a further 3-storey brick clad commercial block of similar age and appearance to that on the southern block. To the rear of this block the site is occupied by surface car parking bounding on to a further structure understood to be a police station.

There is no clear evidence of any existing basements to these commercial properties. However, internal inspections of these structures would be recommended in the next phase of investigation.

2.3.2 Market basement

The basement of the market building was briefly accessed during the site visit where a number of defects were noted. It was found that there are the following defects.

- Cracks to wall both structural and non-structural
- Cracks and reported water ingress to the floor slab
- Vertical movement possibly from flooding causing uplift to certain walls and areas of the floor slab
- Localised issues with bearings of beams and stairs from the vertical movement
- A crack width gauge measuring horizontal movement of an internal wall (it is unknown when this was installed and whether this is being monitored)
- Cracks and flood event leakage around the existing windows
- Exposed electrical fuse box and loose pipework
- Settlement to walls
- Severe corrosion to structural elements such as alcoves and steelwork.

A structural assessment of the basement was also carried out by Integra Consulting in 2014 with a follow up inspection in 2017. The findings and recommendations are presented in a report dated October 2017 (RH/2703 Rev A).

Further discussion should be held with the Bury Council team responsible for procuring and managing the previous basement structural work to determine if any of the recommended remedial works have already taken place or if there are plans to implement this work.

The areas of basement to the east and west of the main basement are accessed from different locations and were not inspected on the site visit. It is believed that the levels and conditions are largely consistent with the main basement but this should be confirmed in the next design stage.

2.4 Topography

The topography of the site has been interpreted from Ordnance Survey terrain data [1]. The site slopes from northwest to southeast (refer to Figure 2). The highest part of the site is Railway Street. The northern block varies between 68.5 mOD in the north to 65.5 mOD in the south, and 67.0 mOD in the west to 68.9 mOD in the east.

The southern block varies between 66.2 mOD in the north to 61.5 mOD in the south, and 64.8 mOD in the west to 64.2 mOD in the east.

A benchmark on Radcliffe Bridge indicates a level of 63.3mOD.

There is a significant change in level around the Bridge Tavern with an approximately 4m level change along Church St West to Deansgate resulting in the need for a retaining wall around the beer garden area. A brick retaining wall of

circa 2m retained height is also located to the northern edge of the Railway Street car park.

A topographical survey of the full site is recommended as part of the investigations undertaken at the next work stage.

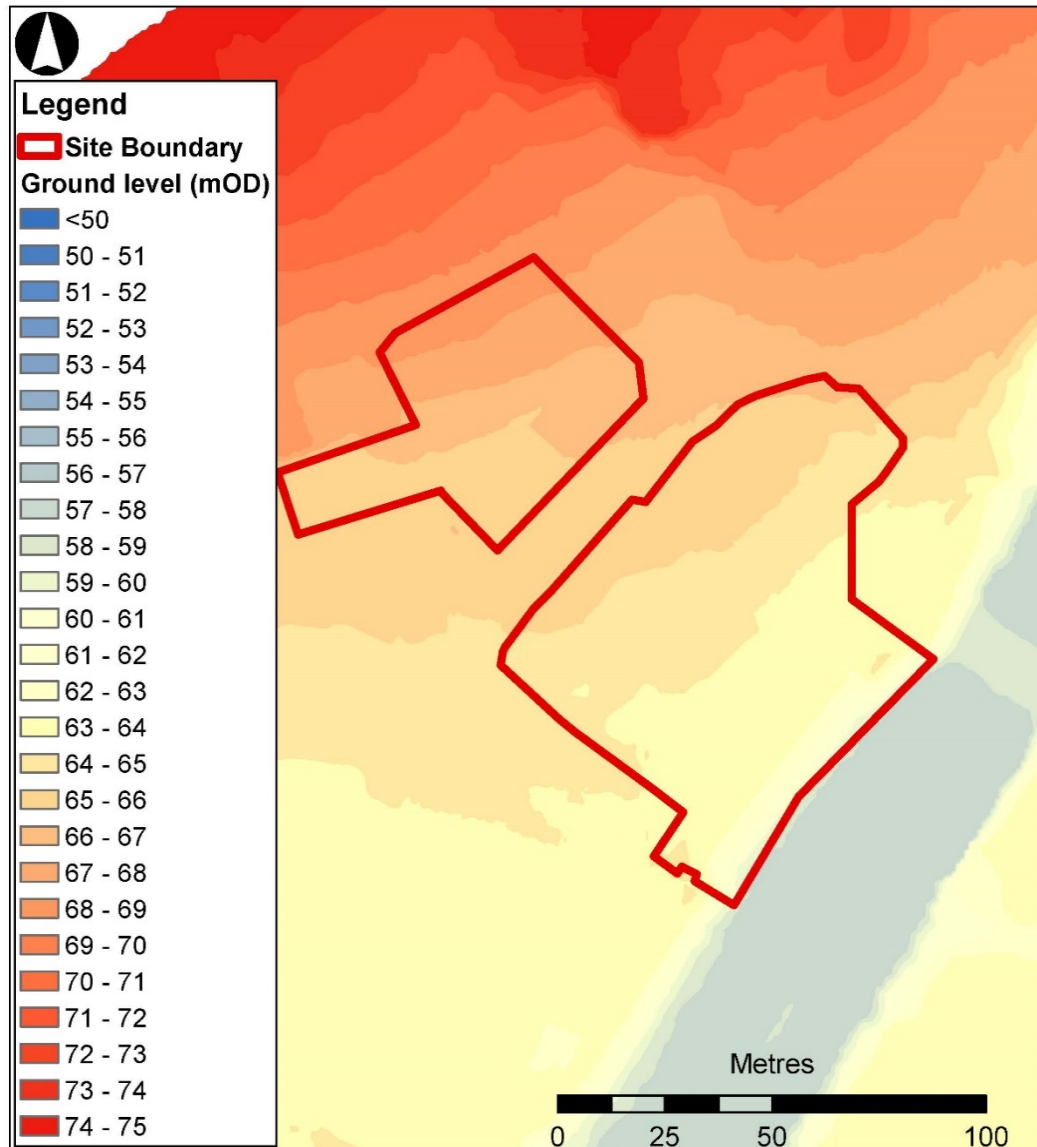


Figure 2: Topography of the site and surrounding area (based on EA LiDAR DTM [9])

2.5 Existing utilities and drainage

A third-party utility search was undertaken for the site (Groundwise [3]) which indicates the following utilities within and adjacent to the site:

- Electrical cabling (11kV, 6.6kV and LV cables) and substation;
- United Utilities combined sewers and surface water sewers;
- United utilities water supply pipes;
- Medium and low pressure gas networks;

- Virgin Media telecommunications ducts;
- SSE telecoms (fibre telecommunications network); and
- BT telecommunication cables, chamber and kiosk.

The presence of these utilities and drainage infrastructure are likely to pose constraints on the proposed masterplan or significant cost to divert these; as described further within Section 5.

2.6 Proposed development

AEW are developing a masterplan for the proposed remodelling of this area of Radcliffe town centre on behalf of Bury Council. The site is to become part of 'The Hub' of the wider Radcliffe town centre masterplan.

Based on the latest proposals the northern block will contain 4,800 sqft of retail space, as well as an office and 64 parking spaces. In the southern block, the market, pub and public realm are to be retained. The existing retail will make way for the main 3-storey Hub building, containing pools, gyms, retail, community and event space, council offices and a library. There is an opportunity to pedestrianise a section of Dale Street which currently divides the two blocks. However, options to build across Dale Street are being explored by AEW.

The latest masterplan is presented in the AEW Progress Update report [10].

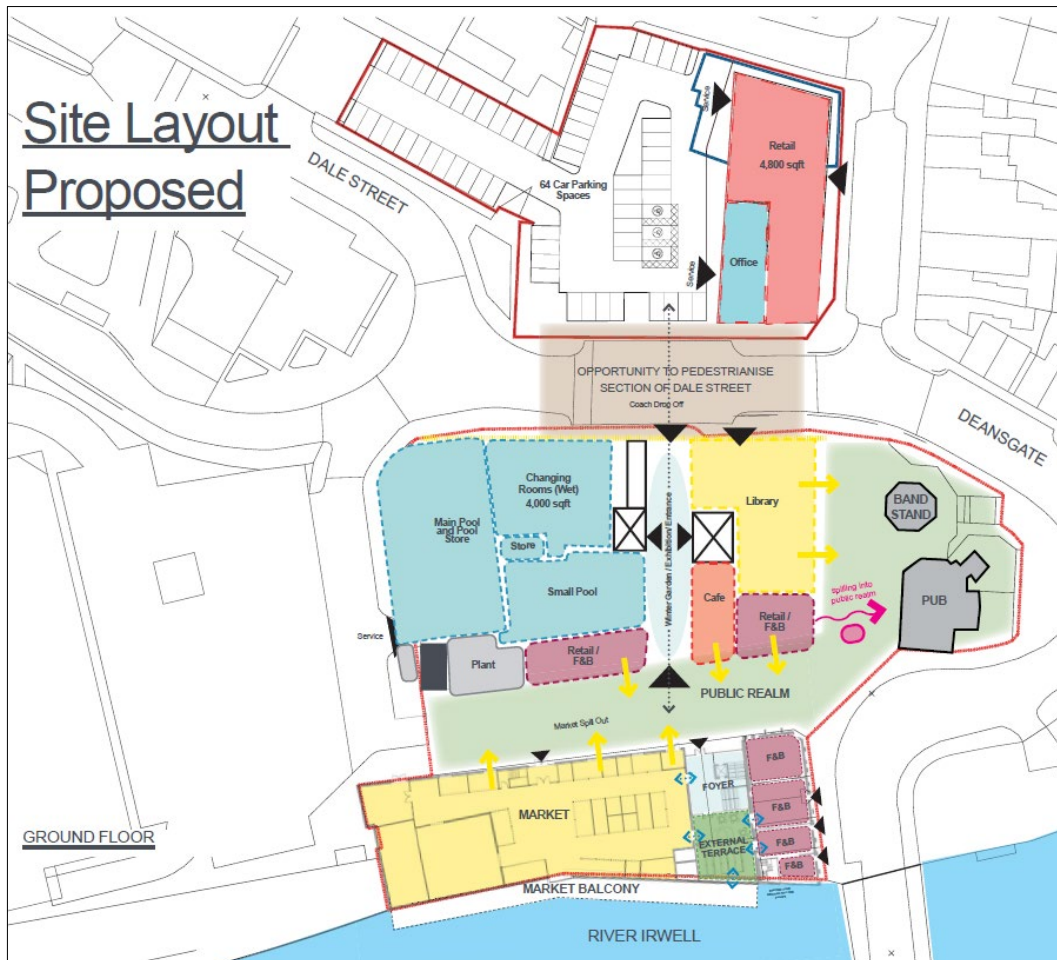


Figure 3: Latest proposed masterplan (dated 26/02/2021)

3 Site history and environmental setting

3.1 Site history

The history of the site has been summarised below based on historical mapping [1], aerial photography [11] and historical site photographs[12]. Key historical maps are provided in Appendix B.

Table 1: Summary of site history

Map date	Northern block	Southern block	Immediate surroundings
1848-1850	Buildings are present in the south of the site with the rest open land.	Blackburn St runs NW-SE in the east of the site with a dye works in the west.	A cotton mill is present to the west of the northern block.
1893	The site is occupied by a number of terraced buildings, with one of these spaces occupied by a bank. Foundry St runs NW-SE through the west of the site.	The site is occupied by a number of terraced buildings, an inn and a hall. Foundry St forms the western boundary of the site, and Factory St NE-SW in the south.	Green Hill Mill and Mount Mill are to the west of the northern block. Irwell Mill is to the west of the southern block.
1909	No significant change.	A number of buildings in the south have been replaced by the 'Market Place'. The hall is now labelled Market Hall.	Green Hill Mill is now disused. Irwell Mill is labelled as a cotton mill. A police station is located to the west of the northern block.
1929	No significant change.	Additional buildings to the south of the site containing a bank.	Green Hill Mill has been replaced by Fairfield Works.
1937	No significant change.	Removal of buildings in southwest of site.	The majority of Irwell Mills has been replaced by a cinema.
1955-1956	Removal of buildings in the south of the site.	The previous market hall has been replaced with a market hall along the southern boundary. The central area has been opened up into a bus shelter. A building in the east of the site is now labelled as Bridge Inn PH.	Fairfield Works is described as 'paper and cotton bags'.
1970-1975	Some buildings in the north have been demolished, new buildings constructed in the south and buildings extended in the east. The west of the site is a car park and Foundry St no longer runs through the site.	The bus shelter, existing terraced buildings, and marketplace have been removed from the centre of the site. Dale St has been created which is now the northern border of the site. A new commercial block has been created in the west of the site. The electrical substation is shown.	Road reconfiguration. The bus shelter has been moved to the west of the southern block, replacing the cinema. A sheet metal works is located to the west of the northern block.

Map date	Northern block	Southern block	Immediate surroundings
1987-1988	No significant change.	No significant change.	Fairfield Works has been removed.
1992-1995	No significant change.	The terraced buildings are removed from the east of the site.	No significant change.
2003	No significant change.	Blackburn St is pedestrianised and a bandstand is shown on the map.	No significant change.
2010	No significant change.	No significant change.	No significant change.
2021	No significant change.	No significant change.	The bus station south west of the site has been replaced by a supermarket (Lidl) – constructed in 2018.

During the site walkover, discussion with the market manager revealed that to his knowledge the site was previously occupied by a sweet factory. When inspecting the basement area the market manager confirmed the basement was previously used as a snooker hall and remnants of a bar structure remain in one part. The western part of the basement (the part of basement accessible from the market access) was formerly an air raid shelter and remnants of a toilet blocks and signage can be seen there. The market manager also confirmed that the part of the basement to the west, currently under a café was formerly the basement to a butchers shop.

3.2 Geology

3.2.1 Superficial deposits

The British Geological Survey (BGS) 1:10,000 geological map indicates the south of the southern block is underlain by glaciofluvial sheet deposits comprising sand and gravel [2]. Based on the geological mapping glacial till deposits are expected in the north of the northern block. Superficial deposits are not shown on the geological map within the middle portion of the site. Given the history of the site, made ground is expected across the entire site.

3.2.2 Solid geology

The BGS mapping shows the bedrock beneath the majority of the site is the Pennine Middle Coal Measures (PMCM) comprising mudstone, siltstone and sandstone. However, there is a fault in the east of the site (trending NW to SE), resulting in Nob End Sandstone formation (PMCM) shown underlying the eastern part of the site.

3.3 Existing ground investigation data

3.3.1 BGS

The BGS lists no historical borehole records within the site, however there are 12 historical borehole records available within the surrounding 200 m, all to the northeast of the site. The boreholes were drilled to between depths of 2 and 7.62 m.

Boreholes SD70NE75/C [4] and SD70NE75/D [4] are located near Thomas Street 60 m north of the site and described in Table 2.

