



Apex Tower, Manchester

Drainage Strategy

Project No: 2104-14
January 2022
MLB-REN-00-ZZ-RP-C-00002
Rev: 01

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Revision	Description	Issued by	Date	Checked
01	Issued for planning	J Bullough	28.01.2022	A Isherwood

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1.0 INTRODUCTION

1.1 Purpose of this report

This Drainage Strategy has been prepared to support the planning application for the proposed development - Apex Tower, Manchester.

The assessment includes: a summary of the site, an estimate of the existing and proposed surface water discharge rates, infiltration assessment, SUDs assessment, and outline drainage proposals and performance criteria.

This report should be read in conjunction with the Flood Risk Assessment, renaissance, October 2021.

The proposals within this report are intended to demonstrate the feasibility of the overarching drainage strategy to support the planning proposal.

2.0 THE SITE

2.1 Site Location

The proposed development site is located off Albion Street and Great Bridgewater Street, Manchester. When considered cumulatively, the site is bound to the west by Albion Street, the northeast by Great Bridgewater Street, and the south by Trumpet Street.

The site location is described below:

- Post Code M1 5LE
- OS X (Easting) 383686
- OS Y (Northing) 397608
- Nat. Grid SJ836976

The site location is illustrated in Figure 2.1 below.



Map data ©2021 Google

Figure 2.1: Site Location

2.1 Site Description

The development site is circa 0.041 hectares and comprises two distinct parcels. The main component of the site (A) is currently a private car park and is located at the west of the site, along Albion Street. The second is smaller rectangular plot of land (B) also used as a car park. The sites lie adjacent to Trumpet Street, to the south, and Great Bridgewater Street to the north. The two parcels are separated by the Briton's Protection Pub. The site is mostly flat as can be seen from the topographical survey in Appendix A.

The main access to the site can be gained via Trumpet Street to the south.

2.2 Existing Site Drainage

The existing site is currently 100% impermeable. Based on an assessment of the development site and the topographical survey (Appendix A) there is no existing foul or surface water network on the site and inherently no existing connection to the public sewer. It is therefore assumed that the site currently drains by discharging into the highway.

Refer to Appendix B to United Utilities Sewer Records.

2.3 Geology

Published geological mapping does not indicate the site to be underlain by Made Ground however based on the historical mapping and the development that has taken place, made ground deposits are highly likely to be present. A large area of made ground is indicated to be present approximately 50m to the west, south and further afield to the east of the site according to BGS mapping.

The western area (Site A) is indicated to be predominantly underlain by glaciofluvial sheet deposits, typically comprising sand and gravel. Glacial till, typically clay with minor silt, sand and gravel, is indicated to encroach into the northern end of Site A.

In contrast, the eastern area (Site B) is indicated to be predominantly underlain by glacial till (clays), with glaciofluvial deposits (sand and gravel) indicated to encroach into the southern area.

The deeper solid geology is indicated to be part of the Chester Pebble Beds Formation which typically comprises sandstone.

No faults are shown on or within an influencing distance of the site.

There are two relevant BGS borehole records within 50m which show broadly similar ground conditions. The closest is located immediately north of the site within the road intersection between Lower Mosley Street and Great Bridgewater Street. At this location the ground conditions comprised bituminous surfacing over reinforced concrete and hardcore to 0.70m bgl, underlain by natural strata comprising very stiff brown silty and sandy clay with grey fissures, stone inclusions and bands of silty laminated clay. Bedrock comprising very dense red fine/medium grained sandstone was encountered from 5.10m bgl.

The second borehole is located circa 40m north-east where concrete over ashy made ground was encountered to 1.00m bgl, underlain by natural strata comprising very stiff red brown sandy silty clay with grey stained fissures. Highly weathered brown medium to coarse grained sandstone was encountered at 5.50m bgl.

Rotary coring within both boreholes indicates solid core recovery typically exceeded 80% and rock quality designation often exceeded 50% below 7.50m bgl.

2.4 Hydrology

The nearest surface water feature is the Rochdale Canal which lies 36m south of the site, whereas the nearest natural watercourse is the River Medlock located 169m south and the flow direction is indicated to be from east to west.

The site is indicated to lie 22m east of a Source Protection Zone, Zone III, Total Catchment (the area needed to support the discharge from the protected groundwater source) for a groundwater abstraction well.

There are no active surface water abstractions within 2000m of the site. The nearest historical surface water abstraction licence was located 1797m south for process water and general cooling at Hydes Brewery.

The closest licenced discharge consent is an historical discharge of sewage final/treated effluent to the River Tib culvert located 48m south-east, revoked in 1993. The closest active licenced discharge consent is for sewer storm overflow into the River Medlock, located 175m south-east.

With regard to the hydrogeology, information accessed on DEFRA's, "Magic Map Application" (DEFRA, 2019) indicates that the Glaciofluvial Deposits and Glacial Till are classified as a Secondary Aquifer (A) Aquifer. The 'Secondary A' aquifer is defined as permeable layers capable of supporting water at a local scale and in some instances providing an important source of baseflow to rivers. The Chester Pebble Beds Formation is classified as a Principal Aquifer.

Information obtained from the Environment Agency (EA) Risk of Flooding from Rivers and the Sea (RoFRaS) database indicates that the risk of flooding across the site is negligible as the site is not indicated to be within either an EA designated Zone 2 or Zone 3 flood plain.

The British Geological Survey indicate there is a potential for groundwater flooding at the subject site, with a moderate risk rating. Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

2.5 Proposed Development

The proposed development is for combined residential and commercial units, split over two sub-sites separated by the Britons Protection public house, which is to be retained. The development of Site A in the west will involve the construction of a 27-storey residential apartment building with ground floor amenities, substation, visitor parking and cycle stores. The development of Site B in the east will involve the construction of a 7-storey office building.

Refer to Appendix C for the proposed development plans.

