



McLaren (Broad Street Mall) Ltd and UREF III LP

Broad Street Mall, Broad Street, Reading, RG1 7QE

Phase 1 Desk Study

1922703 R01 (03)

RSK GENERAL NOTES

Project No.: 1922703

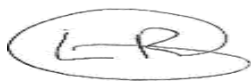
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Client: McLaren (Broad Street Mall) Ltd and UREF III LP

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

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1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by McLaren (Broad Street Mall) Ltd and UREF III LP ('the client') to carry out a Phase 1 Desk Study of the land at Broad Street Mall Broad Street, Reading RG1 7QE (hereafter referred to as 'the site'). The project was carried out to an agreed brief as set out in RSK's proposal (Ref. 1922703-T01(00), dated 24th November 2022).

RSK's service constraints are shown in **Appendix A**.

The Site in question is being considered for development for commercial and residential use.

1.2 Objectives

The objective of the work is:

- to identify any land contamination and/or geotechnical constraints to the proposed development and to support discharge of relevant planning conditions and relevant building control requirements
- to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use

1.3 Scope of works

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2021) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance.

A brief summary of relevant legislation and policy relating to land contamination is given in **Appendix C**.

The scope of works for the Desk Study has included the following:

- review of the history of development on the site and surroundings
- assessment of local geology, hydrogeology and hydrology
- review of relevant information held by appropriate statutory authorities
- review of any previous site investigation reports made available
- completion of a site reconnaissance survey to assess the visual condition of the site
- development of an initial conceptual site model (CSM)
- preliminary consideration of geotechnical constraints and hazards

- identification of the need for further action, e.g. intrusive investigations, if any.

1.4 Existing reports

No existing reports relevant to the site assessment have been provided to RSK.

1.5 Limitations

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described through this document.

2 SITE DETAILS

2.1 Site location

Site location details are presented in **Table 1** and a site location plan is provided on **Figure 1**.

Table 1 Site location details

Site name	Broad Street Mall
Full site address and RG1 7QE	Broad Street, Reading RG1 7QE
National Grid reference (centre of site)	471254, 173367

2.2 Site description

The Site boundary and current site layout are shown on **Figure 2**. The Site covers an area of c. 0.79 hectares at basement level. It is currently occupied by the southern part of a commercial shopping centre (Broad Street Mall) with a level of basement beneath the entire site footprint.

The wider Broad Street Mall is roughly rectangular in shape and is currently a major shopping centre located in the heart of Reading town centre, occupied by multiple retail and food shops. It can be accessed by the public via four entrances situated on the north, east and south sides of the building, and there is a multi-storey car park located on the western side of the building.

2.3 Surrounding land uses

The Site is located in Reading, within a predominantly commercial setting. Immediate surrounding land uses are described in **Table 2**.

Table 2 Surrounding land uses

North	North of the site is Oxford Road, which is lined with multiple shops, takeaways and restaurants. The area north of the site is still the town centre, and therefore there is a mixture of commercial businesses and amenities. Some residential flats seem to be present above the shops on the opposite side of Oxford Road.
East	East of the site is St Mary's Butts, which hosts multiple pubs and restaurants. South east of the site is Reading Minster Church and there is a small area of greenspace surrounding this.
South	South of the site is Dusseldorf Way, there is a pedestrianised area where there are regularly market stalls and an open roofed bar/restaurant area. Moving further south there is some soft landscaping, Lavender Place Community Gardens, the Hexagon Theatre, Thames Valley Police and Reading Magistrates Court.

West

Queens Walk is located west of the site, and this is a pedestrianised street with multiple restaurants. The entrance to Fountain House (office building) is located on Queens Walk, as well as pedestrian access to some residential apartments which appear to be student accommodation. Moving further west there is the A329 and some residential homes beyond this.

2.4 Development plans

The proposed layout of the site, at the time of preparing this report, is shown in **Appendix B**.

It is understood that subsequent development (marked within the redline boundary) will only pertain to the southern portion of the Broad Street Mall, with the remainder of the shopping centre remaining operational.

Since the original iteration of the report, the redline boundary has been reduced from the wider Broad Street Mall to just the southern section. The Envirocheck Report referenced throughout Section 3 has been undertaken for the entirety of the shopping mall, as per the previous redline boundary, although this does not affect any of the results of the assessment. The redline boundary of the envirocheck report also does not strictly cover the temporary works on Dusseldorf Way or Queens Walk although again this is considered to have no effect on the results or conclusions of this report.

The development plans obtained from the client show that the site is intended for redevelopment for residential apartments, comprising four buildings named Block A, B, C, and D. The southern frontage will comprise retail units, as well as the entrances to the apartment blocks. It is understood that a new, ramp to the multistorey car park will also be constructed as part of the final development works.

The existing basement is to be retained as part of the new residential/retail development and will continue to join directly to the basement below the shopping centre.

The proposed development incorporates areas of podium level soft landscaping between the tower blocks which will provide communal spaces for residents.

Planning application number 182137 is a granted and active planning application pertaining to the site, according to the Reading Borough Council Planning Portal.

3 DESK-BASED ASSESSMENT

The desktop study was designed generally to meet the objectives of a preliminary (phase 1) investigation, as defined by BS 10175:2011 + A2 2017 (BSI, 2017) and this assessment relates to LCRM Stage 1, Tier 1 preliminary risk assessment. The "vicinity" of the site for the purposes of this report is defined as locations situated within an approximate 250 m radius of the site, although certain sources and/ or sensitive targets further than 250 m may also have been considered.

The study aims principally to identify and assess the potential risks and liabilities associated with contamination of the ground, on and in the vicinity of the site. While this includes consideration of current operations and housekeeping on the site, the report does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

3.1 Site history

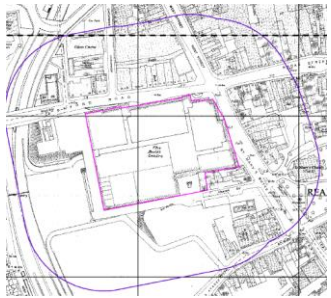
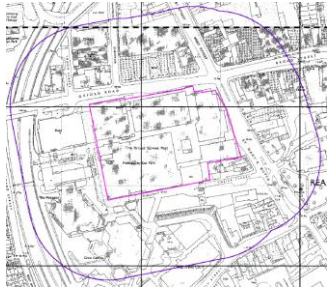
3.1.1 Historical development record

The development history of the site and surrounding area based upon assessment of historical plans and records is detailed in **Table 3**. The historical maps reviewed are shown within the environmental database report in **Appendix D**.

Table 3 Summary of historical development

Date from	Date to	Historical Land Use (on-site)	Area of site
1879	1898	The site is already heavily developed by 1879, with buildings covering approximately 90% of the area. The buildings appear to be residential housing, however there is a building named Steam Saw Mill located in the north west of the site. In the centre of the site there is an outside area containing trees which may be a courtyard. Hope Street enters the site in the south west.	
1899	1912	There is a smithy and a public house located in the north of the site, and there is a Fire Station in the southeast of the site.	

Date from	Date to	Historical Land Use (on-site)	Area of site
1912		Saw Mills still remain in the north west corner of the site, but there is now a timber yard labelled in what was previously the courtyard area. A road named Cork Street now exists in the north east of the site. In the west of the site there is a building labelled as a Salvation Army Citadel.	
1931		The Timber Yard no longer appears on the site. Drill Hall is labelled in the southeast of the site, although it is unclear whether this is an industrial building, it may be a shooting hall. There is an Inn in the northeast corner of the site.	
1957		Over time the site has become less occupied with housing and more occupied with commercial and amenity space. Saw Mills is no longer labelled on the site, and a large space in the centre-west of the site is now a car park. There is a garage in the east of the site, and there is a ruin in the southeast.	
1962		Buildings in the south of the site have been demolished and the car park has been extended.	
1970		By 1970 all of the pre-existing buildings on the site (bar one) had been demolished and the site appears almost entirely unoccupied.	