Table 2: Summary of nearby BGS borehole records

Description	Depth to base	
	(mbgl)	(mOD)
SD70NE75/C		
Fill – fairly compact topsoil and brick rubble	1.07	71.08
Compact medium-grained sand with a slight clay content	3.35	68.8
Medium hard, coarse-grained sandstone, water-marked: heavily fractured with many joints	5.03	67.12
Heavily fractured sandstone with quartzite inclusions	5.47	66.68
Hard, sound, coarse-grained sandstone	7.62	<64.53
SD70NE75/D		
Fill – fairly compact topsoil, clay and brick rubble	2.13	70.33
Compact clayey sand with some pieces of weathered sandstone	3.76	68.7
Soft shales: quartzite partings	3.96	68.5
Hard sandstone: fissured and jointed	4.12	68.34
Soft clayey laminated shales	4.42	68.04
Hard sandstone: fissured and jointed	4.88	67.58
Hard laminated shales	5.18	67.28
Hard coarse-grained sandstone with pebble & clay stone inclusions	6.01	66.45
Heavily fractured shales	6.4	66.06
Medium hardness, coarse grained sandstone with pebble & claystone inclusions	7.62	<64.84

Groundwater was not recorded in these boreholes.

3.3.2 Lidl ground investigation

Ground investigation was undertaken on the land off Dale Street immediately southwest of the southern block, prior to the development of the new Lidl store [5].

Two window sample holes were drilled in January 2015 by Ian Farmer Associates Ltd to depths of 1.36 mbgl and 4.22 mbgl.

An additional geo-environmental assessment was undertaken by LK Consult Ltd later in 2015, with investigation carried out in June and October. This included:

- Drilling of 9no. window sample boreholes from 0.3mbgl to 5.16mbgl
- Drilling of 2no. cable percussive boreholes from 4.20mbgl to 6.36mbgl
- Excavation of 5no. hand excavated trial hole from 0.7 to 1.0 mbgl
- Standard Penetration Tests (SPTs) approximately every 1m in natural strata.
- Installation of monitoring wells in 6no. boreholes for gas monitoring and groundwater sampling.

The geological sequence encountered within the boreholes is generally consistent and comprises made ground underlain by natural sand, sand and gravel and clay deposits. Mudstone bedrock was encountered in 5no. locations between 3.5 mbgl and 5.7 mbgl.

Made ground was generally formed of a surface layer of hard surfacing (concrete, tarmac, block paving, and flagstones) over construction sub-base (yellow sand and gravel comprising limestone). This formed a layer up to 0.8 m thick overlying slightly silty slightly clayey gravelly sand with frequent to occasional brick, ash, clinker, glass, concrete and coal fragments – areas of high clay content noted within made ground. A weak hydrocarbon odour was identified in WS1 between 1.0 m and 2.5 mbgl and an in situ measurement of volatile hydrocarbons detected a concentration of 0.9 ppm in a soil sample collected from this location.

Soft clays and loose sand, inferred to represent an alluvial deposit, was encountered beneath made ground in certain locations and ranged in thickness between 0.3 and 2m thick.

A layer of medium to dense sand and gravel, inferred to represent a glaciofluvial sand and gravel deposit was encountered below the alluvial deposit (or made ground where alluvium was absent).

Groundwater levels were recorded between 2.87 m to 4.03 mbgl.

One sample of made ground identified elevated lead concentrations above generic human health risk assessment criteria for a commercial land use. Groundwater sampling did not identify elevated concentrations of contaminants. One exceedance of hexavalent chromium was identified in one leachate test.

Maximum concentrations of 8.4%v/v carbon dioxide and 0.1%v/v methane were recorded and maximum flow was detected as 0.3l/h. LK Consult Ltd recommended installing gas protection in the new building [5].

3.4 Hydrogeology and hydrology

The Pennine Middle Coal Measures which form the bedrock across the site is classified as a Secondary A Aquifer. Secondary A Aquifers are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

There are no active licensed groundwater abstractions located within 1 km of the site. The site is not within a groundwater Source Protection Zone defined by the Environment Agency.

Borehole log SD70NE29 [4] is a record for a groundwater well located around 750 m northeast of the site. The borehole reached a depth of 124 m. During aquifer testing a sustained yield of 4,230 gallons per hour (c. 5.3 l/s) was achieved resulting in a drawdown of 245ft (75 m).

The River Irwell is situated immediately southeast of the site and flows from the northeast to the southwest. Groundwater was recorded in the Lidl investigation at a similar level to the River Irwell and it is therefore likely that groundwater is in continuity with the River Irwell.

3.5 Mining

There are nine records of ground workings within 500 m of the site. The closest of these is Stand Lane Colliery, 139 m southeast of the site, which was operation from 1874 to 1926. The closest surface mineral working was Scar Top, 215 m northeast of the site [7], [8].

The site is not within a Development High Risk Area [8]. According to the Groundsure Coal Mining report *“The property lies within the potential zone of influence of recorded workings in 7 seam(s) of coal. The most recent underground working in the area was in 1900. These workings lie between 35 metres and 325 metres. Any ground movement due to this coal mining activity should have stopped”* [7].

Further evaluation of the seam depth will be required to mitigate the risk of the presence of shallow worked seams below the site.

3.6 Landfills

According to the Groundsure data [2] there are no are no landfills with an active licence within 500 m of the site. The Environment Agency records show two historical landfills within 500 m of the site:

- an inert waste landfill located 183 m west of the site, operated by Bury Council and licenced between March and May 1991, and
- a landfill located 214 m north of the site which was first recorded to operate from December 1974. The date the landfill ceased operating and the type of waste accepted are unknown.

There are ten further records of relating to two historical waste sites. A scrap yard and a public cleansing depot located 320 m and 450 m from the site respectively.

The presence of unrecorded areas of landfilling is unlikely within the site.

3.7 Environmental permits and incidents

The Groundsure report [2] indicates 20no. waste exemptions for activities involving the storage, treatment, use or disposal of waste exempt from needing a permit within 500 m of the site. The closest of these is 144 m east of the site and involves the storage of waste in secure containers and use of depolluted end-of-life vehicles for vehicle parts.

There are seven licensed pollution releases regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment within 500 m of the site. The closest is 163 m south of the site and permits the respraying of road vehicles.

There are 29 licensed discharges to controlled waters within 500 m of the site. The closest is 6 m east of the site and involves sewer storm overflow into the River Irwell.

There have been nine recorded pollution incidents within 500 m of the site. The closest recorded incident was 14 m southeast of the site in August 2002 and involved dyes and inks, having a minor water impact.

3.8 Preliminary ground model

3.8.1 Ground conditions

Based on the review of the published geological information, site history and publicly available ground investigation data the following ground model has been inferred for the site:

Table 3: Inferred ground model

Strata	Depth to base (mbgl)	Thickness (m)	Description
Made ground	1 to 2.5 m	1 to 2 m	Highly variable material predominantly formed of brick, concrete, ash, glass, timber and clinker. Likely to be around 1m thick. Deeper backfill may be found in former basements – potentially poorly compacted fill most likely formed of demolition materials (brick, concrete, glass, ash). The former Sion Street and Foundry Street pavement may remain below ground and historical photographs show this was a cobbled street.
Glaciofluvial deposits	2 to 5 m	2 to 3 m	Predominantly southern block: Loose sand (slightly clayey gravelly sand) over medium dense to dense sand and gravel (slightly silty and/or clayey sand and gravel with occasional coal fragments and sandstone cobbles).

Strata	Depth to base (mbgl)	Thickness (m)	Description
Glacial till	2 to 5 m	2 to 3 m	Predominantly northern block: Firm to stiff consistency brownish grey slightly gravelly silty clay. Gravel is fine to coarse, angular to subrounded sandstone and mudstone.
Pennine Middle Coal Measures	Not proven (likely > 350 m)	>5 m	Mudstone (thinly laminated bluish grey fine-grained weathered mudstone) Nob End Rock formation (sandstone) in east of site (up to 30m thick)

Whilst not shown on geological mapping a soft brownish grey mottled orange slightly gravelly very sandy clay with occasional coal fragments was encountered during the ground investigation at the Lidl site. The layer was recorded between 0.3 and 2 m thick. This deposit may represent an alluvial deposit which may extend under the site.

Groundwater at the site is expected to be around 3 to 4 mbgl and is likely to be in continuity with the River Irwell. Local perched groundwater bodies may exist locally, for example within former basements, or perched above cohesive glacial till.

3.8.2 Possible sources of contamination

Made ground at the site may comprise demolition materials from past use of the site and may therefore contain asbestos, heavy metals, polycyclic aromatic hydrocarbons and potentially volatile and semi-volatile hydrocarbons. The soils below the electrical substation in the south of the site may have been impacted by leaks of transformer oil (a type of refined mineral oil) and coolant fluids which may contain polychlorinated biphenyls (PCB).

Dye works may be a source of a range of possible contaminants including metals, inorganics, acids, solvents, pesticides, fungicides. However, given the age of the dye works which once occupied parts of the southern block the likelihood of many of these contaminants, in particular the volatile hydrocarbons, is considered to be low.

The ground gas generating potential at the site is expected to be low and the ground gas regime at the site is likely to be very similar to the adjacent Lidl site (see Section 3.3.2).

4 Flooding

4.1 Flood risk mapping

The Environment Agency flood risk mapping indicates the site is not located within an area at risk of river or coastal flooding, except for a small area just north of the market building on the corner of Blackburn Street.

The Groundsure data [2] indicates the site is not at risk of surface water flooding. This is consistent with the LiDAR data which suggests a fall from north to south and no low points within the site which may allow rainwater to accumulate (refer to Figure 2).

The northern and southern extremities of the site are shown to be within an area at low risk of groundwater flooding. The central part of the site is shown within an area of negligible risk of groundwater flooding [2].

4.2 Basement flooding

During the site walkover, it became clear from observations and discussion with the market manager that the risk of flooding of the basement from the Irwell is a major concern and is currently a significant constraint preventing the market operators from using the basement to its potential. Remnants of makeshift flood defences in the form of sandbags and plywood sheeting remain in all window openings. The market manager confirmed that flood water also enters from gulley chambers in the basement floor and sandbags are placed over the chambers to reduce the up flows. The market manager reported that the gullies on the north side of the basement do not produce any backflow during the observed flood events but those in the south of building discharge during flood events.

The basement floor was visibly damaged in places. The floor was cracked and distorted which may be indicative of vertical groundwater pressure which exceeds the floor slab strength during these flood events.

Recent flood events impacting the basement occurred in December 2015, March 2019 and Feb 2020.

It was also stated by the market manager that some water ingress occurs on the northern side of the basement from water infiltrating from the above concrete paved surfacing.

The source and route of basement flooding needs to be determined through further investigation (see Section 6). Based on available information, likely flooding sources are either individually, or a combination of the following:

- The directly adjacent River Irwell;
- Groundwater; and
- The United Utilities combined and surface water sewers in close proximity to the building and a likely direct connectivity from the gullies into the sewer system.

5 Design considerations

5.1 Introduction

This section presents a summary of some of the key site features and constraints identified as part of this desk-based review and site walkover. The features identified may impact on the masterplan and other early design or development decisions. These constraints will require further investigation or assessment as the design progresses.

5.2 Site levels

The current site is relatively flat with only slight slopes which follow the gentle topography of the area. The proposed development levels for the site are not known but are assumed will be similar to the existing levels due to adjacent developments, highways and flood risk. Further assessment of the site levels should be undertaken at an early stage and in consultation with engineering disciplines to consider the impacts on earthworks/ waste, utilities, flood risk and highways. Levels of the carpark and public realm areas have been assumed to remain the same.

5.3 Flooding

5.3.1 Fluvial flood risk

Except for a small area in the north corner of the market building the site is not within a zone mapped as at risk from river flooding. Additional assessment of this corner of the building may demonstrate that the flood risk in this area is not a real feature, rather is a due to inaccuracies in OS Terrain data the EA flood risk assessment is based upon. This should initially involve a visual inspection followed by a topographical survey to determine the ground level in that area.

5.3.2 Onsite surface water management

As noted above in Section 5.2, it is assumed that proposed site levels are similar to the existing levels. Site levels design will need to minimise flooding risk to the proposed buildings and also account for planning requirements to contain surface water (from the 1 in 100 year plus climate change flooding event) on site as far as reasonably practical.

The aspect of containing the surface water on site for the 1 in 100 year rainfall event may be of particular interest to the Lead Local Flood Authority (LLFA) given that the existing site levels run off into the River Irwell which has up and down stream flood risk. Containing this extreme event on site could involve adaptations to the existing level scheme to introduce localised managed ponding areas and/or raised edges. However, from our review of existing site levels it may prove impractical to achieve this while providing an accessible public realm and so an approach that maintains the present falls towards the River Irwell may be

necessary. Therefore, it is recommended that discussions with the LLFA (Lead Local Flood Authority) are held as early in the design process as possible to agree a balanced approach.

It is also necessary to consider the integration of Sustainable Drainage Systems (SuDS) under planning policy. While the majority of the masterplan is hard paved, the inclusion of trees already provides an opportunity for SuDS through bio-retention tree pits and there may be further opportunities through an integrated drainage/landscaping approach early in the design.

5.3.3 Market basement flooding

The market basement is known to flood periodically (typically every 1 to 2 years). The River Irwell, groundwater and the sewer network (immediately north of the market) are possible sources of the flood water and may occur in combination during a storm event.

Further assessments should be undertaken to determine the most likely cause(s) of the flooding which will inform the mitigation requirements. However, there are certain measures which whilst not eliminating the cause of flooding could be implemented to at least reduce the impacts and volume of water entering:

- Repairs to known cracks in areas of leakage;
- Repairs to, replacement of, or blocking up of windows which are known to allow river water into the basement;
- Re-pointing of the external wall where appropriate; and
- Sealing of redundant drainage (such as foul connections) in the basement.

Installation of new drainage cavities or sumps and pumps may help further mitigate the flooding risk and may be appropriate for occasional use as event space. Full remedial works to the basement and the construction of an internal waterproof structure will need to be considered if a permanent or higher quality use of the basement is proposed. Options for the provision of different levels of flood resilience and the estimated costs of implementing these works should be evaluated in the next work stage.

5.4 Development phasing

Based on Arup experience on other projects, early discussions should be held in relation to agreeing a programme and sequence of development. It may be important to maintain the operation of parts of the retail and market space during development works. This may involve a phased or sequential development programme which may create additional constraints, in particular for earthworks. Space to temporarily process and store excavated material may be limited and may result in additional disposal costs if material needs to be removed from the site.

5.5 Below ground constraints

This section provides a summary of the constraints that have been identified which may have an impact on the proposed development. Historical maps showing key historical features are presented in Appendix B.

5.5.1 Soft ground

Made ground is expected across the site and in places may be deep, for example in former basements. These materials may contain soft spots where these former structures have not been backfilled to a controlled performance specification. Furthermore, the uppermost natural geology at the site has been found to include loose sands and soft clays. These materials are unlikely to provide sufficient strength for shallow building foundations. They would potentially require re-engineering or other improvement to make these suitable for external works. Ground floor slabs formed on this material are likely to be suspended rather than ground bearing. Ground improvement, such as in situ treatment or excavation and replacement to a specification, may be required if shallow foundations are proposed.

5.5.2 Buried obstructions

Old structures may remain buried below ground, in particular basement structures and foundations. This may include relic walls and basement floors or partly demolished structures within the made ground.

Excavations within obstructed made ground will be more difficult due to potential excavation instability, the requirement to overdig and remove these obstructions and the necessity to utilise slow hydraulic breaking and this will impact on the programme and cost of the works.