3.0 EXISTING & PROPOSED SURFACE WATER DISCHARGE RATES

3.1 Pre-Development Surface Water Run-Off Rates

The 2 components of the site are considered to be 100% impermeable, respectively, in their current condition. The areas consist of hard standing that is currently assumed to drain into the highway.

3.1.1 Greenfield Run-Off Rates

As the site has no existing on-site drainage and no positive connection to the public sewer it has been assessed as a greenfield site. Area A has an impermeable area of 0.024 ha (240m²) and Area B an impermeable area of 0.017 ha (170m²), see Table 3.1. The equivalent greenfield run-off rates for each area of the development have been calculated using Microdrainage ICP SUDS method (refer to Appendix D). The rates presented below are what would be typical of a site with an equivalent surface area which remains undeveloped / covered in grass or vegetation. A partly urbanised catchment ratio of 0.75, Q_{bar} has a return period of 2.3 years.

The equivalent greenfield run-off rate shown in Table 3.2 below: -

	Area A	Area B	Total
Impermeable Area (ha)	0.024	0.017	0.041

Table 3.1 – Impermeable Area Summary

	Area A	Area B
Return Period	Q _{Greenfield} (l/s)	Q _{Greenfield} (l/s)
1 in 1 year	0.3	0.2
1 in 2 year	0.3	0.2
1 in 30 year	0.5	0.3
1 in 100 year	0.5	0.4
Q _{BAR} _{RURAL}	0.3	0.2

Table 3.2 – Greenfield Run-off Rates

3.2 Proposed Surface Water Discharge Rates

In line with the Manchester, Salford and Trafford SFRA the development the site is classified as Greenfield.

Due to the small site areas it is not practical to limit the discharge rates to Greenfield run off rates and therefore the maximum discharge for each site will be limited to 5l/s. This has also been confirmed with United Utilities via pre-development enquiry, refer to Appendix E.

3.3 Attenuation Requirements

The proposed development results in circa 303m² of building footprint in site A and 145m² of building footprint in site B.

The post development discharge rates will include for an increase in the rainfall intensity of 40% to allow for climate change as is consistence with a design life of the development of 100 years, as outlined in NPPF.

A quick storage estimate for the 1 in 100 year storm event, plus 40% for climate change, using Micro Drainage, for each area indicates that the approximate attenuation volume shown in table 3.5 is required to limit the peak surface water discharge to 5l/s for each site. The micro drainage calculations can be seen in Appendix F.

Development Area	Surface Water Attenuation Estimate (m3)
Site A	8.1
Site B	2.5

Table 3.5 – Surface Water Attenuation Estimates

For both sites it is proposed that the attenuation is provided via blue roofs designed by a specialist. Due to the roof layout Site B will have 2 blue roof systems that combine within the above ground drainage system.

Preliminary blue roof calculations undertaken by Bauder, refer to Appendix G, have indicated the following discharge rates and attenuation volumes are achievable:

Development Area	Blue Roof Area (m2)	Catchment Area (m2)	Total Discharge Rate (l/s)	No. Outlets	Maximum Attenuated Volume (m3)
Site A	256.7	302.9	0.38	1	24.2
Site B - 1	45.3	86.5	0.58	1	4.2
Site B - 2	30.5	58.6	0.39	1	2.9

4.0 SURFACE WATER DISCHARGE & SUDS ASSESSMENT

4.1 Surface Water Discharge Assessment

In accordance with NPPF, the following hierarchy of surface water drainage options has been considered:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain, or another drainage system;
- Discharge to a combined sewer.

The Phase 1 Desktop study indicates the site to be underlain by made ground and clay deposits which therefore renders infiltration as unviable. Also due to the nature of the development the whole site will be covered by building roofs and associated foundations which prevent the use of infiltration.

Opportunities for discharge to watercourse have been considered. The nearest surface water feature is the Rochdale Canal located approximately 36m south of the site and the nearest named watercourse is River Medlock, located approximately 169m to the south of the site. To discharge into these surface water features 3rd party land and adopted highways would need be crossed and disrupted. Based on the above, direct discharge to the watercourse is deemed not viable.

Also, there are no surface water sewers within the vicinity of the site and therefore each of the site areas will discharge indirectly to the combined 900x1425 combined public sewer within Albion Street via a 150 diameter combined public sewer within Trumpet Street. Each connection will be subject to agreement under S106 of the water industry act.

4.2 Sustainable Urban Drainage

Table 4.1 below provides a summary of typical SUDs techniques outlined within CIRIA guide 753 SUDs manual. Based on a review of the suitability of the SUDs techniques it is proposed that the Apex Tower development may incorporate the following:

- Blue/green Roof roofs to reduce runoff rates, improve water quality and possibly provide amenity value.

SUDs Technique	Description	Suitability for Development Site	
Soft Landscaping	Grassed areas that allow direct infiltration of rainwater	No soft landscaping proposed	✗
Filter Drains	Granular filled Linear drains / soakaway with either granular fill and perforated pipe, or dense vegetation that treat runoff from adjacent impermeable areas	No suitable for development	✗
Swales	Shallow landscape channel that can infiltrate or convey runoff.	No suitable for development	✗
Infiltration Basins	Depressions in the ground designed to store and infiltration runoff to the ground. Can be landscaped to provide amenity value.	No suitable for development	✗
Wet Ponds	Basins with permanent pool of water providing water quality treatment, wildlife, and amenity benefit. Designed to provide temporary storage for additional runoff.	No suitable for development	✗
Extended Detention Basins	Dry basins that are designed to temporarily store runoff providing water quality treatment.	No suitable for development	✗
Constructed Wetland	Ponds and shallow wetland areas with vegetation to improve pollution removal and enhance wildlife habitat.	No suitable for development	✗