Date from	Date to	Historical Land Use (on-site)	Area of site
1973		A shopping centre named The Butts Centre has been constructed on the site, and there is a small building in the south east of the site which doesn't appear to be associated with the mall.	
1980		There is now a labelled multistorey car park on the site, and the building located in the south of the site is labelled as a public house. Fountain House has been constructed in the west of the site.	
1988	Present	The shopping centre is now named The Broad Street Mall, and the public house is no longer present in the south of the site.	
Date from	Date to	Historical Land Use (off-site)	
1879	1883	The area surrounding the site was already very built up by 1879, with what looks to be residential housing. There is a road (St Mary's Butts) immediately east of the site and another immediately north of the site. There are two schools located approximately 30 m south and 90 m southwest and two chapels located 40 m south and 70 m east. There is an Inn located 90 m south of the site and Reading train station is located 480 m northeast of the site. There are railway lines running east-to-west approximately 500 m north of the site, and the Basingstoke branch of the railway diverts off and runs north-to-south approximately 800 m west of the site. There are embankments/slopes running alongside the railway lines and there is an engine shed 750 m northwest of the site. There are numerous gravel pits around the site, one is 1 km northwest with more located >1 km southwest. There is a prison 800 m east of the site. The River Thames is located approximately 750 m northeast, Holy Brook is located 154 m south and the River Kennet is located 300 m southeast. A brickworks named Avenue Works is located 850 m southwest of the site and Coley Kilns and Coley Pottery are located adjacent to this. Ivybridge brickfield is located 950 m southeast and Katesgrove Kilns are located 762 m south. There is a cattle market 400 m north of the site and a biscuit factory 1 km east. There are two breweries, Castle Street Brewery and Seven Bridges Brewery, plus associated malthouses located southeast of the site, 150 m and 200 m away respectively.	

Date from	Date to	Historical Land Use (on-site)	Area of site
1900	1912	There is a circular feature located 300 m northeast of the site which is thought to be a pond. Coley Kilns are no longer present on the map, and Avenue Works seems to have decreased in size. There is a mill located 350 m southeast of the site, and there is a second engine shed located 700 m northeast of the site alongside the railway line.	
1913		There is a printing works located 800 m northwest of the site, beyond the railway lines. There is an iron works located 750 m northeast of the site, a smithy 300 m northeast and the Place Theatre 50 m north. The circular feature thought to be a pond is no longer present and is presumably infilled.	
1931		There are some earthworks labelled approximately 150 m north of the site, and there is a tramway located immediately adjacent to the site to the north. There are some allotment gardens approximately 1km away from the site to the southwest and 750 m northwest.	
1957		There is now a bus depot located 200 m northwest of the site, and there are a number of garages and car parks in the vicinity. There is warehouse located 100 m south of the site. There is an Odeon cinema adjacent to the Palace Theatre to the north.	
1962	1971	There is an electricity substation located 250 m northwest and there is an engineering works located 220 m southwest. There are some slopes immediately adjacent to the site to the west and the south of the site which were not present previously, suggesting some kind of earthworks may have been undertaken.	
1973	1974	There have been some major changes to the road layout and potential changes in levels to the northwest of the site.	
1979	1988	There has been a significant amount of construction south of the site, with the whole area having been reconfigured. The Hexagon Theatre, Civic Centre and Police Station have been constructed.	
1988	Present	The surrounding area remains largely unchanged with a significant amount of business and industry continuing to operate.	
Relevant information sources: Historical OS maps ☒ Town plans ☐ Information from the Local Planning Authority ☐ Aerial photography ☒ Previous reports ☐			
Note: Reference to published historical maps provides invaluable information regarding the land use history of the site, but historical evidence may be incomplete for the period pre-dating the first edition and between successive maps.			

Due to the multiple phases of demolition and development on the site, made ground is anticipated to be the most likely source of contamination. It is possible that the basement level of the mall is founded on natural strata, in which case made ground may have been removed prior to construction.

Historically there was some industry on the site including a Saw Mill and a Timber Yard, and the site has also seen long term use as a car park. In addition, the site is exposed to a high volume of both adjacent and through-traffic from the nearby roads and the delivery bays in the basement. All of the above factors suggests there is an increased likelihood of hydrocarbon contamination in the soils beneath the site.

The historic maps do not illustrate the historic chalk mines which are recorded south and southwest of the site, suggesting they may have terminated operations prior to the first maps. The environmental database shows that the underground Reading Chalk Mine existed from 327 m southwest of the site, stretching to 573 m southwest of the site.

3.1.2 Unexploded ordnance

A review of publicly available unexploded ordnance (UXO) risk maps indicates that the site is located in an area with **low** potential for wartime bombs to be present (Zetica, 2023).

3.2 Information from environmental database report

Relevant environmental permits and incidents detailed within the environmental database report (see **Appendix D**) are summarised below in **Table 4**.

Table 4 Summary of environmental permits, landfills and incidents

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Agency and hydrological				
Environmental permits – incorporating Environmental Permitting Regulations (EPR) and/ or Pollution Prevention and Control (PPC) permits; former Integrated Pollution Controls (IPC), Local Authority Pollution Control (LAPC)	0	1	1	191 m W: LA Air Pollution Control, Hobbs Of Reading, Ref. EPA/PAR.B/DC9/P1, PG6/46 Dry Cleaning 355 m E: LA Air Pollution Control, Sketchley Dry Cleaners, Ref. EPA/PAR.BDC16/P1, PG6/46 Dry Cleaning 564 m SW: LA Pollution Prevention and Control, Tilehurst Connect Service Station, Ref. EPA/PAR.B/23/98/P2, 24th August 1999, PG1/14, Petrol Filling Station
Enforcement and prohibition notices	0	0	0	N/A

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Pollution incidents to controlled waters, Prosecutions relating to controlled waters, Substantiated pollution incident register, Water Industry Act referrals	0	3	0 of relevance	156 m SE: Oils (unknown), 22nd November 1991, Ref. WE910648, Category 3 (minor incident). 195 m E: General Pollutant, 16th July 1998, THWE1998039887, Category 3 (minor incident). 222 m SE: Oils (unknown), 22nd July 1997, THWE1997029089, Category 3 (minor incident)

Discharge consents	0	0	6 of relevance	277 m E: Geoffrey Osborne Building Ltd, Ref. Ctwc.3315, 12th June 1989 until 27th June 1991, Unknown Discharge, Holy Brook Receiving (freshwater stream/river) 307 m SE: H&G Simmonds Ltd, Ref. Ctr.0211, 19th December 1955 until 12th June 1990, Trade Discharges (cooling water), Kennet Receiving (freshwater stream/river) 324 m SW: Thames Water Utilities Ltd, Pumping Station on Sewerage Network, Ref. Temp1767, 3rd September 2010 until 13th October 2015, Sewage Discharges, Holy Brook Receiving (freshwater stream/river) 541 m NW: Reading Transport Ltd, Ref. CATM.3308, 6th July 1998, no revocation date (potentially still active consent), Trade Effluent Discharge, Abattoir Ditch Receiving (freshwater stream/river) 605 m E: John Graham Construction Limited, Ref. Eprdb3097a1, 7th October 2015 until 21st February 2017, Trade Effluent Discharge, Holy Brook Receiving (freshwater stream/river) 694 m NW: Network Rail Infrastructure Limited, Ref. Eprhb3597rh, 1st June 2018 until 31st July 2019, Trade Discharge
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Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
				(process water), Tributary of River Thames Receiving (freshwater stream/river)
Registered radioactive substances	0	0	0 of relevance	All authorisations either revoked or cancelled.
Landfill and waste				
Active landfills	0	0	0	N/A
Historic / closed landfills	0	0	1	963 m NW: Cow Lane, Ref. EAHLD13278, 31 st December 1950 until 31 st December 1959, Deposited Waste Included Inert Waste.
Other waste management licences	0	0	3	725 m NE: Thames Water Utilities Limited, Ref. 105216, Mobile Plant for Land-Spreading Sewage Sludge, Issued 7 th September 2011. 761 m W: EGW Carter, Ref. 86001, Metal Recycling Sites (Mixed), Surrendered 19th March 1996 until 23rd July 1999. 995 m NW: R Collard Limited, Ref. 101199, HCI Waste TS & Treatment, Issued 11th February 2010.