Whilst the foundation methods for proposed new buildings have not yet been established the presence of potentially large buried obstructions may affect the method of piling and potentially exclude the use of certain methods. Driven or CFA (contiguous flight auger) piles may encounter problems and are therefore unlikely to be suitable if obstructions are not removed in advance.

5.5.3 Shallow rockhead

The depth to Coal Measures rockhead is expected to be around 5 m below ground level. It may be preferable to deepen foundations to rockhead, especially where soft or loose deposits are encountered at shallow depths (see above).

In areas of deeper excavation, for example the footprint of the proposed swimming pools, excavation into rock may be required. The excavatability of rock is determined by the degree of weathering and cementation, strength and discontinuity spacing and can be assessed by ground investigation.

5.5.4 Shallow groundwater

Data from adjacent sites indicates that groundwater is around 3 to 4 mbgl but there may be localised perched groundwater at shallow depths. Excavations can be unstable and compaction difficult where these activities take place near to or below groundwater. Groundwater control may therefore be required for deeper excavations for example the new swimming pool or removing older basements.

Higher specification water proofing will be required for structures built below groundwater level. Consideration should be given to raising ground floor/ basement levels above groundwater level.

5.5.5 Possible contamination

Made ground at the site may comprise demolition materials from past use of the site and may contain asbestos, heavy metals, polycyclic aromatic hydrocarbons and potentially volatile and semi-volatile hydrocarbons.

Made ground soils which remain on site (either in situ or excavated and re-used) are likely to be suitable for a commercial type development and extensive soil remediation is not anticipated. The human health risk will likely be mitigated by the presence of hard surfacing across most of the site which would prevent exposure to the contaminants present. The hard surfacing and site drainage will limit infiltration into the ground and therefore minimise any leaching. Soil leachability targets and validation testing may be required for soils which are placed below groundwater (if required).

It may be necessary to import clean topsoil for use in tree pits or other areas of soft landscaping if the site soils are not chemically suitable for planting or pose a human health risk.

The electrical substation in the southern block may have caused localised oil and PCB contamination and testing should be undertaken adjacent to the substation to determine the risk posed to the River Irwell. Localised remediation of soils/ hydrocarbons (if present) may be required depending on the risk to the River Irwell.

As a minimum a geoenvironmental desk study will be required for submission with a planning application for the proposed development. Pre-commencement planning conditions will likely be applied that require ground investigation, contamination risk assessments and a remediation strategy that demonstrate mitigation of risks.

5.5.6 Earthworks balance and phasing

Re-using the existing soils in the new development will be the most sustainable way to develop the site whilst minimising waste. However, the site is constrained by a relatively small footprint and may require a complex construction sequence to maintain partial functionality of the market and other retail outlets (see Section 5.4). Excavation to form below ground structures such as swimming pool is likely to produce surplus material which may not be possible to use elsewhere within the

development. It is therefore likely that waste soil will be generated if this material can't be accommodated elsewhere on the development.

It is recommended that the site levels are reviewed and optimised at an early stage in the project development to maximise the re-use of soils (i.e. reduce the volume of waste soil material). This will need multidisciplinary engineering input to work through constraints such as flood mitigation, utility diversions, road levels and tie into the existing road network. Identifying suitable areas to process and store soils will also need to be considered in the context of the development phasing/sequence.

Materials which are to be re-used will need to be suitable from both a geotechnical and geoenvironmental perspective. Whilst soils are likely to be suitable this will require ground investigation to assess and confirm the re-use potential.

5.5.7 Ground gas protection

The ground gas regime on the site is expected to be similar to the adjacent Lidl site. Therefore, some form of ground gas mitigation is expected to be required in new buildings. The existing basement, if retained, may need some form of ventilation to mitigate the risk of exposure to ground gases which may include mechanical ventilation due to difficulties associated with retrofitting. Future ground investigation should include ground gas monitoring to inform design of gas protection measures.

5.5.8 Archaeology

There is potential for archaeological interest due to the industrial heritage of the site and surrounding areas. This may result in delays during earthworks and additional costs associated with surveys. Consultation with the County Archaeologist should be undertaken as there may be a need for separate desk study and intrusive investigation to assess archaeological interests.

5.6 Utility and drainage constraints

Appendix C provides a summary of the key major utility constraints identified from statutory records which may impact on the site development as it is currently shown [10]. To inform the masterplanning exercise, these have been grouped into four geographic areas of the proposed development and are discussed below;

- Blackburn Street;
- Dale Street;
- the market northern frontage; and
- the leisure facility west and north boundary.

The utilities search, showing all the utilities present at the site, is included in the Groundwise report [3]. It is noted that statutory utility plans may not reflect the as-built location of the utilities which should be confirmed by non-intrusive and intrusive investigation as appropriate.

In assessing the utility constraints Arup has focussed on major constraints which, from our past experience, may involve significant cost or programme impacts. Local utility connections and disconnection and diversion of minor low voltage cables are not discussed here, nor are local impacts due to level changes as they are unlikely to significantly shape the masterplan but should still be considered in any costing exercise being undertaken.

Footpaths/pavements which are outside the redline boundary or unlikely to be affected by the proposed development have not been considered in this assessment. However, if any modifications, resurfacing or remedial works are proposed the affects to utilities will need to be assessed, particularly the introduction of any new vehicle access points as any existing utilities will likely require lowering.

5.6.1 Blackburn Street

There are several utilities of significance located along Blackburn Street that may be impacted by the proposed development or whose location could inform the masterplan due to the potential clash with the proposed Hub / Library Buildings. These include:

- A BT chamber and kiosk in the area proposed to be the Hub. BT records do not indicate whether their infrastructure is copper or fibre. If it includes fibre then these can have a significant cost to divert.
- Virgin Media duct route is indicated along Blackburn Street below the proposed Hub building. To facilitate the proposed masterplan this would require diversion.
- SSE telecoms line which passes under the proposed Hub building which may require rerouting. This may be contained with the Virgin Media duct infrastructure noted above but cannot be confirmed at this time. This is likely to be a fibre route and may have a significant diversion cost associated with it.
- LV cables below the proposed library footprint.
- A 6 to 6.6kV cable is in close proximity to the proposed library and retail unit immediately south. It will be vital to understand an accurate location of this route to understand any constraint on the masterplan posed by it.
- An 18" low pressure gas main runs alongside the proposed Hub building on Blackburn Street and the 18" main on Dale Street is indicated as passing below the northern corner of the proposed library.

Further investigation such as GPR and inspection pits to locate these utilities is recommended.

5.6.2 Dale Street

A high number of services are shown to run through Dale Street and footpath, including:

- SSE telecoms (Fibre Telecommunications Network);

- 11kV and 6.6kV cabling;
- LV cabling;
- Medium and low pressure gas mains;
- Combined sewers; and
- Water supply pipes

The current development proposal is to pedestrianise Dale Street (refer to Section 5.6.5 below for further considerations related to development of public realm).

It is assumed that if Dale Street is pedestrianised then it will remain an adopted highway. If it was to be stopped up (removed from the adopted highway) then wayleave/easement agreements would be required with the infrastructure providers or the services diverted elsewhere.

It is noted that the impact on transport will require further consideration (see Section 5.10).

Arup understands that an option to build over Dale Street to connect the northern and southern blocks is also being considered. Given the large amount of significant utilities and drainage within Dale Street, it will be vital that the cost to divert this infrastructure is considered as part of this decision. In particular modifications to the SSE telecoms (fibre) route, 11kV network and medium pressure gas main will likely induce a high diversion cost. It is recommended that options for the diversions are considered at an early stage and costs are obtained via C3 quotations to help inform design decisions.

5.6.3 Market northern frontage

There are a large number of HV cables and BT ducts that run along the market frontage (northern wall). These utilities are unlikely to be impacted by the present masterplan because the current proposal aligns with the existing market footprint. However, if the façade line were to be extended further into the street (i.e. north) then there is a risk of disruption to these utilities which will need further consideration.

The United Utilities (UU) sewer drawings do not appear to be conclusive around the market basement area due to the complex drainage arrangement. It is recommended that a CCTV survey of the sewers is undertaken at the design stage to obtain further details of the connectivity, condition and discharge location of these sewers. As noted elsewhere in the report, this should also investigate the connectivity to/from the Market building basement. The UU sewer records drawing (refer to Appendix C) shows a sewer running along the footpath to the north of the existing market taking the combined sewage and water from the surrounding buildings. The drawing suggests the sewer then discharges to the River Irwell via a public surface water drain. It appears the drainage along Blackburn Street is designed to overflow during high flow events and discharge into the sewer adjacent to the market. This may be a possible source of the flooding observed in the basement and should be further investigated.

5.6.4 Leisure facility west and north boundary

Several utilities pass within the footpath along Dale Street, including where the road diverges south towards Lidl. The current Leisure facility building is shown to extend north and west beyond the footprint of the existing building and into the footpath potentially impacting the utilities.

The following services would be affected by the presently proposed building extent. The impact of the building could be reduced by developing up to the present building line on the west and north sides, as noted below:

- HV lines (11kV, 6.6kV) and LV cables – impact could be mitigated by leaving current west and north footpaths unaffected.
- 6.6kV to LV substation and associated feed and supply cables
- Virgin Media ducts – impact could be mitigated by leaving current west and north footpath unaffected.
- UU combined sewer below the southern corner of the proposed building
- Cadent 18” low pressure gas main – impact could be mitigated by leaving current west and north footpaths unaffected.

The accommodation of the existing substation or its relocation should be considered early to inform the cost of relocation or spatial impact of accommodation within the leisure facility.

5.6.5 Public realm considerations

Public realm is proposed along Dale Street, the area adjacent to Blackburn Street and the area between the market and leisure facility. Access from the adjoining roads may require new bollards to protect users of the space from vehicular collisions. In particular Dale Street will require some form of structure to prevent or restrict vehicular access (as well as wider traffic studies). These areas will require further investigation to detect and avoid possible service clashes with the foundations of the bollards.

It is likely that trees will be introduced into the public realm. Trees proposed in the public realm areas will need to be carefully planned and co-ordinated against existing utilities and drainage to mitigate potential significant costs to divert services or loss of tree provision. The offset to mitigate these risks varies based on the particular species of tree. It is vital that investigations to locate utility should be undertaken at an early stage to accurately map the route of underground utilities to assist in the positioning of trees.

5.7 Market basement

The current knowledge of the basement condition and the impacts of flooding are presented in sections 2.3.2, 4.2 and 5.3.3. Inspections of the parts of the basement not accessed will need to be undertaken.

During the next design stage further information should be gathered on the current materials and condition including any remedial works undertaken following the Integra recommendations. An outline assessment will need to be undertaken of the

impacts of the changes in use and loading of the market area within the proposed masterplan, including any impacts due to enhancing the flood resilience.

This work will allow the targeting of any intrusive structural investigation works needed to inform the subsequent design of any remedial or strengthening works.

5.8 Low carbon heating and cooling

This section provides an overview of ground source and water source heat pump options which may be appropriate for the development. This is not a comprehensive techno-economic assessment of all options. It has been assumed that the heat pumps will be required predominantly for heating and not cooling.

5.8.1 Ground source heat pumps

There are two types of ground source heat pump open loop and closed loop. Open loop involves abstraction of groundwater from an aquifer which is passed through a heat exchanger and heat pump at the surface. Closed loop is a conductive system where heat exchange loops are installed into the ground and heat is transferred from the soil and rock via conduction.

Open loop

The site is underlain by the Pennine Middle Coal Measures. This is predominantly formed of mudstone interbedded with siltstone and sandstone. The permeability is therefore expected to be variable and potentially low and therefore groundwater abstraction (flow) rates may be low. Therefore, the site may not be suitable for an open loop ground source heat pump system. However, a groundwater borehole within 750m of the site proved a flow rate of 5l/s is possible, resulting in a groundwater drawdown of 75m. A borehole to 200 to 250m may produce water at a temperature of 16°C.

Assuming a change in temperature (ΔT) across the heat exchanger of 5°C the capacity of the open loop system would be around 100kW. For heating, assuming an output temperature of 65°C and coefficient of performance (COP) of 4 the capacity would be around 140kWth.

Closed loop

The proposed car park and public realm space may provide an opportunity to install closed loop boreholes. It may be possible to install between 15 and 20 in these areas with a borehole spacing of 6m (subject to utility constraints). The thermal conductivity of the Pennine Middle Coal Measures has been assumed based on BGS and other published information and, after losses, a closed loop borehole could provide 45 W/m in this area of Radcliffe. Therefore, a single borehole to 200 m could provide 9 kW capacity.

Based on 15 to 20 boreholes, for heating, assuming an output temperature of 65°C and coefficient of performance (COP) of 3 the capacity would be around 200 to 270 kWth.

Mine energy

The Coal Mining Report obtained for the site indicates past coal workings beneath the site. The worked coal seams are reported to be at a depth of up to 325 mbgl. Mine water at that temperature could be around 18°C [8]. With a flow rate of 10l/s and assuming a ΔT across the heat exchanger of 5°C the capacity of an open loop mine system would be around 200kW. For heating, assuming an output temperature of 65°C and coefficient of performance (COP) of 4 the capacity would be around 280 kWth. It may be possible to achieve higher flows than this. Consultation with the Coal Authority is recommended to determine further detail about the mine workings below the site and discuss the potential for a mine energy project.

5.8.2 Surface water source heat pump

A surface water source heat pump, utilising water from the River Irwell may be an appropriate solution. Given the relatively higher flow rate (as compared to groundwater), river systems can often accept a greater heating and cooling imbalance than ground-based systems. However, there will be a strict temperature constraint driven by Environment Agency requirements that will need to be considered. In addition, permit lead times are often longer for surface water systems than ground source systems (and require more regulatory stakeholder engagement).

The capital expenditure for surface water systems next to a site is more likely to be lower than for a ground source system given the lack of borehole drilling and reduced conveyance piping. In addition, there is greater certainty in the capacity from a surface water system, relative to a ground source system (i.e. no geological uncertainty).

Open loop

Without the hydrogeological constraint of an open loop GSHP, the water abstraction flow rate can be designed to meet the heat/coolth demand requirements. However, the discharge temperature to the River Irwell will need to be agreed with the Environment Agency and will likely form a system limitation. System design will need to carefully consider water flow during the winter to avoid pipe freezing. Other factors which will need to be considered are wildlife protection, filtration system, and anti-corrosion / anti-biogrowth measures.

Closed loop

Closed loops systems have less impact on the environment, but also are less energy efficient than open loops systems and require less long-term maintenance. The capacity of the closed loop system is based on the size of the heat exchange array (slinky) installed within the River Irwell and require a minimum depth within the surface water to be feasible. Further discussions will be needed with the Environment Agency and Canal and River Trust to understand the options for a closed loop system with surveys to evaluate the river bed levels and seasonal variations in river water temperature.

5.9 Plant space requirements

Arup has carried out an initial review of building services plant spaces for the leisure centre. The scheme is at very early stages so significant assumptions were made to inform the review, including:

- Plant spaces all based on assumed occupancies, design criteria etc, since data not available at this stage;
- Internal and external heating plant space will vary depending on primary plant solution; and
- Ventilation plant requirement could be reduced if some areas could be naturally ventilated – e.g. offices.