Porous Paving	Granular build-up beneath permeable paving systems that can be used to either store runoff (lined system) and increase time of concentration or allow percolation into the ground.	Building roof covers entirety of the development sites	✖
Trees Pits	Managed permeable paving systems around tree pits that can be used to either store runoff (lined system) and increase time of concentration or allow percolation into the ground.	No suitable for development	✖
Soakaways	Infiltration device to temporarily store runoff and allow it to percolate into the ground.	No suitable for development	✖
Green Roof	Vegetated roof area that reduces runoff and increases time of concentration.	Suitable to the roof areas	✓
Blue Roof	Roof area designed to store and reduce peak runoff rates during intense storms.	Suitable to the roof areas	✓
Underground Storage	Attenuation structures installed below ground to provide runoff storage.	Not via due to basement and foundation provisions	✖

✖ Not suitable

? Potentially suitable subject to further investigation

✓ Suitable

Table 4.1 – SUDs Techniques & Suitability for Development Site

4.3 Water Quality Assessment

The drainage from the site is from the roof to the buildings, an area of public / private space, which is restricted to pedestrian use only, a low trafficked road and residential car parking. Water quality is generally affected by frequent rainfall events, 1 in 1 year events or less, which is circa 5mm/hr for the proposed development site. To assess the water quality consideration will be given to the guidance with the National Standard for Sustainable Urban Drainage (NSSUD) and CIRIA Guide C753. The pollution hazard levels for difference land uses are presented in table 4.2 and are based on the definitions in the NSSUD and C753.

Pollution Hazard Level	Land Use
Very Low	Residential roofs
Low	Individual property driveways, non-residential roofs, residential car parks, low traffic roads, non-residential car parking with infrequent change (e.g. Schools, offices)
Medium	Commercial yards and delivery areas, non-residential car parking with frequent change (e.g. hospital, retail), minor roads
High	Site with heavy pollution (e.g. Haulage yards, lorry parks, waste sites, sites with chemical and fuels are delivered, handled, stored etc.)

Table 4.2 – Pollution Hazard Levels

As the site will be completely covered by the building footprint the Pollution Hazard Level is considered as very low with the primary consideration given to removal of larger debris like leaves, feathers etc. that could cause a blockage.

The following tables indicate the minimum number of treatment stages required before surface runoff should reach the infiltration or receiving water body and are extracted from the NSSUD.

Pollution Hazard Level	Land Use	Low	Med	High
G1	Source Protection Zone 1, within 50m of a well, spring or borehole that supplies potable water.	1	3	Consult the EA
G2	Into or immediately adjacent to a sensitive receptor that could be influenced by infiltrated water. Includes designated nature conservation, heritage, and landscape sites – including Biodiversity Action Plan (BAP) habitats and Protected Species.	1	3	

G3	Source Protection Zone II and III or Principal Aquifer	1	3	
G4	Secondary Aquifer	1	2	
G5	Unproductive strata	1	2	

Table 4.3 – Groundwater Minimum Treatment Stages

Pollution Hazard Level	Normal surface water	Sensitive surface water
Low	0	1
Med	2	3
High	Consult the EA	

Table 4.4 – Surface Water Body Minimum Treatment Stages

Based on the above assessment the roof areas have a very low pollution hazard and the receiving sewer is considered as normal surface water. No treatment stages are therefore required. The adoption of SUDs as noted and good practice will provide inherent treatment. Areas of blue roofs, dependant on detailing, will act to absorb most frequent rainfall events and filter out solids and sediment.

4.4 SUDS Management Plan

The Sustainable Urban Drainage systems are to be generally maintained by a Building Management Company selected by the client with the exception of the oversized pipes and manholes within the proposed adoptable highway in Area 1 which will be offered for adoption as part of a S104 agreement. The building management company will be required to maintain the SUDs features in line with the following recommendations and suppliers' requirements of the various features. The adoptable network within Area 1 will be maintained by United Utilities.

The following operation and maintenance requirements for the SUDs features incorporated into the development are to be adopted by the Building Management Company. These requirements are general and have been extracted from the CIRA Guide C753.

Table 12.5 - Operation and maintenance requirement for green roofs (also applies to blue roofs)

The Main Contractor delivering each phase of development is to update the general requirements to reflect the product specific requirements of the as installed proprietary SUDs and incorporate these into the Operation & Maintenance manual for the building.

TABLE 12.5 Operation and maintenance requirements for green roofs

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

5.0 DRAINAGE STRATEGY

Refer to Appendix H for Below Ground Drainage General Arrangement.

5.1 Surface Water System

Each site area is to have a dedicated surface water network that is to collect the rainwater from the proposed building's roof. The systems will then be combined with foul water network at the site boundary and discharge under gravity to the United Utilities combined sewer present within Trumpet Street, subject to agreement under S106 of the water industry act. United Utilities have confirmed via a pre-development enquiry that connections to the public sewer are acceptable in principle (refer to Appendix E).

The surface water discharge from the sites is to be limited to 5 l/s. This will be achieved via blue roofs and flow restrictors being installed which will provide attenuation that will capture and slow down the flow. The blue roof system is subject to detailed design however preliminary calculations, shown in Appendix G, indicate a maximum discharge of 0.38 l/s and 0.97 l/s from Site A and B respectively. Proposed discharge rates are to be confirmed with the Lead Local Flood Authority and United Utilities as part of the detailed design.

The surface water discharging from the site will be from the building roofs and therefore no treatment is required, however the blue roofs will provide inherent treatment.

The surface water drainage network is to be designed in accordance with Building Regulation Part H, BS EN 752 and Code for Adoption. In addition, the following requirements will also be adopted in accordance with the Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance:

- No surcharging of drainage network for design storm of 1 in 2 years.
- As the site is relatively flat with limited opportunity for management to store exceedance at grade the below ground drainage system will be designed to ensure flooding does not occur on site for both the 1 in 30 year and 1 in 100 year rainfall events
- Flood routing plans, in the event of the drainage network becomes overwhelmed, prepared as part of detailed site design
- No flooding inside buildings in a 1 in 100 year plus climate change event.