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Potentially in-filled land (pit, quarry, pond, marsh, river, stream, dock etc)	0	0	6 Non-water 17 water	Non-water: 654 m SW, 702 m S, 749 m S, 762 m SW, 961 m W, 977 m S. Water: 301 m N, 319 m SE, 353 m SE, 369 m E, 489 m S, 537 m S, 559 m S, 651 m S, 705 m NW, 791 m S, 803 m S, 815 m N, 823 m NE, 895 m S, 895 m S, 947 m N950 m S.
Hazardous substances/ industrial land uses				
Control of Major Accident Hazards (COMAH) sites	0	0	1	949 m NW: Calor Gas Limited, Lower Tier.
Explosives sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning hazardous substance consents/ enforcements	0	0	1	979 m NW: Calor Gas Ltd, Not Active
Contaminated land Part 2A register entries and notices			1	668 m NW: George Street Allotments, Remediation Statement – Remediation Work Completed, 23rd February 2011.

Contemporary trade directory entries	3 (all inactive)	28 Inactive 4 Active	0 of relevance	<u>Inactive</u> On site: Brighthouse, Electrical Goods Sales, Manufacturers & Wholesalers On site: Service Point UK Ltd, Copying & Duplicating Services On site: Colorama Free Film Photo Centres, Photographic Processors 29 m NE: Forest Gold, Bags, Belts & Accessories – Manufacturers & Suppliers 39 m NE: The Discount Photo Co, Photographic Processors 46 m NE: Suprema, Dry Cleaners 46 m NW: UTP Merchant Services Ltd, Cash Registers & Check-Out Equipment 65 m SE: Carpets Like New Reading, Carpet, Curtain & Upholstery Cleaners 97 m N: Prim, Dry Cleaners 99 m S: Carpet Cleaning Reading, Carpet, Curtain & Upholstery Cleaners 101 m N: Everest Jewellery, Jewellery Manufacturers & Repairers 115 m SE: Cleaners Reading, Carpet, Curtain & Upholstery Cleaners 123 m SE: Wasteking Ltd, Rubbish Clearance 119 m E: Sharps Bedrooms, Furniture Manufacturers – Home & Office 148 m W: Adam Halal Meat, Meat (Wholesale) 176 m W: DES Home Appliances Ltd, Hardware 176 m W: Colourflow, Printers 190 m W: Hobbs of Reading, Dry Cleaners 178 m NE: Sanbei, Mobile Phone Accessories & Car Kits 197 m W : Reading Carpentry Services Ltd, Joinery Manufacturers 208 m W: Burghfield Bridge Tyres, Tyre Dealers
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Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
				205 m SE: Reading Borough Council, Pest & Vermin Control 208 m SW: No1 Cleaning Co, Cleaning Services – Domestic 226 m NE: Redknee, Telecommunications Equipment & Systems 229 m S: Scamwell Performance, Engineering Services 232 m NE: AM Stratton, Water Softeners 235 m NE: Car Scrapping Scrap Yards in Reading, Car Breakers & Dismantlers 237 m NE: Delta Air Conditioning & Refrigeration Contractors <u>Active</u> 65 m SE: Kall Kwik, Printers 95 m NE: The Perfume Shop, Perfume Suppliers 139 m W: Minute Man Press, Printers 190 m W: Dots Laundry, Laundries & Laundrettes
Fuel station entries	0	1 (Obsolete)	3 of relevance	133 m NW: Welldale Service Station, Obsolete 561 m SW: Tilehurst Sf Connect, BP Petrol Station, Open 672 m W: Kirsco Reading Service Station, BP Petrol Station, Open 672 m S: Berkeley Service Station, Esso Petrol Station, Open
<i>Note: Entries have only been included within the table where they are located within a 250 m radius of the site or, where they fall outside of this radius but are considered to comprise a significant entry.</i>				

The environmental database report has not identified any significant contamination sources either on or in the vicinity of the site. Whilst there are records of active and inactive trade directory entries such as printers and electrical equipment manufacturers on site, the site is underlain by a basement and therefore there is a low likelihood of these activities

impacting the ground. The report has also not identified any active/historical landfills within 750 m of the site and no areas of potentially infilled ground within 250 m of the site.

3.3 Information from regulatory authorities

3.3.1 Planning records

Planning records held by the Local Authority Planning Department pertaining to the site and relevant to the current assessment are summarised in **Table 5**.

Table 5 Planning information

Year	Details and application reference no.	Part of site
2018	Ref No: 182137 Construction of three residential buildings ranging in height from 5 to 20 storeys above Broad Street Mall.	The existing footprint of Broad Street Mall
2018	Ref No: 182054 erection of 101bed hotel	Former Eva's Nightclub (location of Block D)

3.3.2 Site services

Buried utility services and their backfill can provide preferential pathways for gas, vapour or groundwater to migrate along to another part of the site or to a receptor. They can also represent significant constraints to development.

Obtaining a full set of service plans was outside the scope of this report, however RSK has been provided with a PES survey of the site, see **Appendix E**.

3.4 Site geology

3.4.1 Anticipated geological sequence

Published records (British Geological Survey, 2023) for the area and available historical borehole logs indicate the geology of the site to be characterised by the succession recorded in **Table 6**. There are 41 publicly available BGS historical boreholes located on or within 250 m of the site, a selection of which are presented in **Appendix E**.

Table 6 Site geology

Strata	Description	Estimated thickness	Permeability
Made ground	May be highly variable. Described as brick rubble on historic borehole logs.	1.0 to 2.5 m based on historic boreholes. Made ground may have been removed prior to the construction of Broad Street Mall.	Variable
Taplow Gravel Member	Sand and gravel, locally with lenses of silt, clay or peat.	5 m on average	Permeable
Seaford Chalk Formation (SCF) and Newhaven Chalk Formation (NHCF) (undifferentiated)	NHCF: Soft to medium hard, smooth, white chalks with numerous marl seams and flint bands. Known to contain distinct phosphatic chalks of limited lateral extent. SCF: Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thick marls are known from the lowest beds.	In excess of 100 m based on historic borehole logs from the area.	Permeable
Relevant information sources: BGS Geoindex ☒ BGS borehole logs ☒ Previous SI reports ☐			

With reference to the historical data there have clearly been several phases of construction and demolition on the site and therefore the presence of made ground should be expected.

3.4.2 Radon

The environmental database report provides an assessment of site-specific radon risk. The report indicates that 1% to 3% of homes are above the Action Level of 200 Bq m⁻³ and that no protective measures are required within new dwellings at the site.

Note the site-specific assessment within the environmental database report is at a higher resolution and therefore provides greater detail than that publicly available in the indicative radon atlas at www.ukradon.org.

Further assessment may be required, in line with the guidance provided in BRE publication 211 "Radon: Guidance on Protective Measures for New Dwellings (2015)".

3.5 Mining and quarrying

Evidence has been sought to identify any mining, quarrying, landfilling and land reclamation operations, past and present, which have taken place within 500 m of the site.

3.5.1 Areas of other (rock or mineral) mining

The site lies in an area with a known history of quarrying and mining of chalk from the Seaford Chalk Formation, gravel from the nearby Lynch Hill Gravel Member and clay and shale from the nearby Lambeth Group.