CBRE also requested that Arup provide comment on the suggestion of locating leisure centre plant in the basement of the Market building. Arup wouldn't recommend locating plant within the nearby market building for the following reasons:

- Regular access required to plant in a separate building;
- Basement location makes plant access more challenging and limits plant which can be located there;
- Difficult to separate building in the future, e.g. if one building is to be sold;
- Issues in one building (e.g. fire, refurbishment) will impact the other building; and
- Increased capital cost of services and running costs from additional services distribution.

Arup has also provided high level commentary on aspects to consider as the project moves forward including topics such as zero carbon design, adjacencies and zoning, swimming pool water quality and building optimisation.

Further details of the plant review exercise and additional commentary can be found in the Appendix D.

5.10 Transport

Pedestrianisation of Dale Street could have a number of implications on wider transport movements within the area, including:

- Diversion of traffic and impact on network congestion and delay – particularly given one-way restrictions on Blackburn Street;
- Access to adjacent properties and businesses;
- Relocation of on-street parking bays;
- Requirements to reroute bus services – in particular 513 and 524;
- Opportunities/challenges of maintaining cycle access through the space – potentially incorporating National Cycle Route 6;

- Servicing and delivery requirements for local businesses, including Royal Mail and Lidl; and
- Emergency service access implications.

It is recommended that a transport and access study/assessment is undertaken to understand the implications and develop appropriate solutions/strategies in consultation with Bury Council to mitigate any adverse impacts.

6 Recommendations

Desk-based review of the site, supplemented by a walkover, has identified several features and constraints at the site which relate to the masterplan for the proposed Radcliffe Town Hub. The following sections provide recommendations for surveys and investigations to inform decisions as the design develops further through cost plan to planning application. The recommendations have been split into RIBA Work Stage 2 and 3 to assist in prioritising the surveys.

6.1 RIBA Work Stage 2 – Concept design

The following further work is recommended to inform the development of a cost plan and refine the masterplan prior to developing a planning application:

- **Structural monitoring:** Review the monitoring data for the market basement (if available) and collect new measurements from the existing survey points. Investigate whether the remediation measures have been implemented and their success.
- **Basement flooding investigation:**
 - **Internal survey:** To confirm basement levels relative to river water levels and ground levels for assessing flood mitigation options. Access to the areas of the basement which could not be accessed during the March 2021 walkover.
 - **Investigate the sewer drainage (such as CCTV survey):** The combined sewer and surface water sewer along Blackburn Street and the north of the market is not conclusive and is complex and may be partly responsible for flooding in the market basement.
- **Topographic survey:** To better define the existing site levels across the site, in particular the existing ground level constraints at the site boundary which may form a hard constraint to future site levels. This survey will also help assess the flood risk in the north of the market building.
- **Ground penetrating radar (GPR):** to confirm the approximate location of the key utilities which may contain the masterplan or result in costly intervention or redirection.
- **Transport and access study/assessment:** To understand the implications of pedestrianising Dale Street and to develop appropriate solutions/strategies in consultation with Bury Council to mitigate any adverse impact.
- **Surface water management:** Discussions with the LLFA (Lead Local Flood Authority) to agree a balanced approach to managing surface water.
- **Discussion with Bury Council Environmental Health department:** Whilst there are not expected to be any unusual requirements related to contaminated land it is useful to engage with the Environmental Health Officer/Contaminated Land Officer to determine requirements for a planning application.

- **Further evaluation of past coal mining:** To understand the risk associated with construction over past mine workings and the potential for a mine energy project at the site.
- **Low carbon energy feasibility study:** Several low carbon heating and cooling options may be available at the site. A techno-economic appraisal, considering capital and operational expenditure and carbon savings will assist in identifying the most appropriate option(s) to review further.

6.2 RIBA Work Stage 3 – Developed design

The following is recommended to inform the planning application and refine the cost plan:

- **Utility inspection pits:** To investigate the location and condition of utilities which require diversion or may be impacted by the proposed development.
- **Basement investigation:** Intrusive investigation of the basement structure (wall and floor core samples and analysis) to assist in structural design for the retained basement and design of water proofing options.
- **Ground investigation:** To provide data to support environmental risk assessment (remediation strategy), earthworks and foundations designs.
- **Earthworks levels optimisation:** Following ground investigation and topographic survey, refine the site levels to reduce the volume of waste requiring disposal offsite.

References

- [1] Groundsure, March 2021, MapInsight (GS-7622258)
- [2] Groundsure, March 2021, Enviro+Geo Insight (GS-7622260)
- [3] Groundwise, March 2021, Desktop Utility Search Land on the North & South Side of Deansgate, Radcliffe, M26 1NN (27977DM)
- [4] BGS Geoindex (<https://mapapps2.bgs.ac.uk/geoindex/home.html>, [accessed 15/03/2021])
- [5] LK Consult Ltd, November 2015, Land at Dale Street, Radcliffe Geo-Environmental Investigation and Risk Assessment (LKC 14 1433)
- [6] Integra Consulting (Engineers) Ltd, October 2017, Structural Inspection of Existing Basement Structure, Radcliffe Market Hall, Dale Street, Radcliffe, for Bury Council
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- [8] Coal Authority online mapping (<http://mapapps2.bgs.ac.uk/coalauthority/home.html> [accessed 15/03/2021])
- [9] GOV.UK (2019) DEFRA Survey Data [online] Available at: <https://environment.data.gov.uk/DefraDataDownload/?Mode=survey> [accessed 15/03/2021]
- [10] AEW, 26th Feb 2021, Bury, Radcliffe Town centre Progress Update (12172-AEW-XX-XX-PP-A-008)
- [11] Britain from Above (<https://britainfromabove.org.uk/> [accessed 15/03/2021]).
- [12] <https://www.heritagephotoarchive.co.uk/> [accessed 15/03/2021]

Appendix A

Site walkover

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
Site visited on Tues 9th March by Lee Jordan. On site 10am until approx. 1230pm. Weather – light showers – mostly dry Link to photographs for internal Arup staff: <u>Location:</u> \\Global\europa\Manchester\Jobs\280000\280786-00\7 Site Related Activities\7-07 Arup Site Records\7-07-05 Site Photos\2021-03-09 LDJ Site Visit	
Market Hall – Met with Ricky Davies (Market management) and his colleague Chris Existing market level – Largely brick masonry walled with steel lattice supported roof and concrete floor slab. RD reported that site was formerly a sweet factory, snooker hall and air raid shelter 	

Central area looking north

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
 Western edge of market building, looking east  View of south bank of river from the market observation window – RD confirms that when the river level is at the circled level this is an indicator of significant basement flooding.	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
Market Basement – Stone masonry outer (riverside) wall and brick inner walls Basement is used for storage only but market management want to utilise the space more effectively including for events. Reported by Ricky to be prone to severe flooding every 1-2 yrs at present. Windows to river side partially filled with sand bags and wooden sheeting as a basic flood defence. Some gulleys within basement floor also covered with sand bags as water is reported to enter through these during high river levels. Several chambers present with differing floor levels and types. Area to east – Out of bounds due to loose pipework. Evidence of significant pipework, electrical installations, uncovered fusebox.	Internal and external topo survey required at next stage in project development.[P OST VISIT – Survey obtained within a structural report. To be reviewed]

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
 Main chamber – Evidence of cracking in the concrete floor, floor levels locally distorted.  Floor to window sill height on river side approx. 0.75m Reported to be a former snooker hall. Remains of a bar area are present. Some vaulted areas present on north side of basement and evidence of water entry from above possibly from the external paved area.	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
 Walking to the west, basement enters a slightly lower are with a stone set floor. A pair of water pumps has been placed which activate once water reached a level of 3 inches and appears to discharge through the river wall. 	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study			

Notes	Action by
Further to the west, the basement enters a former air raid shelter with concrete columns supporting a vaulted brick arch ceiling. Two toilet structures present one either side of this room. Stone slab floor slopes from west to east. Window sills blocked with concrete building blocks but height from floor to window sills 1.05m in west and 1.3m in east.  General – Evidence of structural damage/cracking up to 20mm. Some structural tell tales present. RD believed that the council may have some reports.	[POST VISIT – Survey obtained within a structural

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study		

Notes	Action by
Several blocked off staircases – opportunity to reopen these 	report. To be reviewed] Check with client as to availability of any structural reports on market incl monitoring. If not available then structural survey recommended. [POST VISIT – Structural report obtained. To be reviewed]
Structures to east (Market chambers) and west (Coffee shop) of main market and their basements were not accessible at the time of the visit. Further visit needed in next phase of work but for the purpose of the current work, structure and basement conditions assumed to be broadly similar.	
Market - External– Paved area to north of market hall. RD confirms that are not performing well with vehicle loading, they have installed some planters to try and reduce vehicle overrun.	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study		

Notes	Action by
 Looking west – Market Hall on left  Looking east – Market Hall on right. Building to east of market – Market Chambers – Currently disused. Two storeys plus roof space brick building. No access possible. Appears to have a stone walled basement at similar levels.	Topo survey and further inspection of properties required

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
  Southern façade of market showing window elevations within stone walled basement with brick construction over. Note large diam pipe in wall on right of photo.	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
Other areas within South block –  Bridge Tavern and plaza area/bandstand - Looking north.	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study		

Notes	Action by
 Likely cellar access	
 Looking west to Bridge Tavern – Ground levels reducing from north to south	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study		

Notes	Action by
 Plaza area – looking west to 3 storey retail units  Plaza area looking east	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study			

Notes	Action by
 Retail units looking east	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
 Retail units corner of Dale and Lidl car park entrance  ENW Sub station opposite market	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study			

Notes	Action by
 South block – back of retail – some single storey	
North block – Comprises an existing surface car park – Railway St and 3 storey retail/office buildings 	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
Railway St – Public car park  Western edge of north block, looking south.  Increase in ground levels towards Railway St – Looking North	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review		Job number
			280786
Visit made by	Lee Jordan	Place visited	Radcliffe site
			File reference
			7-07-06
Copy to		Person visited	Ricky Davies
			Date of visit
			09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

Notes	Action by
 Increase in ground levels towards Railway St – Looking West  Back of North Block retail.	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study			

Notes	Action by
 Retail/Commercial block – Railway St	
 Eastern façade of North block – looking west	

Record of Site Visit

Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021

Purpose of visit Preliminary site inspection as part of a constraints study

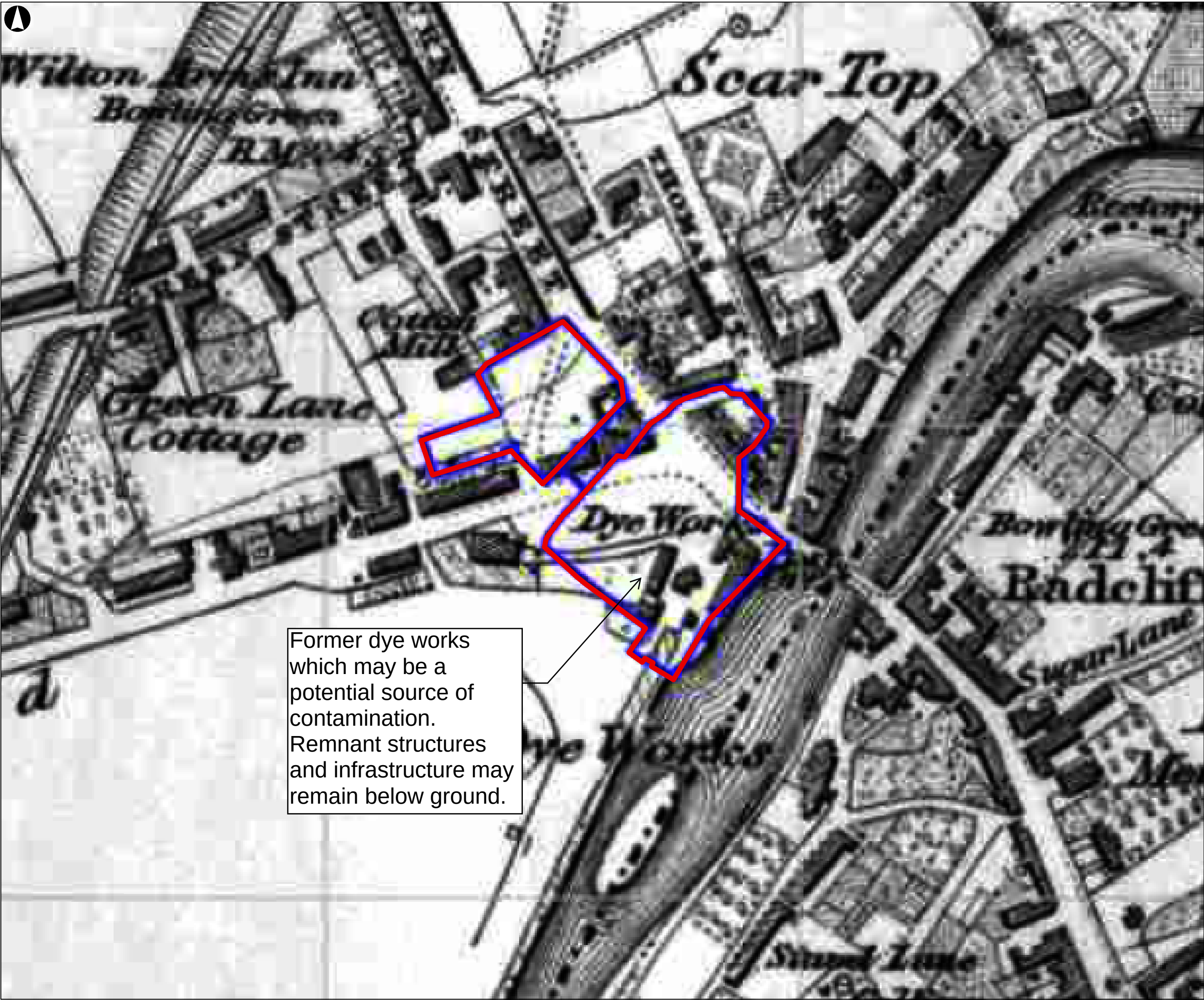
Notes	Action by
 SE Corner of North block – Blackburn and Dale St – looking west	

Record of Site Visit

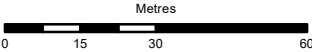
Project title	Radcliffe, Bury – Development Constraints Review			Job number
				280786
Visit made by	Lee Jordan	Place visited	Radcliffe site	File reference
				7-07-06
Copy to		Person visited	Ricky Davies	Date of visit
				09-03-2021
Purpose of visit	Preliminary site inspection as part of a constraints study			
Notes				Action by

Appendix B

Utilities review



Legend
Site Boundary



P0	2021-03-22	MG	MG	MG
Rev	Date	By	Chkd	Appd

ARUP

6th Floor, 3 Piccadilly Place
Manchester M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879
www.arup.com

Client
CBRE

Project Title
Radcliffe Civic Hub

Drawing Title
OS Mapping
1848-1850 (1:10,560)