The surface water systems have been designed to accommodate the 1, 2, 30 and 100 year return events with 40% climate change up to a 6hr duration.

5.2 Foul Water System

The foul water drainage from the apartments, amenity places and plant areas will be collected by a dedicated gravity foul network that combines with the surface water networks at the site boundary. The combined systems are to be connected to the existing combined sewer in Trumpet Street.

The new drainage connection will be subject to a Section 106 application under the water industry act. United Utilities have confirmed via a pre-development enquiry that connections to the public sewer are acceptable in principle (refer to Appendix E).

The drainage system is to be designed in accordance with Building Regulations Part H, BS EN 752 and the 'Codes for Adoption'.

5.3 Exceedance Events

The levels to the site are relatively flat and in an exceedance event, safe egress can be provided directly from the buildings onto either Albion Street, Great Bridgwater Street or Trumpet via the main entrance and emergency exits in the buildings.

5.4 Phasing & Surface Water Management During Construction

It is assumed that given the scale of the development that it will be delivered in a single phase.

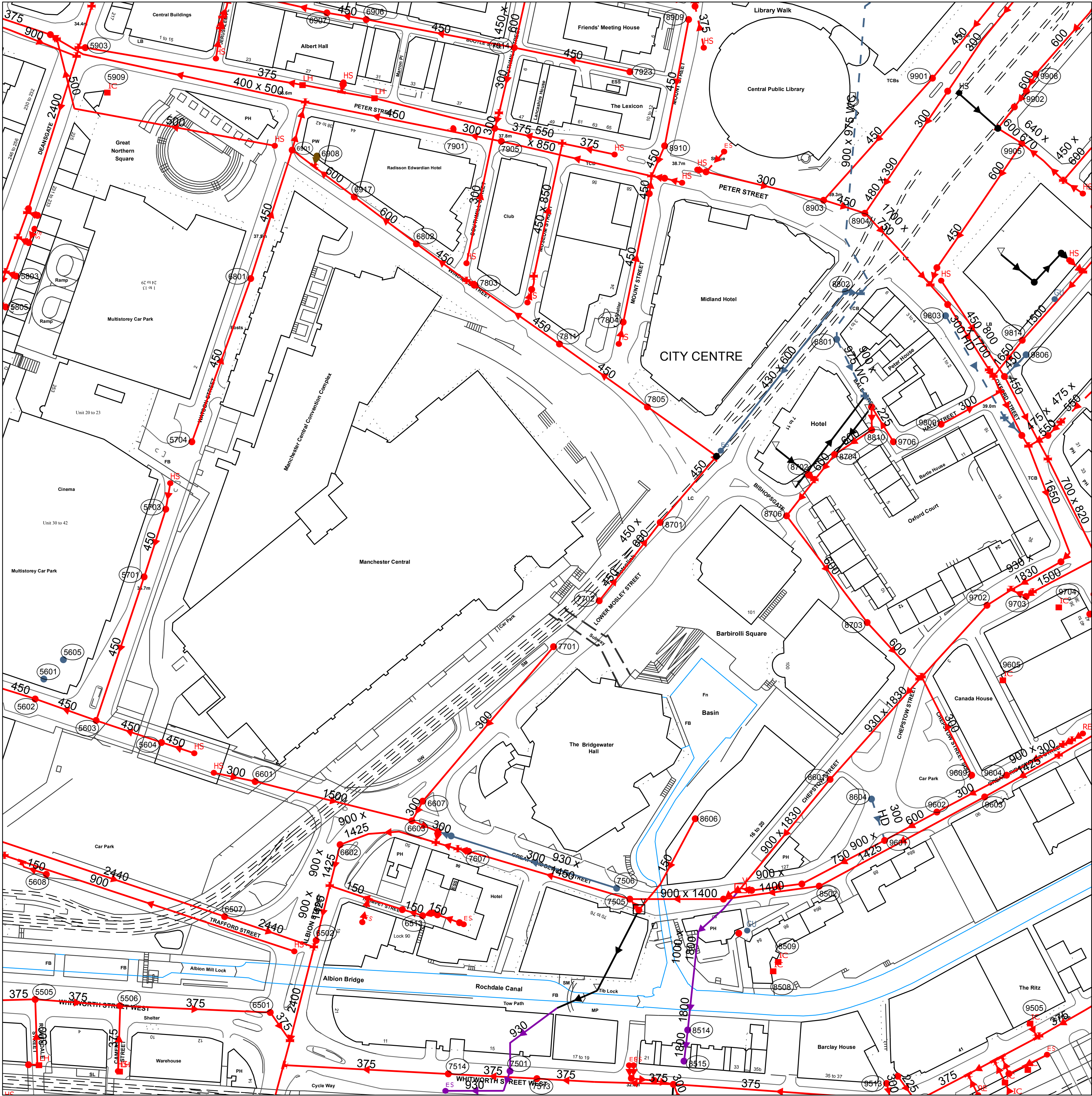
The management of surface water management during construction will be addressed by the Main Contractor as part of their 'Construction Management Plan'.

A brief overview of the key consideration relating to surface water management and flood risk that will need to be incorporated into the Main Contractors construction methodology include:

- The existing buildings on site are to be demolished. Stockpiling of material on site is to be minimised to ensure that the flood storage capacity for the 1 in 1000 year (0.1% AEP) event is not compromised.
- Due to the history of the site, it is anticipated that ground remediation may be required. A working platform will also be required during construction to allow for formation of piled foundations etc. The top of the working platform is to be located at or lower than existing site levels to ensure that the flood storage capacity for the 1 in 1000 year (0.1% AEP) event is not compromised.
- Subject to the level of contamination beneath the site, level of site remediation, and quality of working platform compaction to reduce infiltration, consideration should be given to the risk of residual contamination on site affecting groundwaters and the adjacent watercourse.
- The risk of spillage of diesel and other contamination risk during construction activities are to be assessed and measures implemented to ensure they do not cause a risk to groundwaters and the adjacent watercourse.