The environmental database report describes the presence of the underground Reading Chalk Mines located 327 m southwest of the site, which are not illustrated on the historic maps. The extent of the mines beneath Reading seems to be relatively unknown, and there have been incidents of extreme damage to residential homes due to previously unknown underlying mines collapsing.

3.6 Hydrogeology

A summary of the hydrogeological setting of the site, with respect to the anticipated geological sequence set out in Section 3.4 is presented below in **Table 7**.

Table 7 Summary of hydrogeological setting

Condition	Description
Aquifer characteristics	The site is underlain by a secondary A aquifer relating to the Taplow Gravel Member, and a principal aquifer relating to the Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated). The potential presence of low permeability clay at relatively shallow depths beneath the site, while restricting downwards migration, may increase the potential for lateral migration of shallow groundwater (and therefore mobile contamination, if present).
Depth to groundwater and flow	The anticipated depth to the groundwater table is in the order of 5.6 m to 11 m below ground level estimated from BGS logs. Shallow groundwater in the site area is anticipated to flow in a north east direction, i.e. towards and in the direction of flow of the River Thames.
Groundwater recharge/attenuation	Most of the site is currently covered with buildings and hardstanding and the entirety of the site is underlain by a single level of basement. This will restrict infiltration to ground and groundwater recharge, except where SUDS are present.
Historical implications for hydrogeology	Various stretches of Holy Brook are culverted in the centre of Reading. There are 11 historic boreholes on the site itself, and there are historic chalk mines in the surrounding area, the nearest of which is 327 m southwest, and mineshafts may remain.
Licensed groundwater abstractions	The environmental database report indicates that there are five current licensed groundwater abstractions of which none are public water supply boreholes within a 1 km radius of the site. The groundwater abstractions are licensed for a mixture of retail, commercial and industrial uses, including metal process water, industrial processes and vehicle washing.

Condition	Description
Source protection zones	Information available in the Envirocheck report and on the MAGIC website indicates that the site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

3.6.1 Potential for ground source heating and cooling

Most locations in the UK are suitable for the installation of ground source heating or cooling (GSHC) systems. The most appropriate type of installation is determined by the available space, heating and cooling demands of the proposed development and several geological and hydrogeological factors, and drilling risks. RSK can appraise these site-specific conditions through a desk-based feasibility study to assist in determining the viability of this sustainable source of heating/cooling energy at the site, should this be of interest to you. We also have in-house capability to undertake field assessments, as well as the design and installation of GSHC systems.

3.7 Hydrology

A summary of the hydrology within the site area is summarised in **Table 8**.

Table 8 Summary of hydrology in site area

Condition	Description
Surface watercourses/features	There are no ponds, streams or drainage ditches on or immediately adjacent to the site. The nearest identified surface watercourse to the site is Holy Brook, which is a channel of the River Kennet, located 154 m south east of the site.
Surface water abstractions	The environmental database report indicates that there is 1 current licensed surface water abstraction within a 1 km radius of the site. This is located 324 m south east of the site and is utilised for Amenity: Lake and Pond Throughflow.
Site drainage	Surface drainage from the site is known to collect into a sump and is discharged along with foul water into the foul water sewer system.
Preliminary flood risk assessment	The site is located in flood zone 1, which carries a low risk of flooding from rivers and the sea.

3.8 Sensitive land uses

Table 9 provides a summary of any environmentally sensitive areas identified within 250 m of the site based on the environmental database report.

Table 9 Environmentally sensitive areas

Feature	Present within 250 m of site?	Details	Likely pathways from site?
International designations – Ramsar wetland, Special Area of Conservation (SAC), Special Protection Area (SPA)	No	N/A	N/A
National designations – Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), ancient woodland	No	N/A	N/A
Local designations – Local Nature Reserve, Site of Importance for Nature Conservation (SINC)	No	N/A	N/A
Nearest high sensitivity development, e.g. residential	Yes	Residential homes, 30 m north and 150 m west. Commercial shopping centre (on site).	Direct contact, migration of contamination via dust/fibre deposition, mobilisation of contamination via groundwater.

4 SITE RECONNAISSANCE FINDINGS

A site reconnaissance survey was completed on 1st February 2023 by RSK. The characteristics of the site observed during the walkover and from current ordnance Survey maps are summarised in **Table 10**. RSK were accompanied by a member of the Broad Street Mall management team.

While the shopping mall itself is a publicly accessible area, access to the basement must be supervised by a member of the management team.

A site plan is provided in **Figure 2** with photographic records included in **Appendix G** detailing the main features identified below.

Whilst the walkover summary includes consideration of current operations and housekeeping on the site as potential sources of contamination, it does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

Table 10 Site reconnaissance findings

Feature	Description
Physical characteristics	
Access constraints	Undertaking a potential investigation inside the shopping mall would present some access constraints originating from the size of the entrances and low ceilings.
Site topography	The Site is essentially level.
Surface cover	The site is entirely hardstanding.
Site drainage	Informed during the site visit that surface water is collected into a sump and is discharged into the local foul water sewer system along with the foul water from the shopping mall.
Surface water	There are no streams or drainage ditches on or adjacent to the site. The nearest surface watercourse/feature to the site appears to be Holy Brook located approximately 154 m south east of the site boundary.
Trees and hedges	The majority of the site does not contain trees, hedges or other substantial vegetation. There is a single area of overgrown vegetation awaiting an ecological survey to the rear of the disused Eva's Nightclub in the southeast of the site.
Invasive species	Based upon the walkover survey obvious evidence of Japanese Knotweed or other invasive species has not been identified on-site. This is awaiting confirmation following an ecological survey of the site.
Existing buildings on-site	The site contains an active 2 storey shopping mall and multistorey car park. A small portion of the site in the south east is currently a disused and vacant nightclub.
Retaining walls and adjacent buildings on or close to site boundary	The site is located in a very built up area, and subsequently there are buildings surrounding the site. Fountain House is high rise office building adjoining the site.

Feature	Description
Basements on-site	There is a large basement level of the site, which is primarily used for deliveries to the shops and as a space for refuse storage. The basement level is also the location of multiple electricity substations and a sewage sump.
Made ground, earthworks and quarrying	None observed.
Potentially unstable slopes on or close to site	None observed
Buried and overhead services present	There is a sump present on site which discharges into the local foul water sewers. Gas mains were observed on site, as well as electricity sub stations.
Environmental characteristics	
Underground/ above ground storage tanks and pipework	A sewage sump pit is located in the basement of the site. Informed that there is a 400,000 gallon water tank beneath the site to supply the emergency sprinkler system in the event of a fire.
Potentially hazardous materials storage and use	None observed, but informed by the management team that there are three 200L emergency drums of diesel to power two generators located on site.
Asbestos-containing materials	No obvious asbestos construction materials were observed but a detailed survey of the buildings would be required to confirm the presence or otherwise of asbestos-containing materials. Informed by the management team during the walkover that a recent asbestos survey has been undertaken (approximately November 2022).
Waste storage	Multiple wheelie bins of waste were noted in the basement area of the site.
Fly-tipping	None observed
Electricity sub-stations/ transformers	Two existing sub-stations were observed on the site, but the management informed the existence of five sub-stations in total on the site. Two of the substations will need to be relocated due to the development
Fire suppression	Fire extinguishers are located in various locations around the site, and there is a sprinkler system in place which is supplied by an underground water tank.
Fire history	There have been a handful of small fires at the Broad Street Mall according to the management team and the local news. No record of any serious fires.
Evidence of possible land contamination on-site	None observed

Feature	Description
Potential off-site sources of ground contamination	The area surrounding the site is heavily developed, and therefore the presence of uncontrolled made ground should be anticipated. No significant sources of off-site contamination were noted during the site walkover.