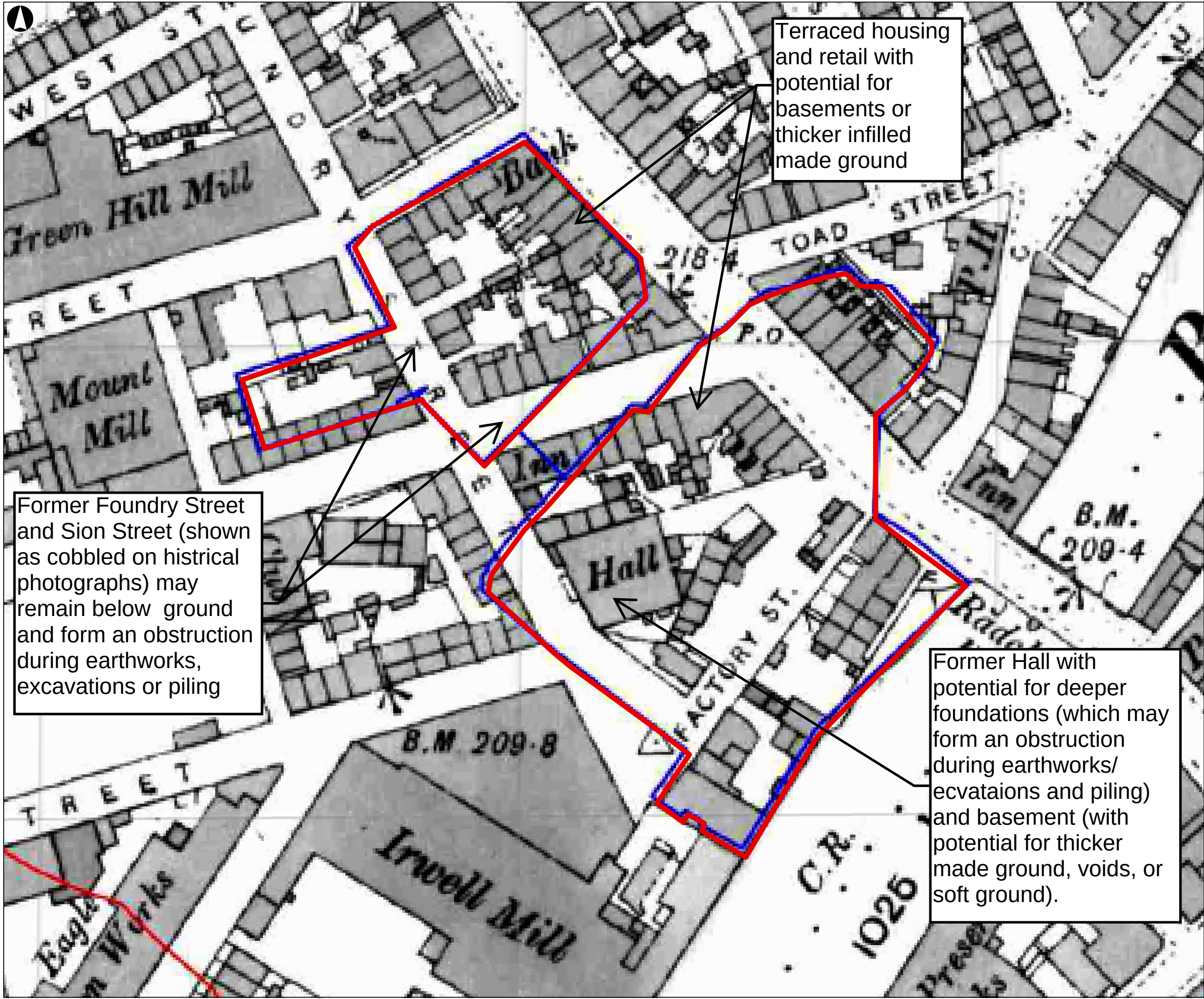
Scale at A3
1:1,500

Role

Suitability
Preliminary

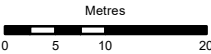
Arup Job No 280786-00	Rev P0
--------------------------	-----------

Name
Figure B1



Legend

Site Boundary



P0	2021-03-22	MG	MG	MG
Rev	Date	By	Chkd	Appd

ARUP

6th Floor, 3 Piccadilly Place
Manchester M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879
www.arup.com

Client
CBRE

Project Title
Radcliffe Civic Hub

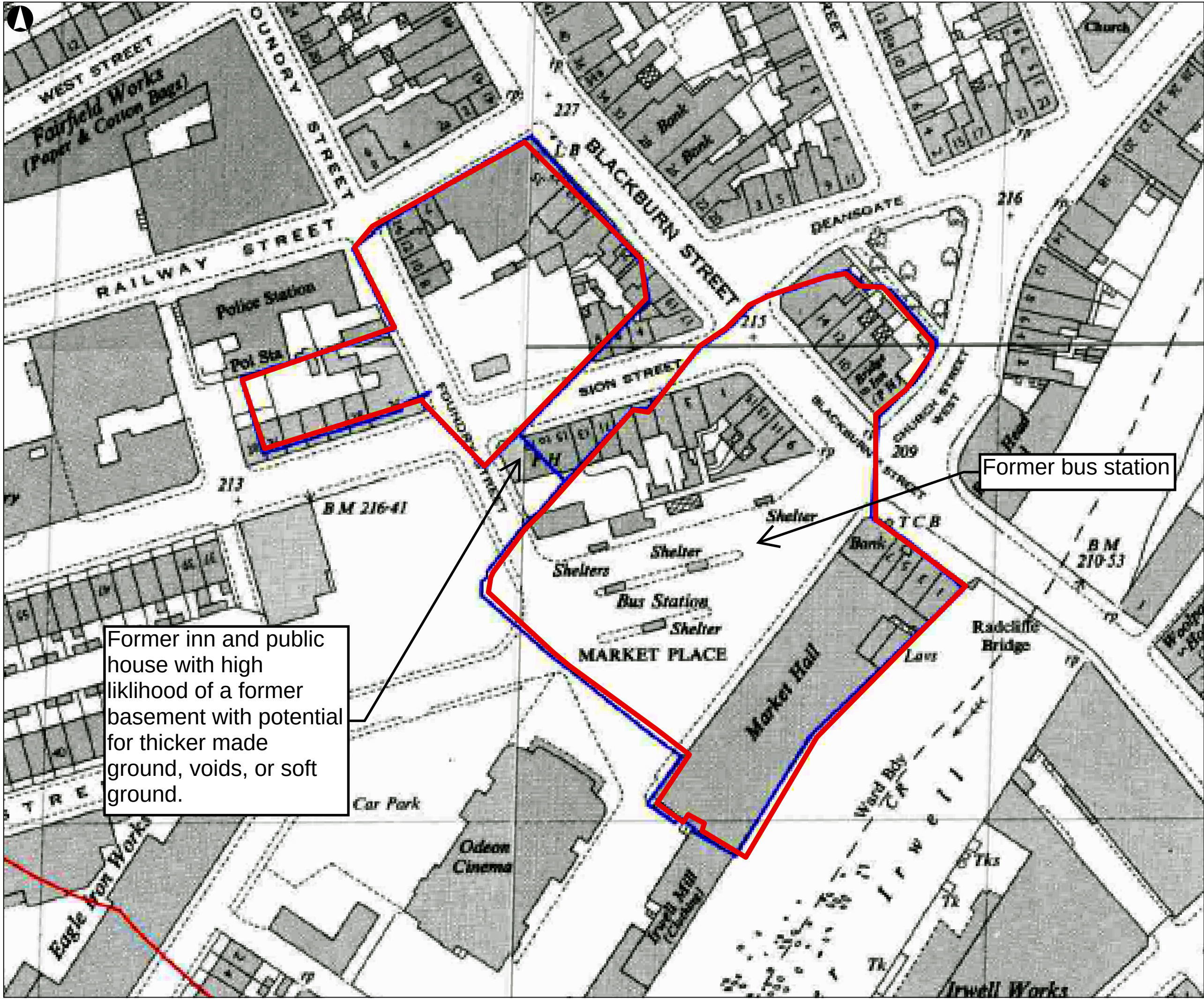
Drawing Title
**OS Mapping
1893 (1:2,500)**

Scale at A3
1:750
Role

Suitability
Preliminary

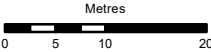
Arup Job No 280786-00	Rev P0
---------------------------------	------------------

Name
Figure B2



Legend

Site Boundary



P0	2021-03-22	MG	MG	MG
Rev	Date	By	Chkd	Appd

ARUP

6th Floor, 3 Piccadilly Place
Manchester M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879
www.arup.com

Client
CBRE

Project Title
Radcliffe Civic Hub

Drawing Title
OS Mapping
1955-1956 (1:2,500)

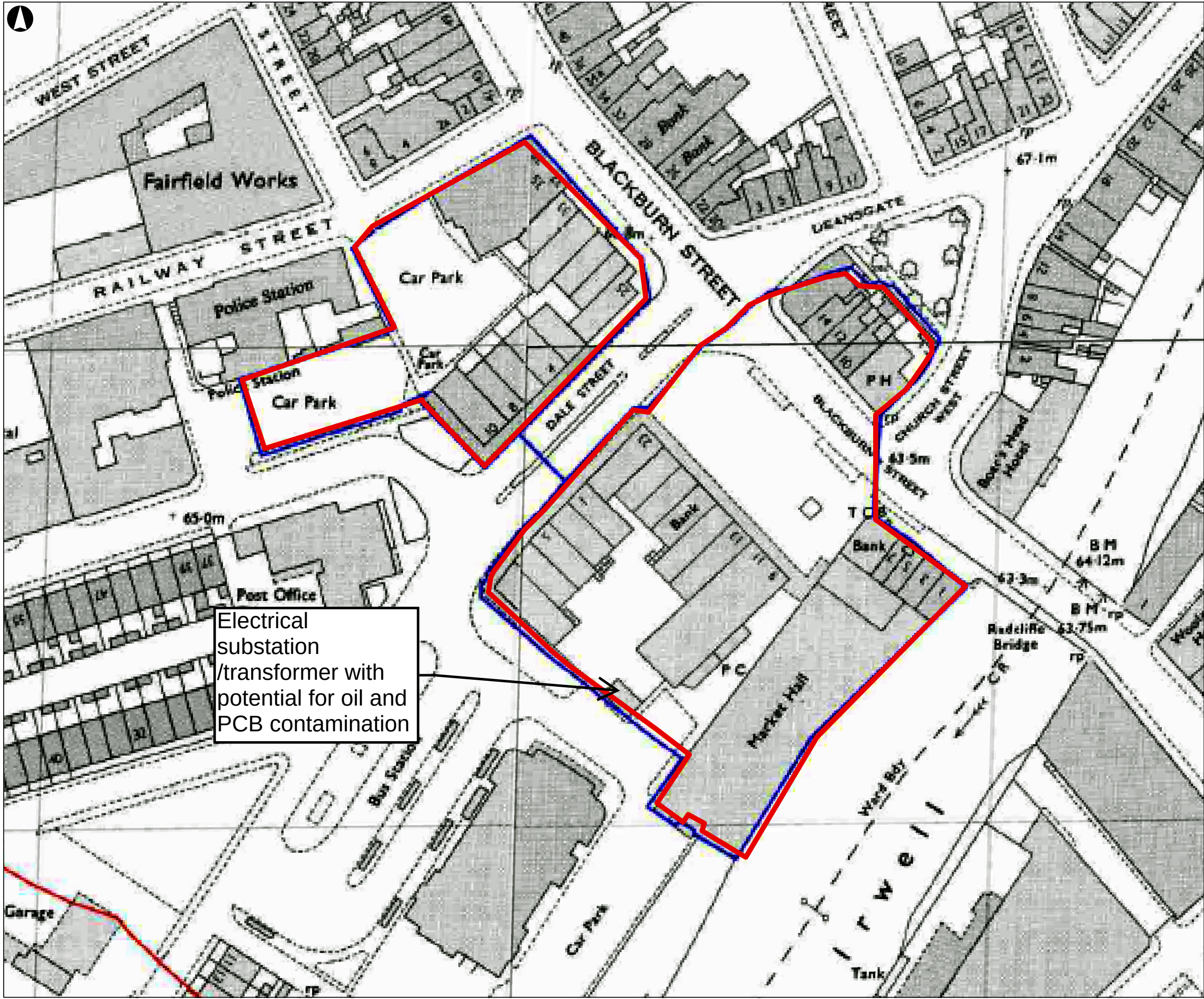
Scale at A3
1:750

Role

Suitability
Preliminary

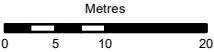
Arup Job No 280786-00	Rev P0
--------------------------	-----------

Figure B3



Legend

Site Boundary



P0	2021-03-22	MG	MG	MG
Rev	Date	By	Chkd	Appd

ARUP

6th Floor, 3 Piccadilly Place
Manchester M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879
www.arup.com

Client
CBRE

Project Title
Radcliffe Civic Hub

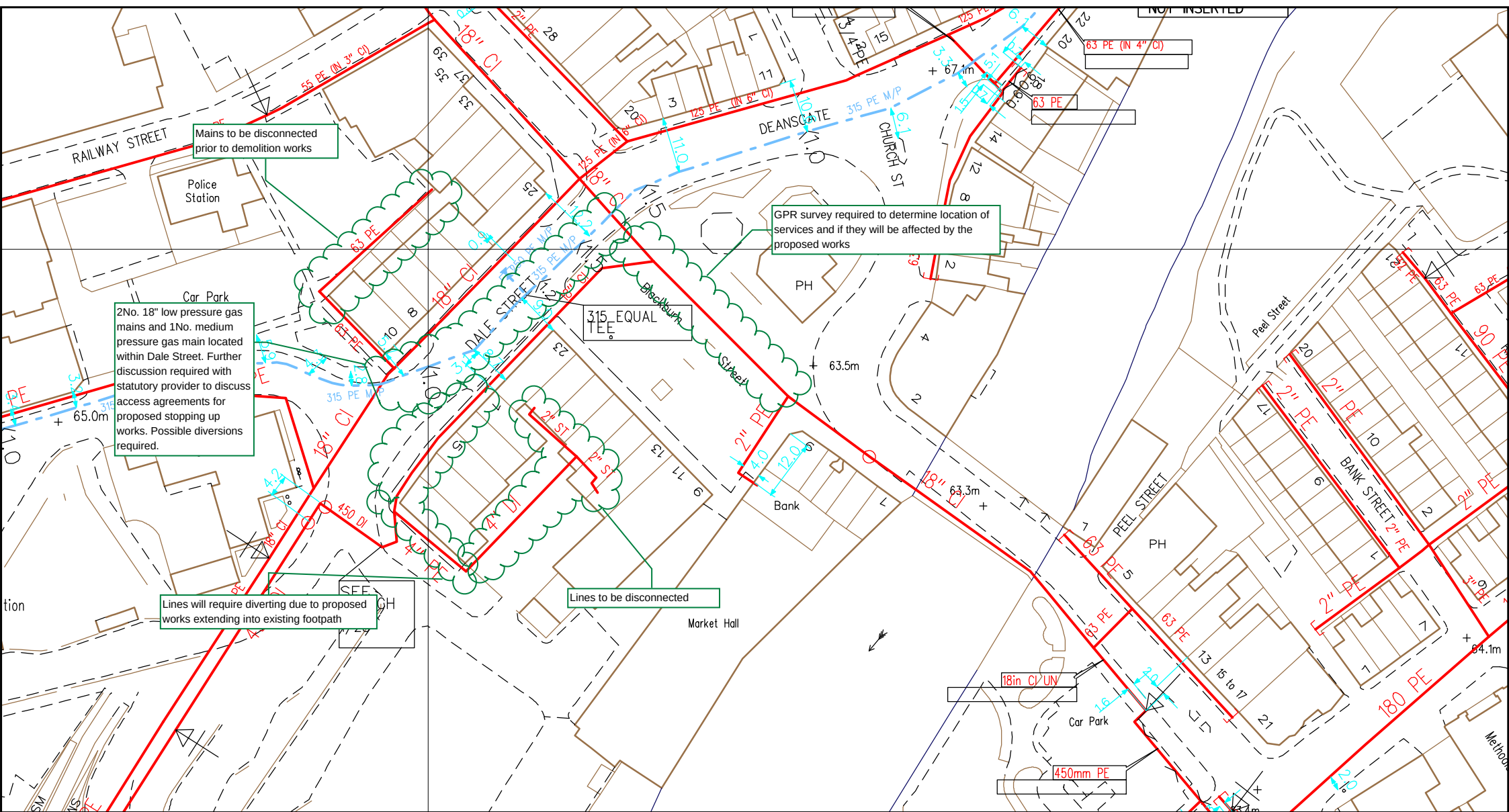
Drawing Title
**OS Mapping
1970-1975 (1:2,500)**