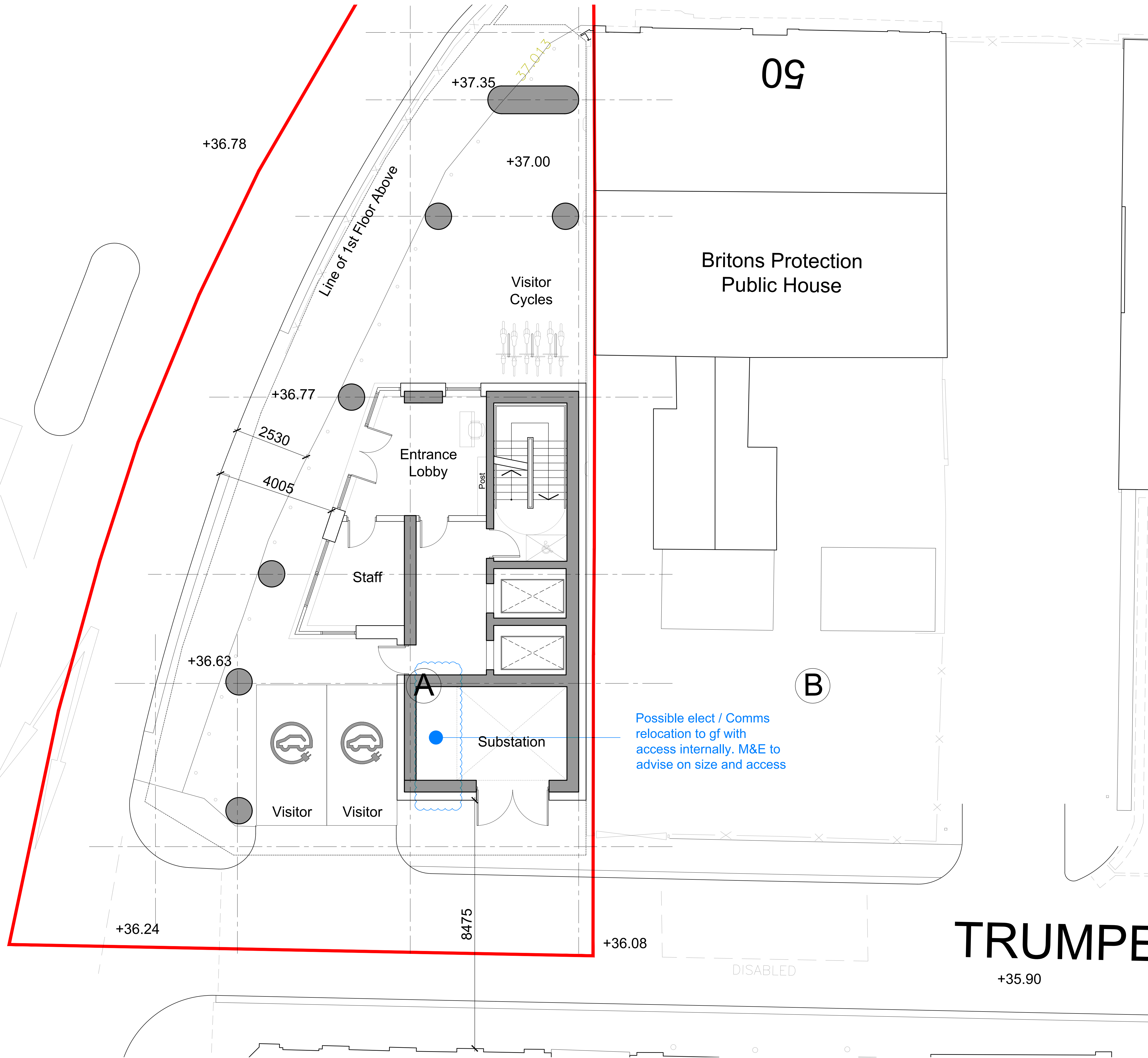
APPENDIX A Topographical Survey

APPENDIX B
United Utilities Water Sewer Records



Ratno	Cover	Func	Invert	Size	x	Size	y	Shape	Matl	Length	Grad
5503	33.4	CO	30.67	300				CI	VC 34.02		8
5505	33.83	CO						CI	VC 34.02		
5506	34.08	CO						CI	VC 34.02		
5501	36.03	SW	31.92	450				CI	CO 80.65		
5502	35.48	CO	0	450				CI	CO 29.73		
5503	35.59	CO	32.67	450				CI	CO 31.62		
5504	35.71	CO						CI	CO 31.62		
5505	35.76	SW						CI	VC 15.16		
5506	35.76	CO	150					CI	VC 13.54		
5507	35.76	CO						CI	VC 13.54		
5508	35.76	CO						CI	VC 13.54		
5509	35.76	CO						CI	VC 13.54		
5510	35.76	CO						CI	VC 13.54		
5511	35.76	CO						CI	VC 13.54		
5512	35.76	CO						CI	VC 13.54		
5513	35.76	CO						CI	VC 13.54		
5514	35.76	CO						CI	VC 13.54		
5515	35.76	CO						CI	VC 13.54		
5516	35.76	CO						CI	VC 13.54		
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APPENDIX C Proposed Development Plans