Potentially significant land contamination or geotechnical issues arising from the survey are summarised below:

1. Electricity substations located within the basement on site;
2. Potential diesel storage within basement on site

5 PRELIMINARY GEOTECHNICAL CONSTRAINTS

5.1 Design class

BS EN 1997-1 defines three different Geotechnical Categories that structures may fall into, which are summarised as follows:

- Category 1: Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations; with negligible risk
- Category 2: Conventional types of structure and foundation with no exceptional risk or difficult ground or loading conditions
- Category 3: Structures or part of structures, which fall outside limits of Geotechnical Categories 1 and 2. Examples include very large or unusual structures; structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions; structures in highly seismic areas; structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.

Based on the information provided above on the proposed development and in view of the anticipated ground conditions, a Geotechnical Category of Category 2 has been assumed for the purposes of designing the geotechnical investigation. This should be reviewed at all stages of the investigation and revised where necessary.

5.2 Preliminary geotechnical hazards assessment

A summary of commonly occurring geotechnical hazards associated with the anticipated geology outlined in Section 3.4 above is given in **Table 11** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 11 Summary of preliminary geotechnical risks that may affect site

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	☒	☐	Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	☒	☐	Design to NHBC Standards Chapter 4 or similar

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Highly compressible and low bearing capacity soils, (including peat and soft clay)	☒	☐	Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions	☒	☐	Likely to affect ground engineering and foundation design and construction
Running sand at and below water table	☒	☐	Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including 'swallow holes' in Chalk terrain)	☒	☐	May affect ground engineering and foundation design and construction – refer to Section 4.1.2
Evaporite dissolution features and/or subsidence	☐	☒	May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides	☐	☒	Likely to require special stabilisation measures
Ground subject to periglacial valley cambering with gulls possibly present	☐	☒	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion	☐	☒	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)	☐	☒	May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area	☐	☒	May affect deep foundations, basements and tunnels
Geological faults, fissures and break lines	☐	☒	May affect ground engineering and foundation design and construction
Underground mining including shafts and adits (e.g. coal, mineral)	☒	☐	Likely to require further assessment including potentially special stabilisation measures
Effects of extreme temperature (e.g. cold stores or brick kilns/furnaces)	☐	☒	Likely to affect ground engineering and foundation design and construction

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	☒	☐	Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)	☒	☐	Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	☐	☒	May affect ground engineering and foundation design and construction
Site topography	☐	☒	May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.			

5.2.1 Chalk

In view of the prevailing ground conditions, with Chalk at shallow depth beneath the site, it is normal practice to consider the potential risk of ground subsidence related to the presence of swallow holes and other natural chalk solution features or man-made cavities.

Based on the Edmund's risk assessment model for natural dissolution features referred to in CIRIA Report C574 (Lord et al. 2002), the site falls into the 'moderate anticipated subsidence risk' category. With reference to Edmund's database of known natural and man-made chalk solution features there are 4 solution pipes within 500 m of the site (157 m NW, 222 m SE, 249 m E, 256 m SE), and a chalk mine shaft entry located 695 m SW.

According to the environmental database report, there are multiple historic mineral sites associated with underground chalk mining located from 327 m SW of the site, and there are recorded mine shaft entries and mine workings 314 m SW, suggesting there may be more mining cavities than the Edmund's database shows.

6 INITIAL CONCEPTUAL SITE MODEL

In the UK land contamination is assessed using a risk-based approach taking account of the magnitude (severity of the hazard) and likelihood (probability) of occurrence. A 'receptor' is something that could be adversely affected by contamination (e.g. people, an ecological system, property or a water body). A 'pathway' is a route or means by which a receptor is or could be exposed to or affected by a contaminant. A 'contaminant source' is a hazard but it can only pose a risk to a receptor where a pathway is present. The relationship between sources, pathways and receptors are referred to as a conceptual site model. A risk can only be released where a contaminant source, pathway and receptor are all in place, referred to as a 'pollutant linkage'.

In line with LCRM (Environment Agency, 2021) and BS 10175: 2011 + A2 2017 (BSI, 2017), RSK has used information in the preceding sections to identify hazards (sources of contaminants), receptors that may be impacted and plausible linking pathways. Where all three are present this is termed a potentially complete contaminant linkage and a qualitative risk estimation is made.

6.1 Potential soil, soil vapour and groundwater linkages

6.1.1 Potential sources of contamination

Potential sources of soil and groundwater contamination identified from current activities and the history of the site and surrounding area are presented in **Table 12**. Ground gas sources are addressed in the next section.

Table 12 Potential sources of soil and groundwater contamination

Potential sources	Contaminants of concern
On-site	
Made ground (i.e. fill material)	Unknown fill material but potentially including brick, ash and clinker and containing toxic and phytotoxic metals, inorganics, polycyclic aromatic hydrocarbons (PAHs), asbestos.
Historic Industry (Saw Mill, Timber Yard, Car Park)	Petroleum hydrocarbons (LNAPL), chlorinated solvents, toxic and phytotoxic metals, asbestos
Storage of oils and chemicals	Lube oil, diesel, kerosene (LNAPL), chlorinated solvents (DNAPL)
Electricity substations	PCB's, petroleum hydrocarbons (LNAPL)
Off-site	
Petrol filling station, from 561 m south-west, 672 m we702 m st and 672 m south	Petroleum hydrocarbons (LNAPL), fuel additives, PAHs, chlorinated solvents (DNAPL), asbestos
Laundry, 190 m west	Chlorinated solvents (DNAPL)
Infilled land (ponds/quarries), 300 m N, 702 m S, 762 m SW.	Unknown fill material but potentially including brick, ash and clinker and containing toxic and phytotoxic metals,

Potential sources	Contaminants of concern
	inorganics, polycyclic aromatic hydrocarbons (PAHs), asbestos.
Historic industry including; engineering works 220 m south west, breweries 150 m south east, railway line.	Petroleum hydrocarbons (LNAPL), chlorinated solvents (DANPL), toxic and phytotoxic metals, asbestos.

The most likely sources of contamination would be associated with any made ground underlying the site that may have been impacted from historical industrial use and/or existing fuel storage and electricity substations currently located within the existing basement.

6.1.2 Sensitive receptors and linking exposure/ migration pathways

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential sources identified above comprise:

- Future site users – residential users [oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, inhalation of vapours from groundwater and NAPL, if present]
- Current site users – public open space users and commercial workers [oral, dermal and inhalation exposure with impacted soil, soil vapour and dust, inhalation of vapours from groundwater and NAPL, if present]
- Current adjacent site users – residential, commercial, public open space users [migration of contamination via dust/fibre deposition, vapour or groundwater migration combined with inhalation]
- Current and future buildings and services [direct contact with contaminated soils or groundwater and chemical attack]
- groundwater in secondary A aquifer within the Taplow Gravel Member superficial deposits [leaching from soils/ percolation to aquifer/ lateral migration of dissolved phase/NAPL]
- Groundwater in principal aquifer within the Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) bedrock deposits [percolation through permeable strata to aquifer/lateral migration of dissolved phase/NAPL]

Potential linking pathways are show in brackets for each item above.

Please note that construction workers and future maintenance workers have not been identified in the conceptual model as receptors because risks are considered to be managed through health and safety procedures according to the CDM Regulations.

Ecological receptors are only considered within the conceptual model in the context of statutory protected sites.

6.2 Potential ground gas linkages

6.2.1 Ground gas generation potential

Potential ground gas sources identified for the site and surrounding are shown in **Table 13**.