Scale at A3
1:750
Role

Suitability
Preliminary
Arup Job No
280786-00
Name
Figure B4
Rev
P0

Appendix C

Utilities review



SCALE: Not to scale
USER ID: DMiller
DATE: 05/03/2021
EXTRACT DATE: 01/12/2020
MAP REF: SD7806
CENTRE: 378565, 406968

Some examples of Plant Items:



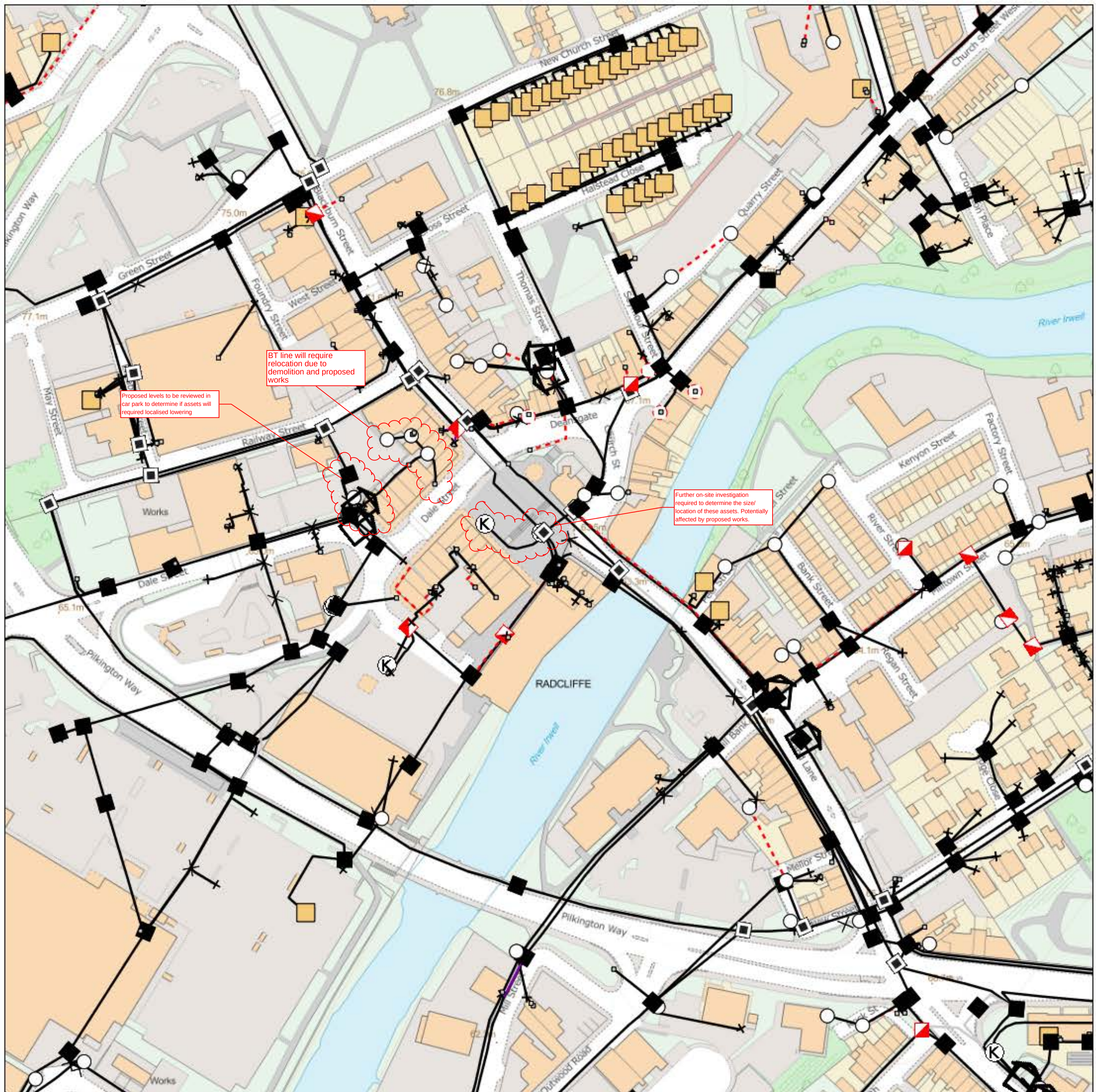
This plan shows those pipes owned by Cadent Gas Ltd in their role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Cadent Gas Ltd or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue. Further information on all DR4s can be determined by calling the DR4 hotline on 01455 892426 (9am-5pm) A DR4 is where a potential error has been identified within the asset record and a process is currently underway to investigate and resolve the error as appropriate.

MAPS Viewer Version 5.8.0.1

Local Machine

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Maps by email Plant Information Reply



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Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

 **openreach**

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FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

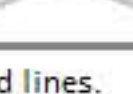
ADVANCE NOTICE REQUIRED
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www.openreach.co.uk/cbyd

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KEY TO BT SYMBOLS

KEY TO BT SYMBOLS			Change Of State	+	Hatchings	
	<i>Planned</i>	<i>Live</i>	Split Coupling	×	Built	
PCP			Duct Tee	▲	Planned	
Pole			Building		Inferred	
Box			Kiosk		Duct	
Manhole			Other proposed plant is shown using dashed lines. BT Symbols not listed above may be disregarded. Existing BT Plant may not be recorded. Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.			
Cabinet						

	<i>Pending Add</i>	<i>In Place</i>	<i>Pending Remove</i>	<i>Not In Use</i>
Power Cable				
Power Duct				N/A

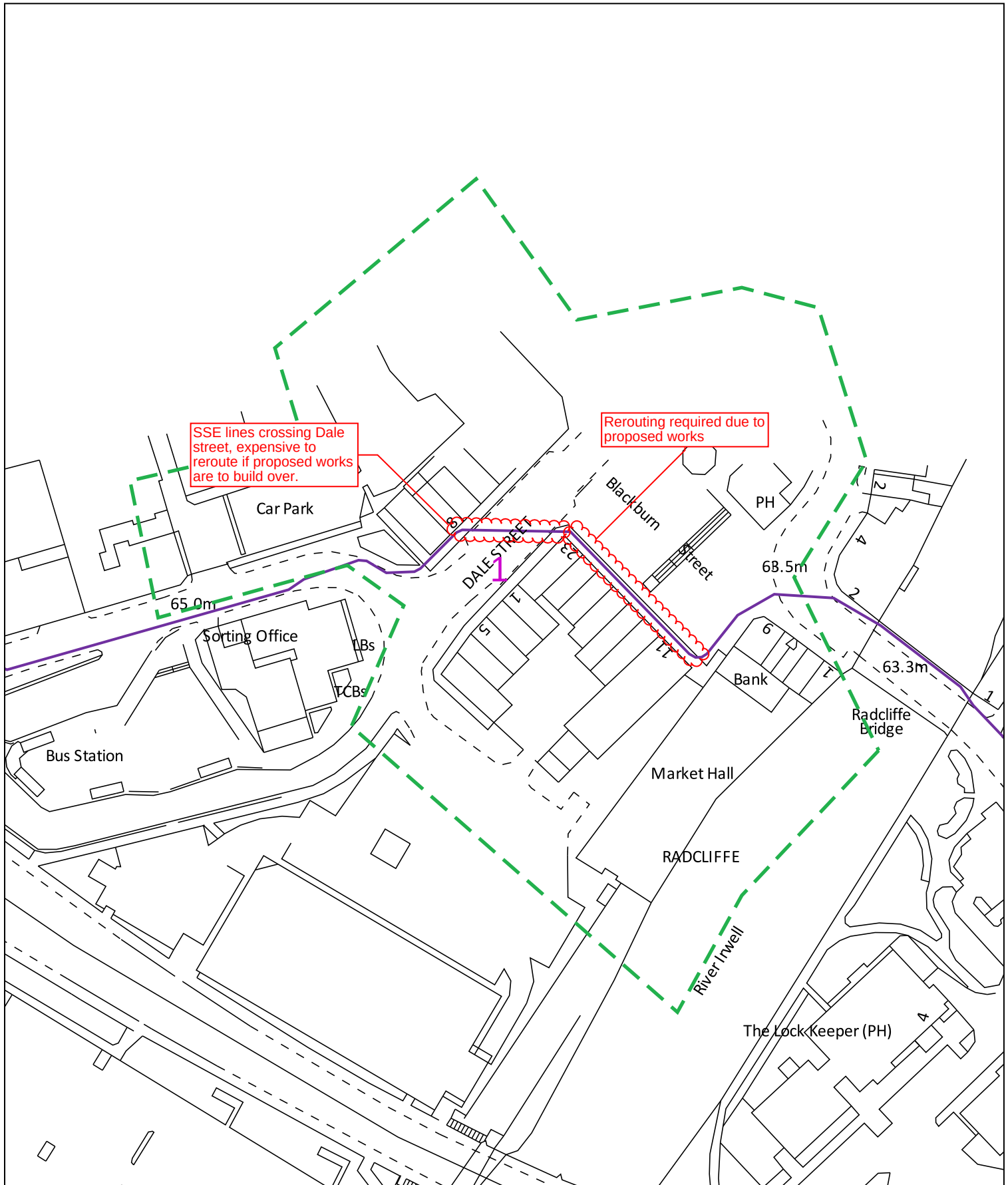
BT Ref : MRU03239T

Map Reference : (centre) SD7856506968

Easting/Northing : (centre) 378565,406968

Issued : 04/03/2021 15:24:04

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0 50m Dig Sites Area: Line:

The quality and accuracy of any print will depend on your printer, your computer and its print settings. Measurements scaled from this plan may not match measurements between the same points on the ground.



Date Requested: 04/03/2021
Job Reference: 21442377
Site Location: 378532 406970

Requested by: Mr Joe Shawyer
Your Scheme/Reference: 27977

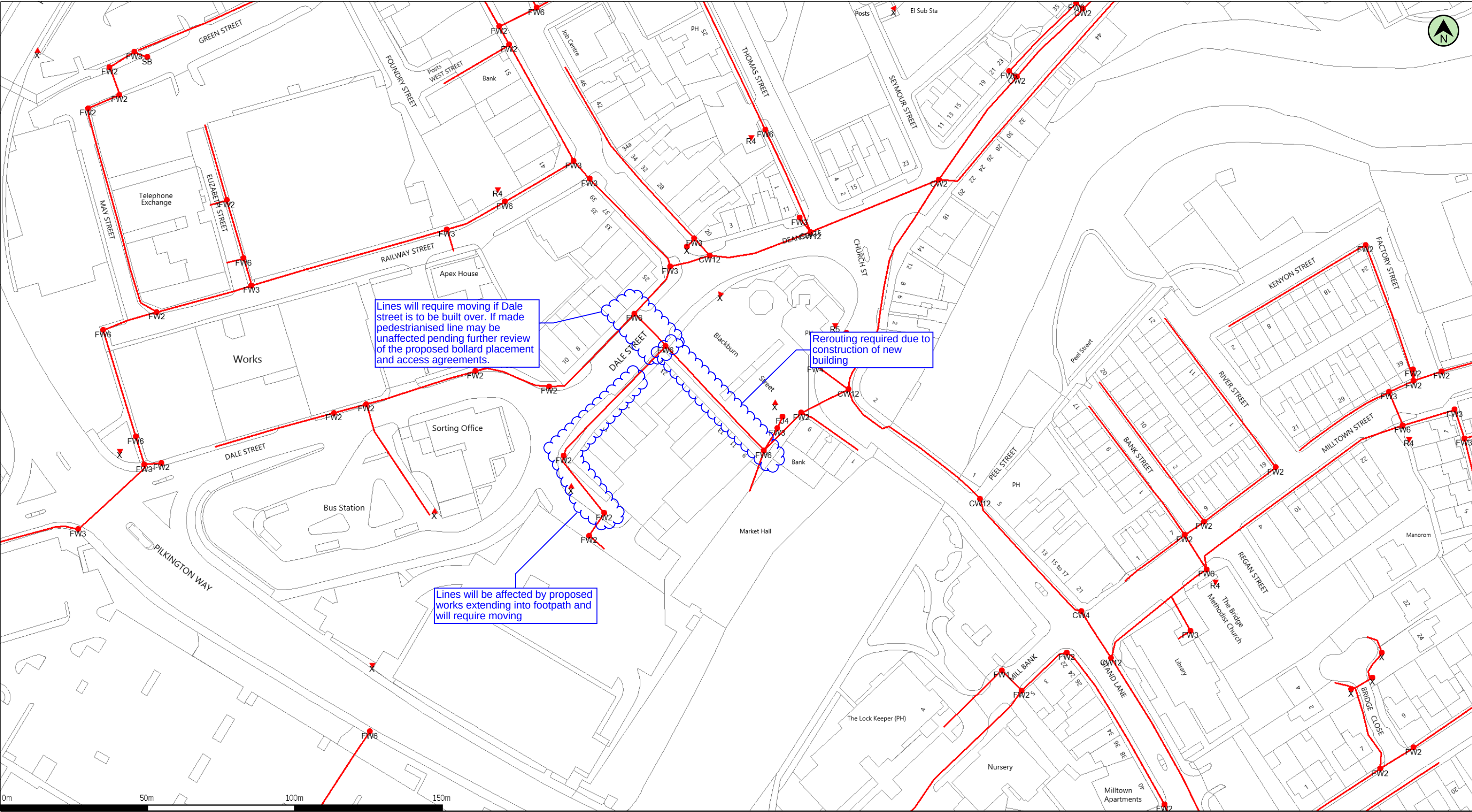
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SSE Telecoms Underground Route **Emergency Number: 0345 305 3337**

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Registered Office:
Inverlmond House,
200 Dunkeld Road,
Perth, PH1 3AQ

Scale: 1:1250 (When plotted at A4)