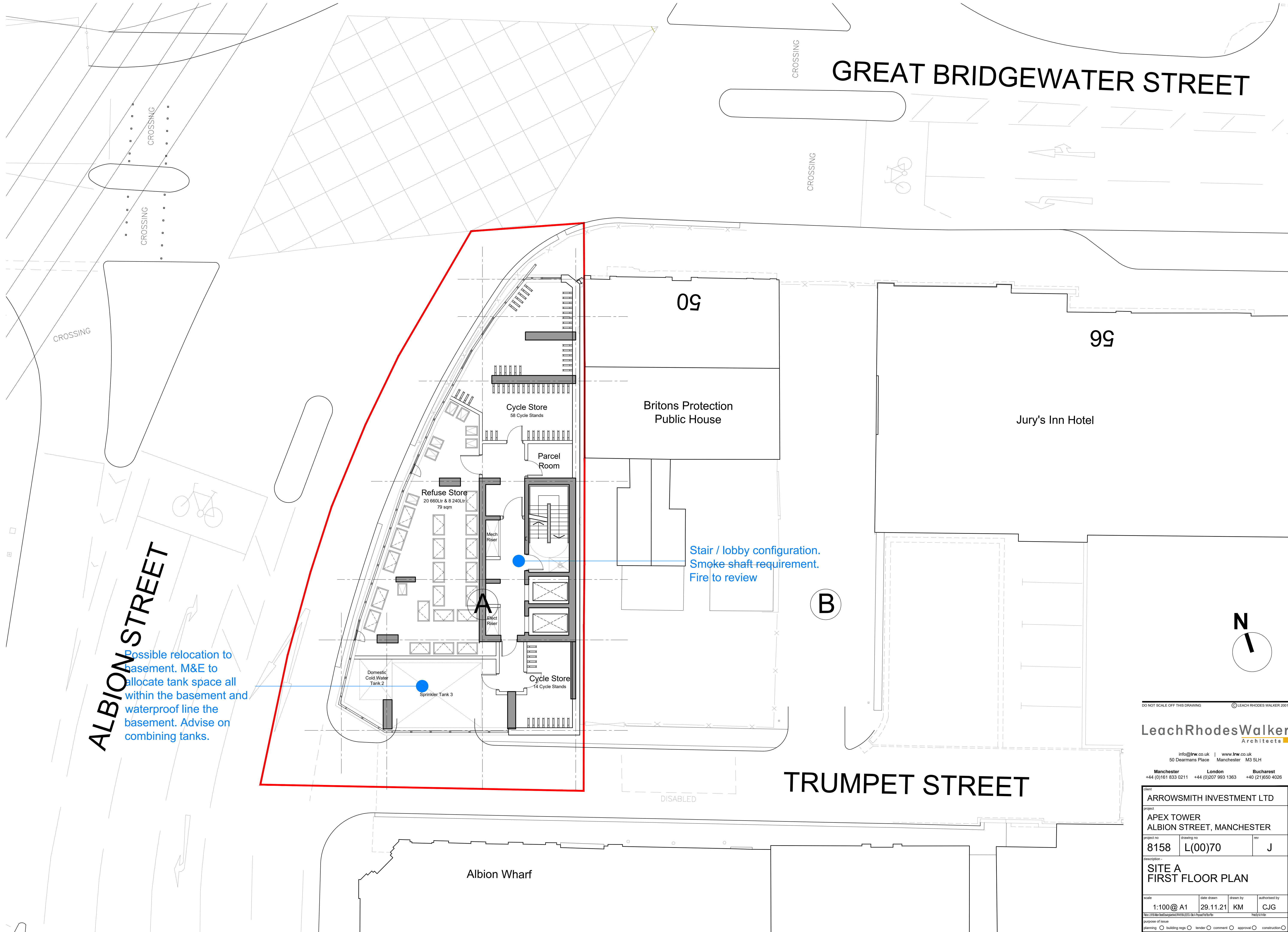


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client			
ARROWSMITH INVESTMENT LTD			
project			
APEX TOWER ALBION STREET, MANCHESTER			
project no	drawing no	rev	
8158	L(00)69	K	
description -			
SITE A GROUND FLOOR PLAN			
scale	date drawn	drawn by	authorised by
1:100@ A1	29.11.21	KM	CJG
Rev: 1/19 by 2019/08/20/2019-			



CROSSING

CROSSING

CROSSING

CROSSING

CROSSING

GREAT BRIDGEWATER STREET

09

99

Britons Protection
Public House

Jury's Inn Hotel

Cycle Store
58 Cycle Stands

Parcel
Room

Refuse Store
20 660Ltr & 8 240Ltr
79 sqm

A

Stair / lobby configuration.
Smoke-shaft requirement.
Fire to review

B

N

ALBION STREET

Possible relocation to
basement. M&E to
allocate tank space all
within the basement and
waterproof line the
basement. Advise on
combining tanks.