Table 13 Potential ground gas sources

Potential sources	Indicative ground gas generation potential (CIEH, 2008)	Additional information
On-site		
Natural carbonate soil and strata such as chalk and limestone	Very low	The bedrock geology beneath the site is the Seaford Chalk Formation and the Newhaven Chalk Formation (undifferentiated)
Made ground with low degradable organic content (e.g. up to 5% organic material and no easily degradable waste).	Very low	Made ground was previously recorded beneath the site, however this may have been removed prior to construction of the mall during the excavation of the basement.
Off-site		
Natural carbonate soil and strata such as chalk and limestone.	Very low	The bedrock geology beneath the site is the Seaford Chalk Formation and the Newhaven Chalk Formation (undifferentiated)
Made ground with low degradable organic content (e.g. up to 5% organic material and no easily degradable waste).	Very low	Due to the highly developed nature of the surrounding area, a significant thickness of made ground is anticipated.
Natural soil strata with a low degradable organic content, e.g. alluvium, peat	Very low	Alluvium deposits are present in the surrounding area.
Infilled pond less than 15 m diameter, infilled before 1930s to 1940s (300 m N)	Very low	300 m north east, thought to be infilled prior to 1913.
Landfill 1945-1960s (963 m NW)	Low	963 m NW, licensed to accept waste including inert waste. Other types of waste accepted are unknown.
Mine workings more than 50 years since last worked (327 m SW)	Moderate	There are BGS recorded underground chalk mines located approximately 327 m away from the site.

Given the anticipated ground conditions set out above, significant sources of ground gas generation have been identified associated with potentially significant thicknesses of made ground both beneath the site and in the surrounding area. Off site sources such as disused mine workings, unknown infilled land and a historic landfill which accepted unknown waste including inert waste are considered sufficiently distant to not affect the site.

6.2.2 Preferential pathways for ground gas migration

Credible preferential pathways potentially connecting the source and receptor through vertical and lateral migration are:

- geology of the Taplow Gravel Member and the Seaford Chalk Formation and the Newhaven Chalk Formation (undifferentiated) which is likely to be permeable.
- faults/ fissures/ fractures in the underlying geology
- building foundations, piled foundations and vibro-stone columns
- construction joints and cracks within building structure
- utility routes and service penetrations into buildings
- mine shafts and adits
- mine workings extending laterally

6.2.3 Sensitive receptors and linking pathways

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential ground gas sources identified above comprise:

- Current and future site users – residential users, commercial workers [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion/ asphyxiation]
- Current and future buildings and services [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion].

The assessment has identified receptors to include building structures and both current and proposed end-users.

Construction workers have not been identified as receptors for the purposes of this assessment. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and the use of PPE.

6.3 Preliminary risk assessment

The preliminary risk assessment findings and potentially complete contaminant linkages are shown in **Table 14** overleaf. The risk classification based on the combination of hazard consequence and probability using a risk matrix from CIRIA C552 (Rudland et al., 2001). This relates to Tier 1 preliminary risk assessment in LCRM (Environment Agency, 2021).

Table 14 Risk estimation for potentially complete contaminant linkages

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Made Ground and contaminants associated with historic land use (Saw Mill, Timber Yard, Smithy, Car Park)	Current and future site users	Ingestion, oral and dermal exposure with impacted soil, dust/fibres	Unlikely	Medium	Low	The existing basement underlying the entire site is to be retained as part of the new development, and so end users would be isolated from any potential contaminants in the soil by the presence of the basement slab. In addition, proposed soft landscaped areas are to be located at podium level and so any soils used here should be imported from a reputable source.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Made Ground and contaminants associated with historic land use (Saw Mill, Timber Yard, Smithy, Car Park)	Current and future site users	Inhalation of vapours originating from soil or groundwater	Low Likelihood	Medium	Moderate/Low	The site has been subject to a significant amount of industry, and soils beneath the site may be impacted with contamination from these activities. While the risk of direct contact with the soil is low, potential vapours may intrude onto the site via cracks/fissures in the basement slab or service pathways. In addition, whilst the basement is used for vehicular deliveries (and thus would be ventilated to an extent to mitigate exhaust fumes), development plans do show a number of enclosed spaces (bin stores and plant rooms) where vapours or gases could potentially accumulate. The depth to groundwater is anticipated to be in the order of 5.6 m below ground level, with no expected contact with made ground, therefore groundwater vapours are not considered to be a risk.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Made Ground and contaminants associated with historic land use (Saw Mill, Timber Yard, Smithy, Car Park)	Current and future site users	Ingress into buildings, build-up in confined spaces and asphyxiation	Low Likelihood	Medium	Moderate/Low	Historic borehole records prior to the construction of the shopping mall suggest a significant thickness of made ground (3.3 m) beneath the site. While it is likely that the made ground was removed from site prior to the construction of the mall, this is not confirmed and the risk cannot be discounted. In addition, the surrounding area has historically been heavily developed, and it is likely that a significant thickness of made ground exists adjacent to the site. Whilst the basement is used for vehicular deliveries (and thus would be ventilated to an extent to mitigate exhaust fumes), development plans do show a number of enclosed spaces (bin stores and plant rooms) where vapours or gases could potentially accumulate.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Made Ground and contaminants associated with historic land use (Saw Mill, Timber Yard, Smithy, Car Park)	Adjacent site users	Migration of contamination via dust/fibre deposition, vapour or groundwater migration combined with inhalation	Unlikely	Medium	Low	Any on-site made ground and/or potential contaminants associated with past land-use will be encapsulated beneath hardstanding, therefore dust/fibre deposition is considered to be unlikely. Due to the depth to groundwater, it is not anticipated that there will be any contact with made ground/contaminants associated with past land-use, and subsequently no vapours are expected. In addition, adjacent land will largely be open-space, where there will not be any build-up of vapours.
	Buildings and services	Direct contact with contaminated soils or groundwater and chemical attack	Likely	Mild	Moderate/Low	Due to the historic industry on the site, elevated concentrations of hydrocarbons should be anticipated in the soils. This may degrade services beneath the site over time.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Made Ground and contaminants associated with historic land use (Saw Mill, Timber Yard, Smithy, Car Park)	Buildings and services	Ingress into buildings, build-up in confined spaces and explosion	Low Likelihood	Medium	Moderate/Low	The likelihood of made ground generating enough ground gas to present a risk to human health is relatively low, however historic borehole logs from the site prior to the construction of the shopping mall showed a maximum thickness of 3.3 m of made ground. This significant depth carries a slightly elevated risk of ground gas generation.
	Groundwater in secondary A aquifer and principal aquifer	Percolation through permeable strata to aquifer/lateral migration of dissolved phase	Unlikely	Medium	Low	The site is covered in basement hardstanding, limiting water recharge into both aquifers. It is understood that surface water is collected into a sump and discharged into the local foul water sewer. In addition, the site is not located in a source protection zone and there are no public potable water supply abstractions within 1 km of the site.
	Surface water course	Lateral migration of dissolved phase, site run-off/drainage	Unlikely	Minor	Very Low	It is understood that surface water is collected into a sump and discharged into the local foul water sewer, therefore eliminating any site run-off to surface watercourses.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Oils and chemicals stored on site Electricity substations	Current and future site users	Oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, inhalation of vapours from groundwater	Low Likelihood	Mild	Low	The site is covered in basement hardstanding that appeared in a good condition and no visible signs of staining or leakage were observed.
	Adjacent site users	Migration of contamination via dust/fibre deposition, vapour or groundwater migration combined with inhalation				
	Buildings and services	Direct contact with contaminated soils or groundwater and chemical attack				
	Groundwater in secondary A aquifer and principal aquifer	Percolation through permeable strata to aquifer/lateral migration of dissolved phase				
	Surface water course	Lateral migration of dissolved phase, site run-off/drainage				
Contaminants originating from surrounding industry, including historic engineering works, historic breweries, and the current	Current and future site users	Oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, inhalation of vapours from groundwater	Unlikely	Medium	Low	Any potential contamination originating from off-site industry will be encapsulated beneath hardstanding, therefore removing viable pathways for a complete contaminant linkage.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
laundry, petrol filling stations and railway line.	Buildings and services	Direct contact with contaminated soils or groundwater and chemical attack	Unlikely	Mild	Very Low	The depth to groundwater is in the order of 5.6 m below ground level, and is therefore unlikely to mobilise potential contaminants.
	Buildings and services	Migration and ingress of ground gas into buildings, build-up in confined spaces and explosion	Unlikely	Medium	Moderate/Low	The likelihood of made ground generating enough ground gas to present a risk to human health is relatively low, however historic borehole logs from the site prior to the construction of the shopping mall showed a maximum thickness of 3.3 m of made ground. This significant depth carries a slightly elevated risk of ground gas generation.