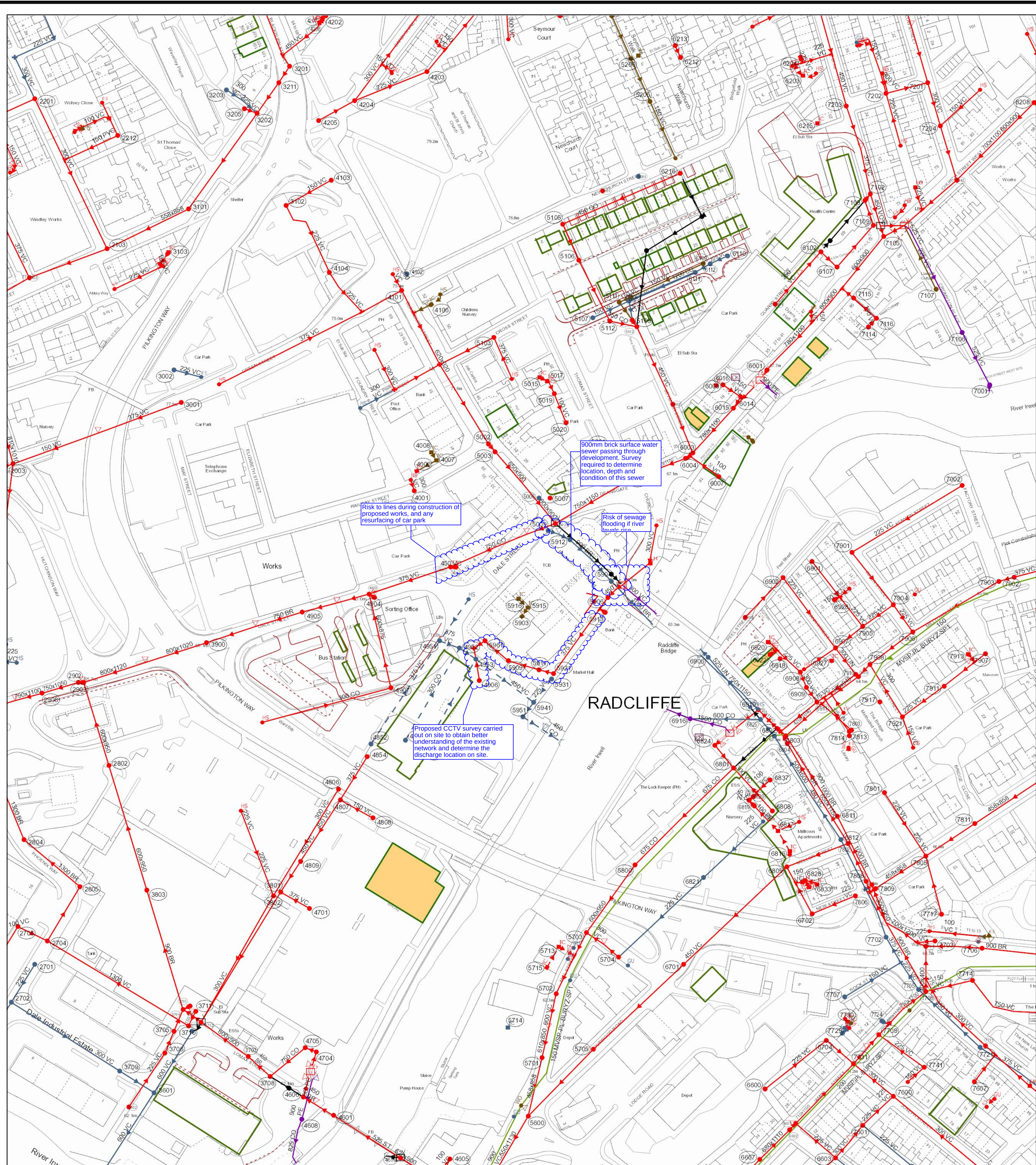
(c) Crown copyright and database rights 2021 Ordnance Survey 100019209 Date: 04/03/21 Scale: 1:1250 Map Centre: 378550,406968 Data updated: 05/02/21 Our Ref: 516065 - 1 Telecoms Plan A3

Important Information - please read The purpose of this plan is to identify Virgin Media apparatus. We have tried to make it as accurate as possible but we cannot warrant its accuracy. In addition, we caution that within Virgin Media apparatus there may be instances where mains voltage power cables have been placed inside green, rather than black ducting. Further details can be found using the "Affected Postcodes.pdf", which can be downloaded from this website. Therefore, you must not rely solely on this plan if you are carrying out any excavation or other works in the vicinity of Virgin Media apparatus. The actual position of any underground service must be verified by cable detection equipment, etc. and established on site before any mechanical plant is used. Accordingly, unless it is due to the negligence of Virgin Media, its employees or agents, Virgin Media will not have any liability for any omissions or inaccuracies in the plan or for any loss or damage caused or arising from the use of and/or any reliance on this plan. This plan is produced by Virgin Media Limited (c) Crown copyright and database rights 2020 Ordnance Survey 100019209.

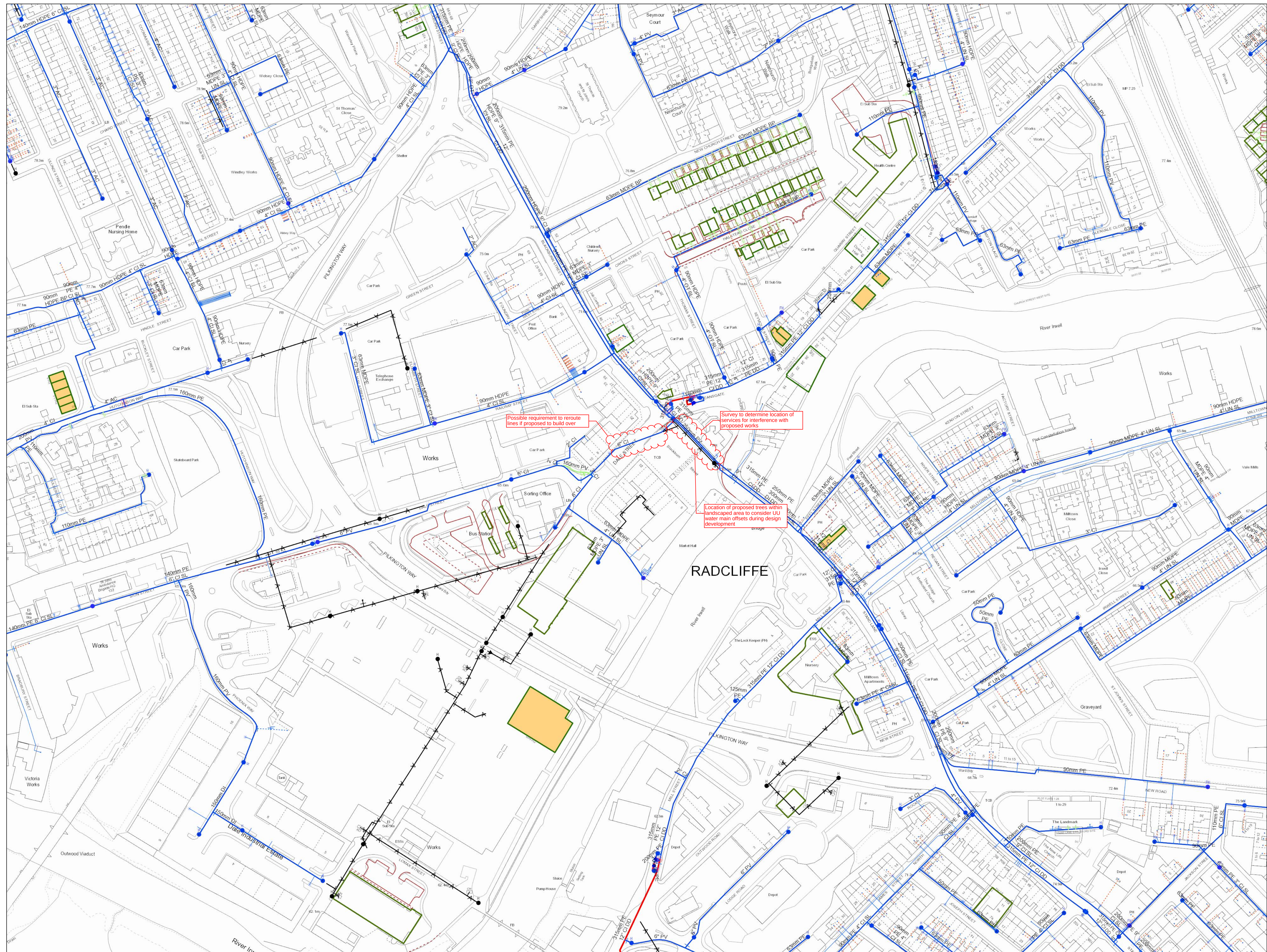
Duct, Trench	Chamber	Cabinet

mail@groundwise.com
27977





Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad	Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
6903	63.73	CO	0	225			BR	2.87839	1 in 102	7108	69.11	CO	65.71	400			BR	7	1 in 20
4852	63.23	SW	60.72	375			CO	30.41381	1 in 82	5902	62.81	CO	0	225			BR	48.60041	1 in 141
7201	64.32	CO	62.17	300			BR	41.1521	1 in 107	7811	65.1	CO	63.3	458			BR	32.46705	1 in 176
5941	63.91	SW	60.96	450			VC	10	1 in 67	5701	62.83	CO	60.53	458			BR	33.39922	
5811	63.17	SW	61.31	400			VC	17.22005	1 in 222	7310		CO	60.53	458			BR	25.21477	
3001	77.97	CO	75.25	375			CO	49.0408	1 in 34	6825	63.4	SW	59.6	600			CO	38.83791	1 in 485.473825
4951	64.37	SW	61.31	400			BR	5	1 in 114	6207		FO	0	225			VC	25.63607	
6003	67.1	CO	61.1	760			BR	5		6822		FO	0	225			PE	2.759542	
6210	62.1	CO	61.31	400			BR	4.472136		6508	68.72	CO	65.61	650			BR	3.29425	
7001	59.99	OV	59.98	525			VC	3.789903		7708	69.11	CO	69.63	450			BR	5.626844	
4805		CO	60.34	300			VC	13.84887		7702	69.11	SW	0	375			BR	44.09475	
6916	63.55	OV	59.52	1500			CO	14.14805		6901		CO	61.66	700			VC	59.58743	
6216	76.2	CO	72.15	450			CO	70.64817	1 in 307	7704	67.90	CO	63.93	700			VC	45.60702	
7714	72.23	CO	62.31	375			VC	32.92584	1 in 16	7905	64.14	CO	62.08	225			BR	38.33591	1 in 274
7908	64.16	CO	61.31	225			UN	9.328375	1 in 93.2837471	7203	66.4	CO	64.47	450			BR	25.29822	1 in 37
7717		CO	71.88	300			VC	33.46872		6811	64.26	CO	62.39	1000			BR	52.78873	1 in 50
5103	73.4	CO	71.88	300			VC	22.11008	1 in 12	7907	65.79	CO	63.3	1000			BR	42.48829	1 in 47
5951	63.88	SW	60.81	450			VC	13.04337	1 in 93	7904	64.48	CO	0	225			VC	18.43911	
3904	65.36	CO	60.34	800			BR	39.73514	1 in 893	7107	64.78	FO	62.48	225			VC	39.32576	
2702		SW	0	300			VC	71.02113		7904	64.48	CO	62.41	225			VC	20.85587	1 in 65
3708	62.78	CO	60.58	450			BR	16.44851	1 in 57	7901	64.43	CO	0	225			VC	37.01581	
5705	63.5	CO	61.29	450			VC	51.69543	1 in 287	5003		CO	0	650			BR	23.44204	
4806	62.72	CO	60.23	750			VC	11.01094		7102	65.89	CO	63.27	450			BR	18.44784	1 in 56
7109	66.44	CO	63.31	375			VC	14.49932	1 in 32										
2103	77.13	CO	73.03	558			BR	45.88028	1 in 68										
4808	OV	58.3	825				CO	25.71874	1 in 429										
4704	63.34	CO	60.23	750			PE	6.534871											
6819		CO	61.37	400			BR	4.346568											
5005	67.28	CO	60.96	750			BR	45.27829	1 in 1509										
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6807	72.72	CO	69.35	680			BR	23.30782	1 in 93										
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3002	76.84	SW	74.58	225			VC	15.52417											
6802	63.6	SW	60.34	800			BR	50.02462											
6820		CO	0	225			PE	3.008266											
6904		CO	0	800			CO	17.08901											
4904	65.3	CO	60.3	800			BR	3.055551											
3902	62.15	CO	0	225			VC	36.05551											
7711	72.92	CO	71.1	300			VC	35.38381											
4854		CO	0	375			VC	28.30194											
4905	65.08	CO	60.63	750			CO	27.20294	1 in 97										
5108	73.52	SW	0				UN	0.2037101	1 in 46										
6802	67.2	CO	64.98	375			UN	17.98972	1 in 46										
6802	63.6	SW	525				UN	35.97028	1 in 33										
4902	65.8	CO	62.4	600			BR	23.85071	1 in 16										
7808	65.47	CO	63.37	650			BR	23.22941	1 in 25										
5001	68.59	CO	65.76	450			VC	11.18034	1 in 71										
4906		CO	0	375			VC	18.24829	1 in 21										
4205		CO	0	225			VC	22.82542											
7201	65.57	CO	63.01	300			VC	25											
7809		CO	0	225			VC	26											
3705	62.02	CO	60.82	225			VC	13	1 in 108										
6803	74.82	CO	73.62	225			VC	29.09888	1 in 11										
4203	77.54	CO	75.72	225			VC	67.47392	1 in 120										
6805	63.6	CO	60.5	750			BR	6.41751											
3711		CO	0	150			VC	6.944722	1 in 77										
7202	66.68	CO	63.9	300			VC	23.78973	1 in 39										
6107	67.95	CO	64.71	375			VC	30.82375											
6908		CO	0	300			VC	9.245722											
5961		CO	0	375			VC	7.21102											
5909	64.07	CO	60.82	375			VC	17.02039											
7801		CO	0	225			VC	41.88878											
6804	63.85	CO	60.8	800			VC	7.507878											
4901	65.79	CO	0	375			VC	47.43417											
6001		CO	60.91	750			VC	17.98972											
6824	63.29	CO	60.54	675			CO	16.31179											
4807	62.83	CO	0	450			BR	40.49891	1 in 36										
6801	72.38	CO	69.05	710			BR	45.96738	1 in 57										
6808	64.05	CO	61.2	300			VC	31.9101											
3803		CO	0	600			VC	52.12489											
7809		CO	63.21	650			BR	3.72287											
7813		CO	0	600			VC	23.56929											
2908		CO	0	790			BR	15.52417	1 in 56.4277238										
7802	64.8	CO	61.06	558			BR	32.72898	1 in 25										
2102	77.36	CO	72.36	558			BR	46.14109											
7709	70.19	CO	67.33	680			BR	19.10497											
3102	78.49	CO	74.79	225			VC	46.88094											
7911		CO	0	225			VC	28.6007											
5206		CO	61.97	225			VC	16.95027	1 in 102										
4808	63.1	CO	61.9	150			VC	20.59126	1 in 55										
6702	64.37	CO	61.97	225			VC	32.52965	1 in 250										
3709		SW	0	300			VC	22.4722	1 in 186										
5901	63.86	SW	61.28	225			VC	16.40122	1 in 250										
3706	61.98	CO	60.89	225			VC	13	1 in 98										
3101	76.99	CO	73.23	558			BR	50.08962	1 in 9										
7803	65.17	CO	62.48	375			VC	55.28553	1 in 472										
6109	72.81	SW	71.15	225			VC	9.492034	1 in 11										
7105	65.81	CO	61.62	600			BR	47.16379	1 in 16										
7600	73.32	CO	71.06	300			VC	28.42534	1 in 16										
2706		CO	0	150			VC	18.17548	1 in 152										
6002	68.36	CO	65.41	450			VC	29.15476	1 in 11										
5704	63.01	CO	61.38	225			VC	10.63015	1 in 36.4205097										
7803		CO	61.38	225			UN	11.9859											
6812	64.59	SW	62.9	450			VC	32.78829											



LEGEND

Proposed	Abandoned	Live	Distribution Main
Trunk Main	Comms Pipe	Private Pipe	Concessionary Service
Raw Water	LDTM Raw Water	LDTM Treated Water	

Air Valve	AC Valve, open	AC Valve, closed	CC Valve, open	CC Valve, closed	Non Return Valve	Pressure Management Valve	OMS Valve	Stop Tap	Flow Meter	Domestic Meter	Commercial Meter	Pump	Hydrant	Fire Hydrant	Anode	Chlorination Point	De-chlorination Point	Strainer Point	Access Point	Hatch Box	IP Point	Sampling Station	Logger Box	Bore Hole	Inlet Point	Bulk Supply Point	End Cap	Site Termination	Change of Characteristic	Condition Report
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Property Types								
Water Tower	Valve House	Booster Pumping Station	Intake Pumping Station	Water Treatment Works	Supply Reservoir	Service Reservoir	Impounding Reservoir	Pipe Bridge

Symbology for proposed assets is the same as above, but shown in green.
Symbology for abandoned assets is the same as above, but shown in black.