Domestic
Cold Water
Tank 2

Sprinkler Tank 3

Cycle Store
14 Cycle Stands

DISABLED

TRUMPET STREET

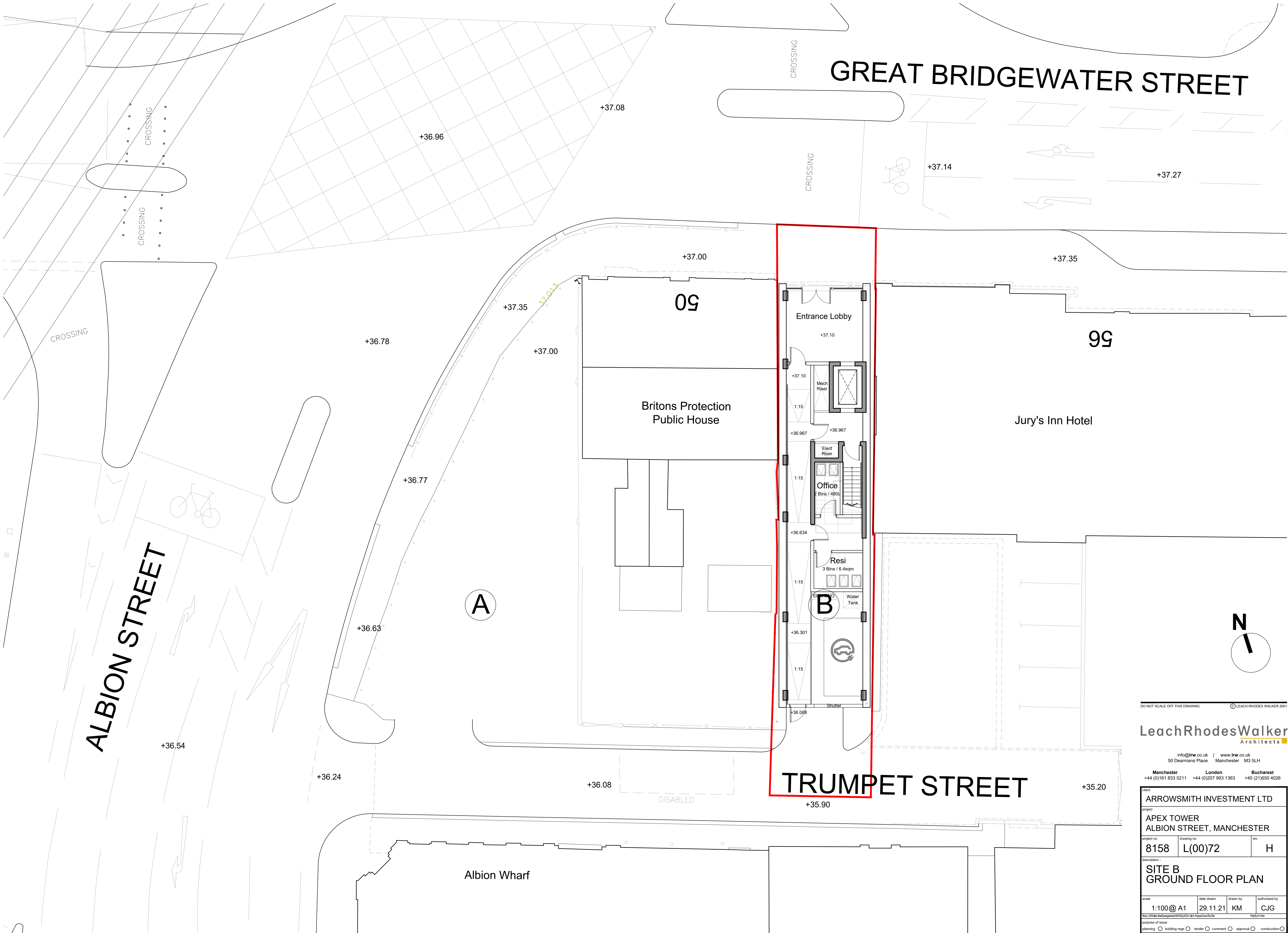
Albion Wharf

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client ARROWSMITH INVESTMENT LTD			
project APEX TOWER ALBION STREET, MANCHESTER			
project no 8158	drawing no L(00)70	rev J	
description - SITE A FIRST FLOOR PLAN			
scale 1:100@ A1	date drawn 29.11.21	drawn by KM	authorised by CJG
purpose of issue planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐			