Risk matrix		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Potentially complete contaminant linkages with a potential risk of moderate to low or higher identified in **Table 14** comprise:

- Current/future site users - Inhalation of soil vapours originating from made ground and potential contamination associated with historic land use.
- Current/future site users – Ingress of potential ground gas into buildings/confined spaces and asphyxiation, originating from significant thicknesses of made ground both on and off site.
- Buildings and services – Direct contact with potentially contaminated soils originating from made ground, potential contamination associated with historic land use
- Buildings and services - Ingress of potential ground gas into buildings/confined spaces and explosion, originating from significant thicknesses of made ground both on and off site.

These potentially complete contaminant linkages need to be assessed further through appropriate site investigation to target the identified sources of potential contamination and assess the feasibility of identified pathways.

6.4 Data gaps and uncertainties

Key data gaps and uncertainties identified in the CSM at desk study stage include:

- gaps in available historical OS maps [1884 to 1898, 1902 to 1911, 1914 to 1930, 1939 to 1947, 1949 to 1956, 1963 to 1969, 1981 to 1987, 2007 to 2021]
- site was developed before first published OS map and prior history not known
- there are no previous investigations available for the site, therefore no information on actual concentrations of contaminants in soil and groundwater or ground gas at this stage
- groundwater depth and flow direction are conceptual at this stage

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Site History

The site was developed prior to 1879 by what appears to be residential housing in an already well established part of Reading. In later decades, parts of the site were developed by a Sawmill, Smithy and a Timber Yard. By the late 1950s, these industries had disappeared and much of the site was occupied by commercial and amenity space, as well as a car park.

The site was almost entirely demolished by 1970 and the existing shopping centre had been constructed by 1973.

7.2 Geo-environmental assessment

Based on the results of the Preliminary Risk Assessment the contaminant linkages that have been identified to be potentially complete (relevant contaminant linkages) and to require further action are:

- Current/future site users - Inhalation of soil vapours originating from made ground and potential contamination associated with historic land use.
- Current/future site users – Ingress of potential ground gas into buildings/confined spaces and asphyxiation, originating from significant thicknesses of made ground both on and off site.
- Buildings and services – Direct contact with potentially contaminated soils originating from made ground, potential contamination associated with historic land use
- Buildings and services - Ingress of potential ground gas into buildings/confined spaces and explosion, originating from significant thicknesses of made ground both on and off site.

Data gaps and uncertainties have been considered and further assessment is considered to be required.

Should unforeseen contamination be encountered during redevelopment then specialist advice should be sought to determine the appropriate course of action.

The assessed risks to end users through the direct contact pathway is based on the redline boundary provided by the client, which shows the entire site to be underlain by a single level of basement (isolating end users from potential contaminant within underlying soils). It is noted that the overall development plans for the scheme do show areas of soft landscaping outside the redline boundary included at ground level on the south side of Dusseldorf Way and potential risks may be present in these areas.

7.3 Geotechnical assessment

The key findings of the initial geotechnical assessment are as follows:

- The site has been assigned a moderate anticipated subsidence risk, based on the Edmunds Risk Assessment.

- There are a number of solution pipes located within 500 m of the site, as well as historic mine workings in the local area.

7.4 Recommendations

The following recommendations are made for further assessment of the site to investigate the risks identified above and to address remaining uncertainties:

- Shallow boreholes – To determine shallow ground conditions and allow assessment (through sampling and testing) of near surface soils and enable the installation of gas monitoring wells.
- Deep boreholes – To determine deeper ground conditions and geotechnical properties of the underlying bedrock for piled foundation design, in particular relating to potential instability associated with the underlying chalk.
- Ground gas assessment – To determine the ground gas regime beneath the site and assign a characteristic situation.

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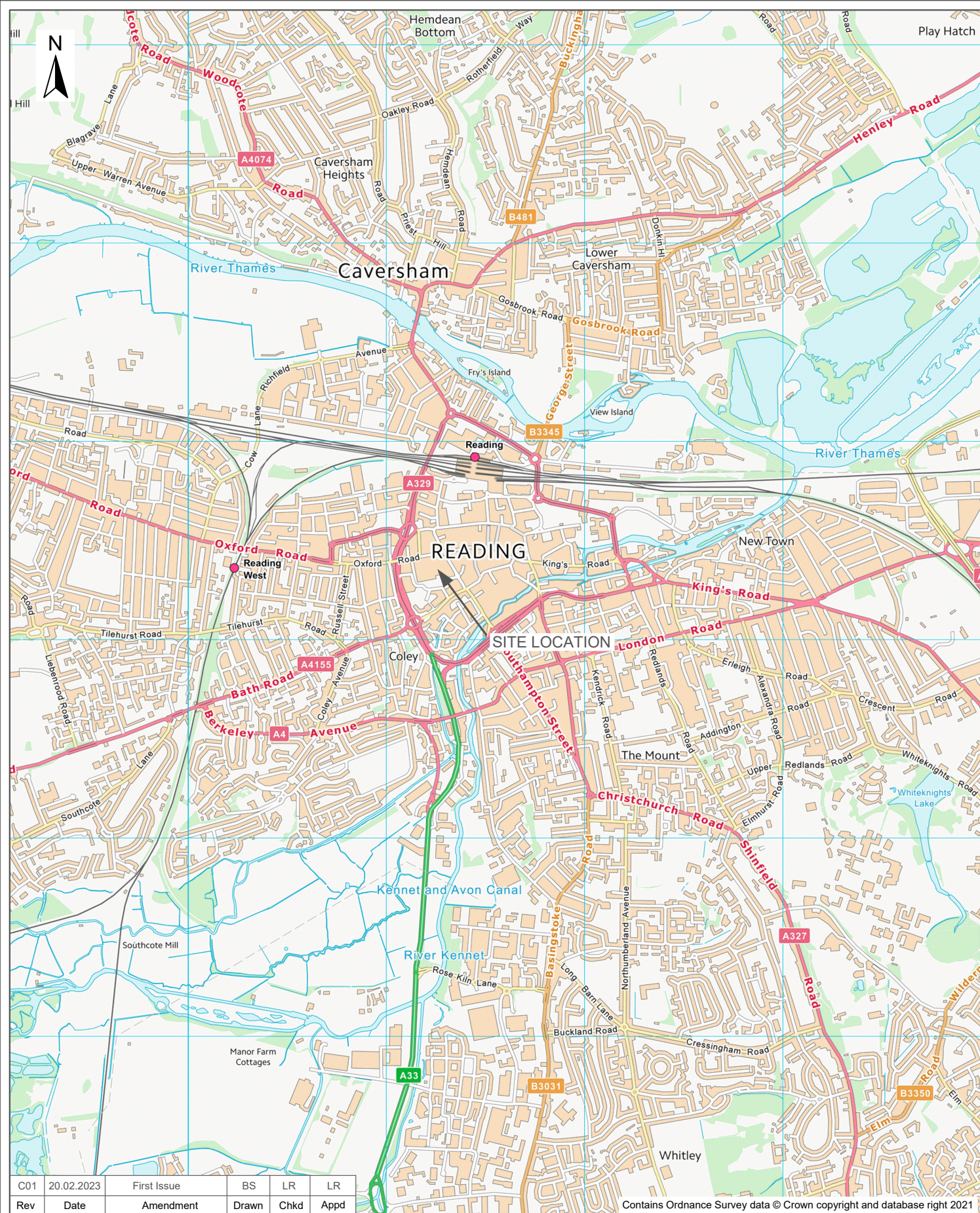
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FIGURES