Address or Site Reference:

Land on the North & South Side of Deansgate Radcliffe
M26 1NN,

Scale: 1:1250
Date: 08/03/2021

Printed by: Property Searches

**WATER
MAIN
RECORDS**

United
Utilities
Water for the North West

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Appendix D

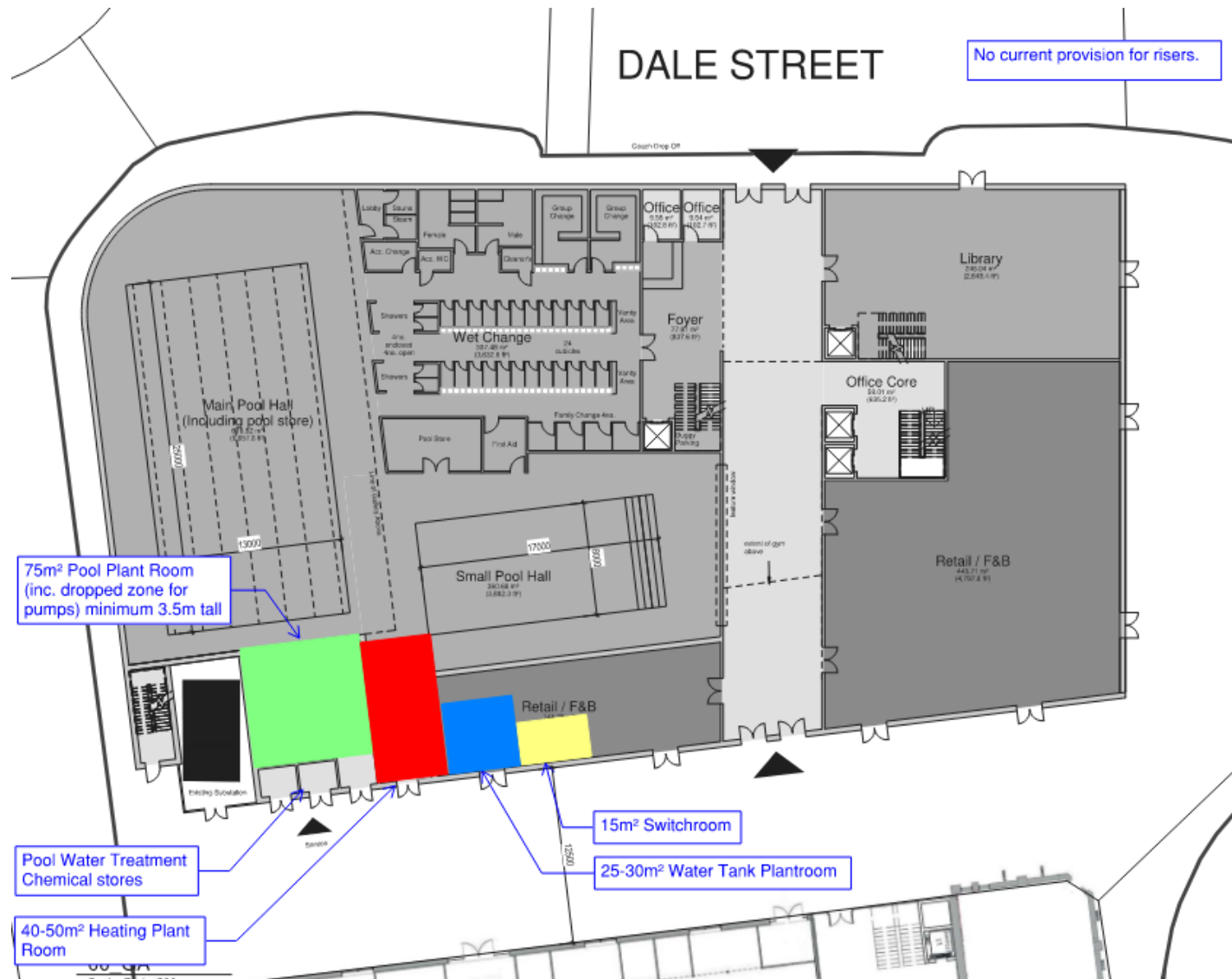
Plant space review and building
services commentary

Plant spaces review - Commentary

- Plant spaces all based on assumed occupancies, design criteria etc, since data not available at this stage
- Internal and external heating plant space will vary depending on primary plant solution
- Ventilation plant requirement could be reduced if some areas could be naturally ventilated – e.g. offices



Ground floor plant



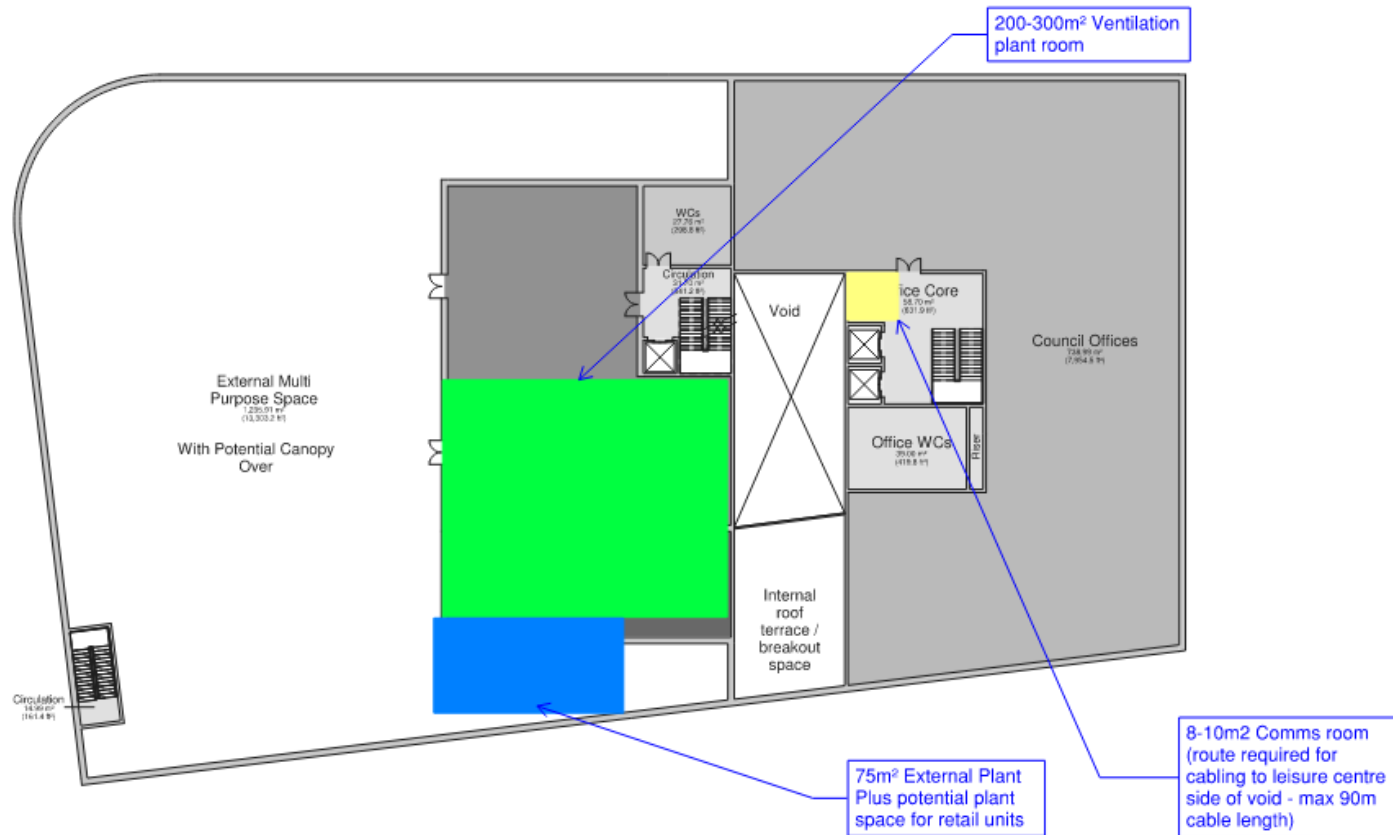
First floor plant



8-10m2 Comms room
(route required for
cabling to leisure centre
side of void - max 90m
cable length)

01 GA
Scale @ 1 : 200

Second floor plant



02_GA
Scale @ 1 : 200

Locating plant within the market building...

- We wouldn't recommend locating plant within the nearby market building:
 - Regular access required to plant in another building
 - Basement location makes plant access difficult and limits plant which can be located there
 - Difficult to separate building in the future, e.g. if one building is to be sold.
 - Issues in one building (e.g. fire, refurbishment) will impact our building
 - Increased running costs from additional services distribution.

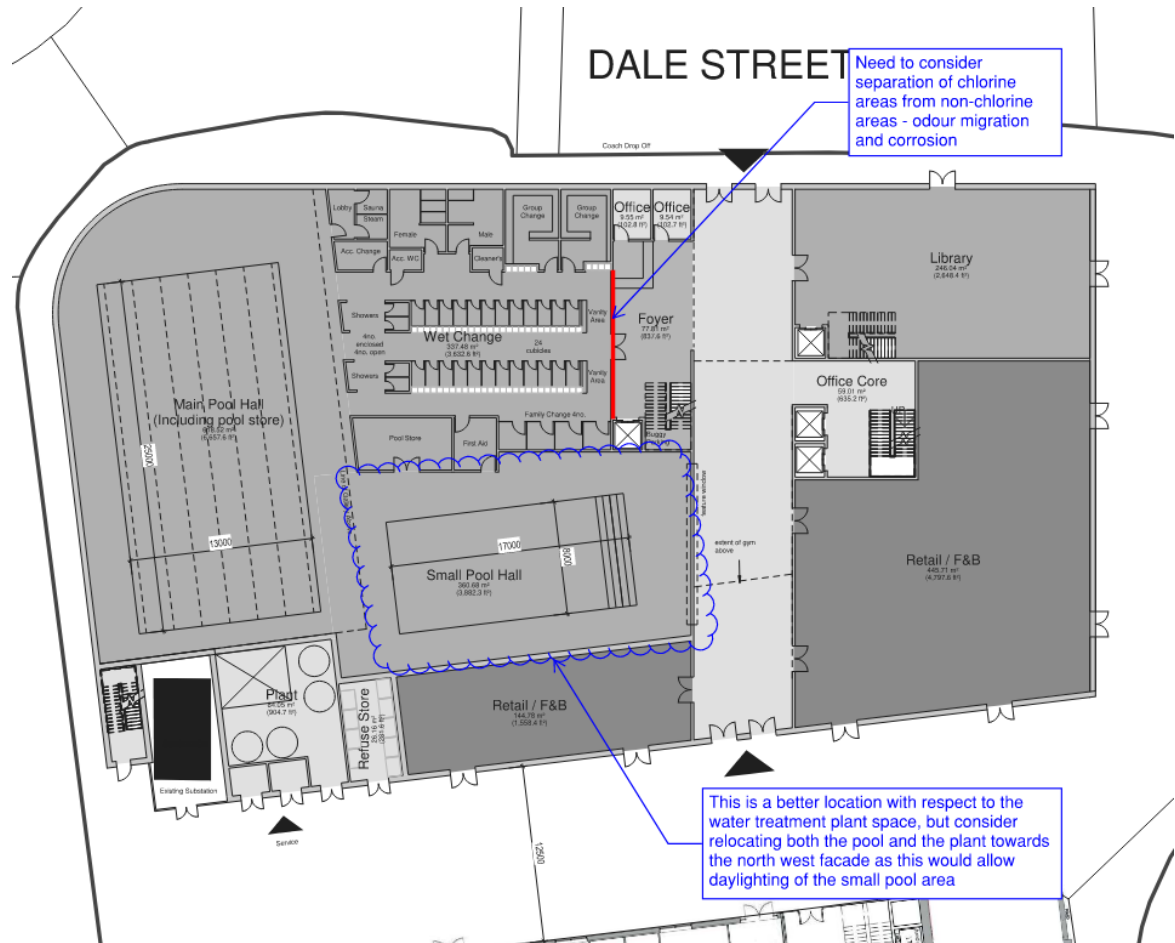
If plant was to be located under market building...

- Water Tank Plantroom would be preferred choice
 - Reduced maintenance access compared to other plantrooms
 - Easy to bury external service
 - If for any reason service from the market building was interrupted could be replaced with temporary water supply

However, in our view the drawbacks identified on the previous page outweigh the area saving from water tank relocation

Other aspects for consideration

- Thermal and chlorine zoning
- Adjacencies etc



Other aspects for consideration

- Low energy / Zero Carbon design
 - Fabric performance: Airtightness and insulation U-values
 - Thermal zoning
 - Design for daylighting
 - Use of beneficial solar gains
 - Matching heating and cooling loads to facilitate polyvalent heat pumps



Other aspects for consideration

- Suggest setting targets for aspects such as:
 1. Space heating demand for all heated areas (kWh/m²)
 2. Space cooling demand for all cooled areas (kWh/m²)
 3. Pool water heating demand (kWh/m²)
 4. Domestic hot water heating demand (kWh/person)
 5. Pool water treatment pumping energy (W/(m³/hr)
 6. Ventilation system energy demand (kWh/m²)
 7. Lighting energy demand (kWh/m²)
 8. Other appliances energy demand (kWh/m²)
- Suggest building post-occupancy optimisation into the project from the start



Other aspects for consideration

- Filtration & Water treatment – critical component, needs appropriate attention to:
 - Achieve highest water quality standards
 - Minimise energy consumption
 - Minimise water consumption