FIGURE 1 SITE LOCATION PLAN



C01	20.02.2023	First Issue	BS	LR	LR
Rev	Date	Amendment	Drawn	Chkd	Appd

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Client
Broad Street Mall

Project Name
McLaren Living

Description
Site Location Plan

Dimension m	Size A4	Scale 1:25,000	Geolocation 471254,173367	Project ID 1922703	Drawing no. 11101	Rev C01	File name 1922703-HH-111-SS-D-C-11101-C01
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FIGURE 2 SITE LAYOUT PLAN



LEGEND

Site boundary

Applicants Ownership

Notes:

Base plan provided by Client
No.Ref: AHR Architects Ltd (Drawing No-BSM-AHR-ZZ-00-DR-A-08120)

C02	10.11.2023	Second Issue	BS	BW	BW
C01	20.02.2023	First Issue	BS	LR	LR
Rev	Date	Amendment	Drawn	Chkd	Appd

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Client

Broad Street Mall

Project Name

McLaren Living

Description

Site Layout Plan

Project ID	Drawing no.	Revision
1922703	11201	C02

File name

1922703-HH-112-SS-D-C-11201-C02

Dimensions	Scale	Size
m	NTS	A3

APPENDICES

APPENDIX A

SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for McLaren Living (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client, dated 24th November 2022. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, persistent, bioaccumulative or toxic chemicals (including PFAS compounds) or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site,

unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

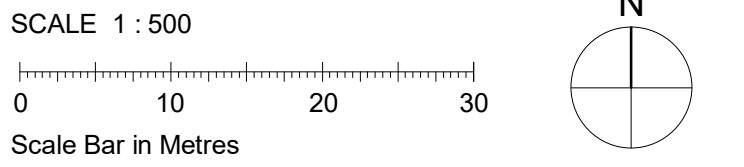
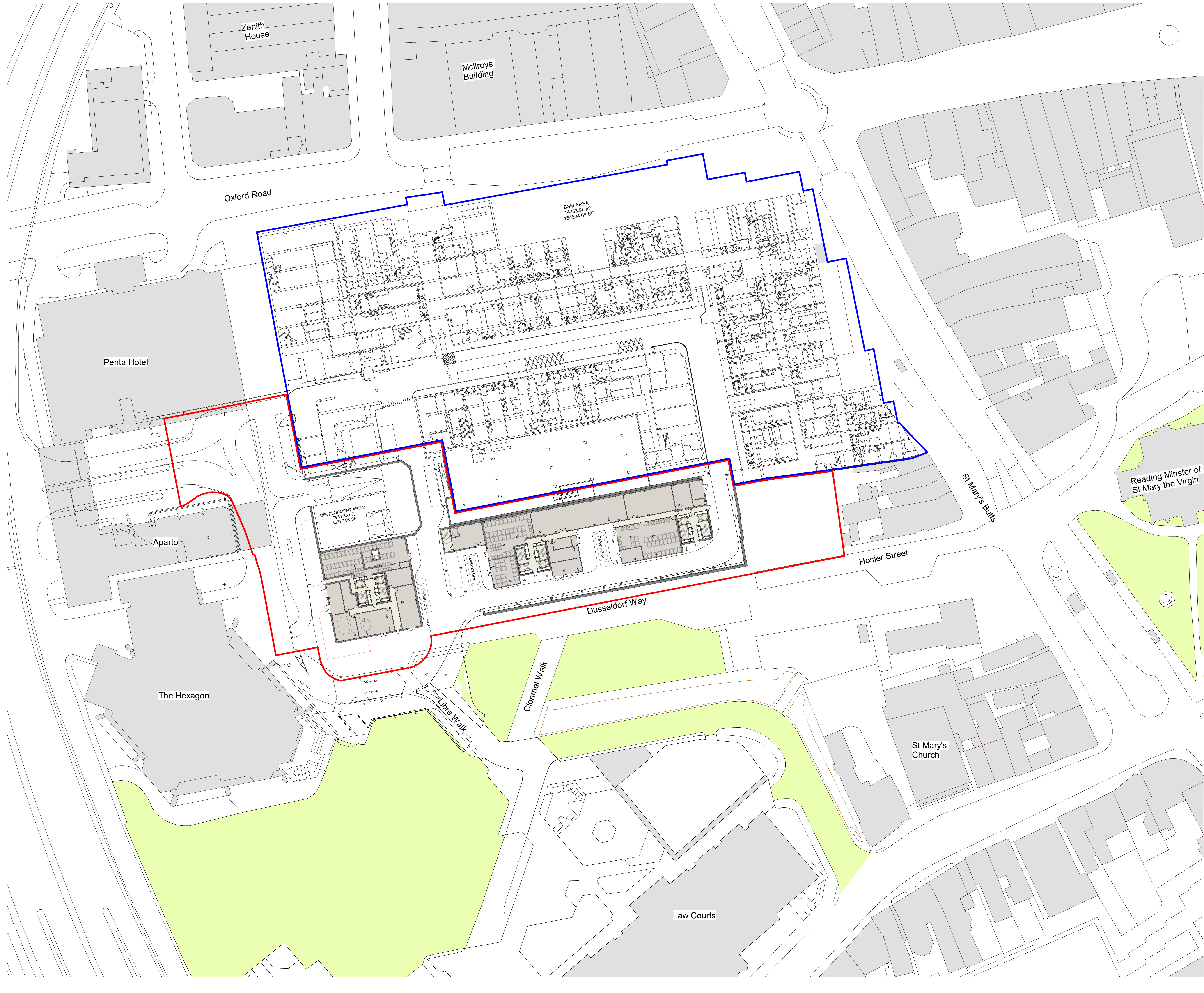
- a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.
- b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.
- c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.
11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.
12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B

DEVELOPMENT DRAWINGS



Key

Circulation

BOH

Key

Red Line Boundary
Area within boundary: 7931.83 m²

Applicants Ownership
Area within boundary: 14353.95 m²

Rev	Description	Date	Dr by	App by
original by		date created		
BS		29/11/23		DB

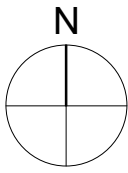
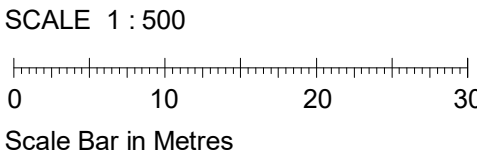


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client name	
McLaren (Broad Street Mall) Ltd and UREF III LP	
project	
Broad Street Mall Residential	
drawing	
BSM Development Scheme Site Plan - Basement	
computer file	plot date
1/10.32.1.1/DEM_Profile_Folder_redacted/bethany.stewart/Documents/Reit_Plan/Local File/Rev/2023/BSM-AHR-ZZ-CZ-A1-A-0001_Apartment_bethany.stewart.rvt	
project number	scale
2022.00307.000	1 : 500 @A1
drawing number	rev
BSM-AHR-ZZ-B1-DR-A-08120	S2

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Key

- Amenities
- Circulation
- BOH
- Retail

Key

- Red Line Boundary
Area within boundary: 6238.61 m²
- Applicants Ownership
Area within boundary: 14353.95 m²

Rev	Description	Date	Dr by	App by
original by BS		date created 29/11/23		approved by DB



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client name	McLaren (Broad Street Mall) Ltd and UREF III LP		
project	Broad Street Mall Residential		
drawing	BSM Development Scheme Site Plan - Ground Floor		
computer file	1/10.32.1.1/DEM_Profile_Folder_redacted/bethany.stewart/Documents/Ret_Plan/Local Plan/Rev 2023/BSM-AHR-ZZ-00-A-0001	plot date	17/02/2023
project number	2022.00307.000	scale	1 : 500 @A1
drawing number	BSM-AHR-ZZ-00-DR-A-08120	rev	issue status
			S2
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