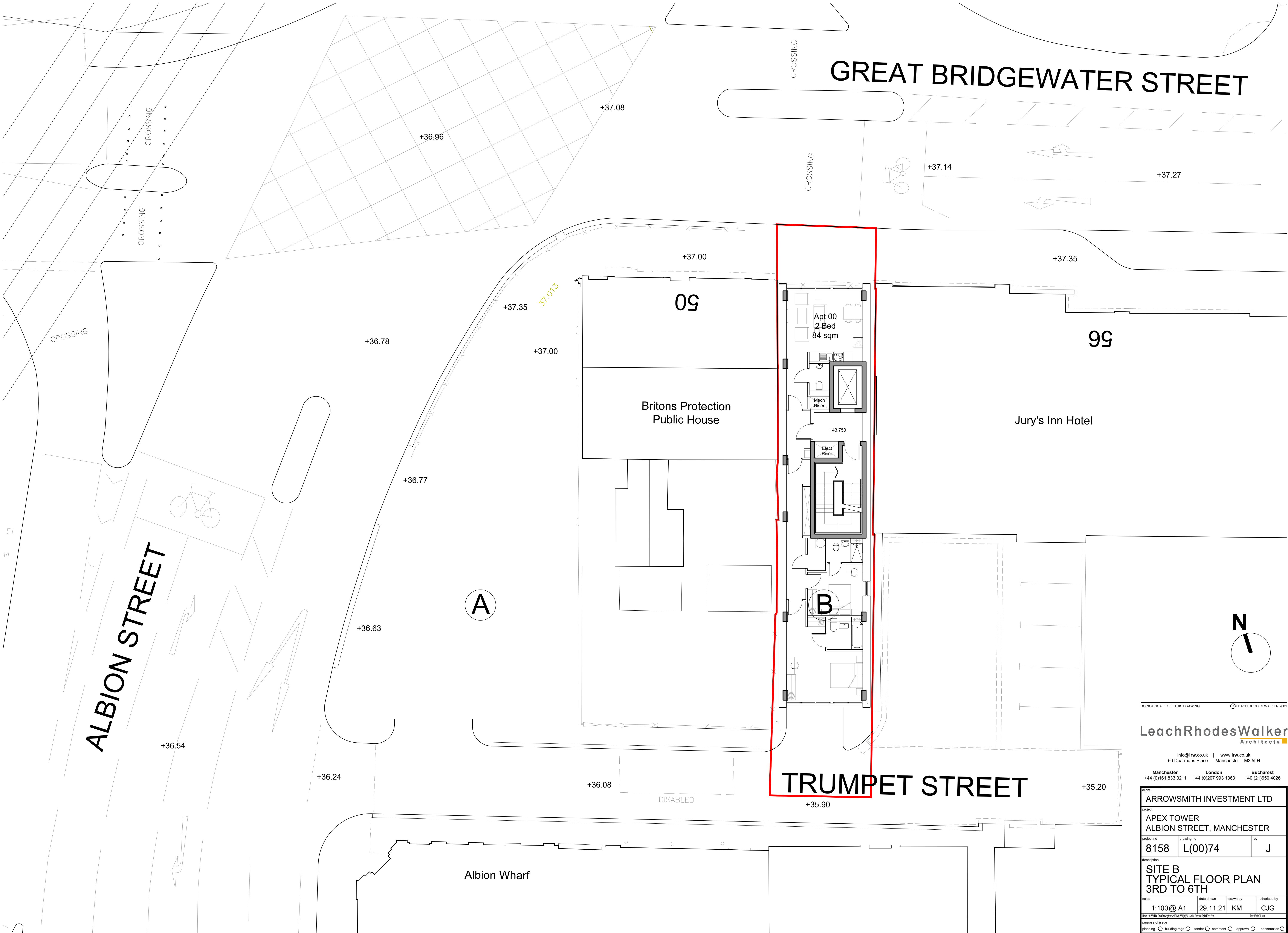


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client			
ARROWSMITH INVESTMENT LTD			
project			
APEX TOWER ALBION STREET, MANCHESTER			
project no	drawing no	rev	
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description -			
SITE B GROUND FLOOR PLAN			
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1:100@ A1	29.11.21	KM	CJG
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purpose of issue			
planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐			

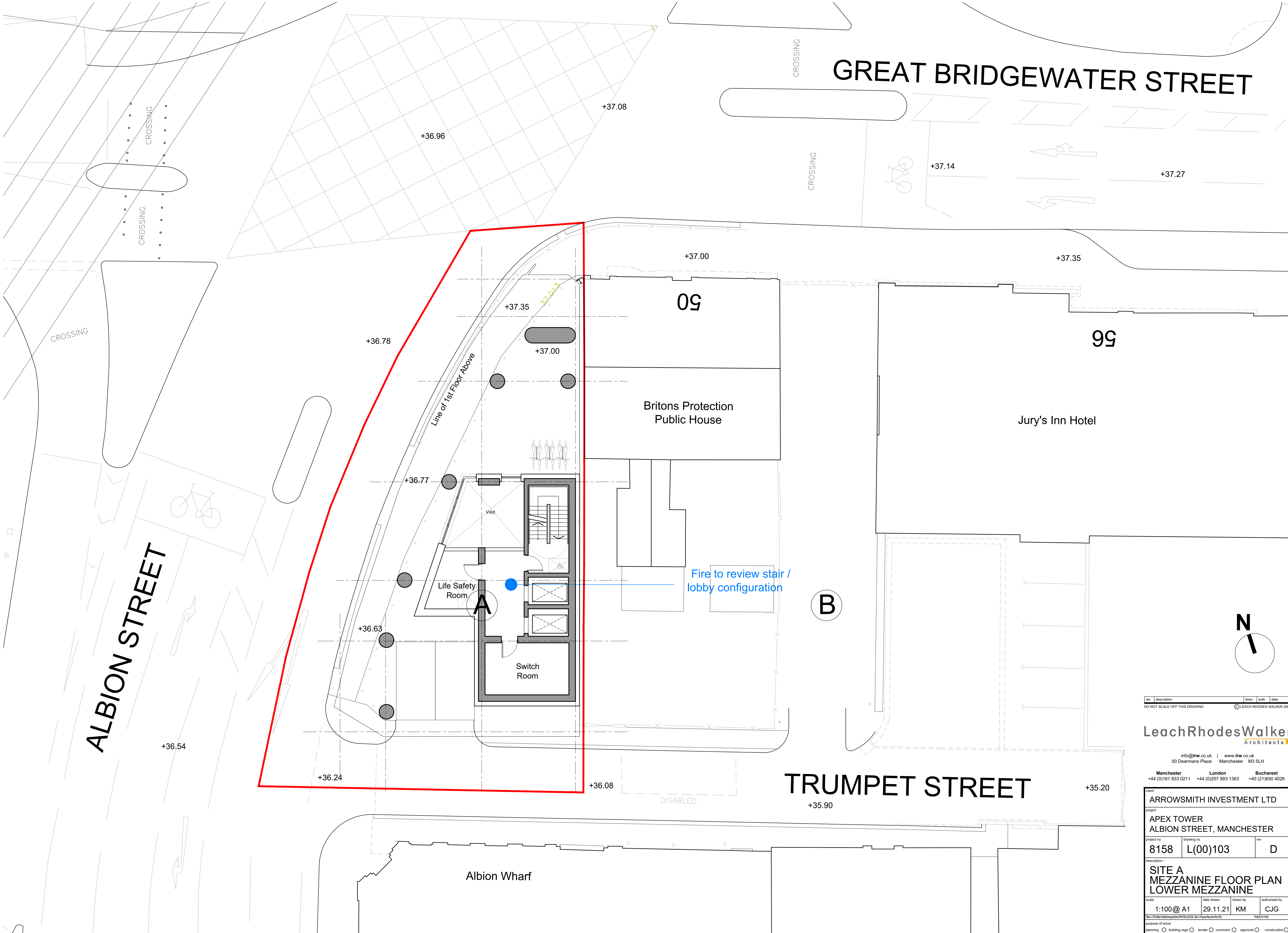


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client			
ARROWSMITH INVESTMENT LTD			
project			
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project no	drawing no	rev	
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description -			
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purpose of issue			
planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐			



rev	description	drawn	auth	date
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client			
ARROWSMITH INVESTMENT LTD			
project			
APEX TOWER ALBION STREET, MANCHESTER			
project no	drawing no	rev	
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description -			
SITE A MEZZANINE FLOOR PLAN LOWER MEZZANINE			
scale	date drawn	drawn by	authorised by
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purpose of issue			
planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐			

CROSSING

B

ALBION STREET

TRUMPET STREET

99

Jury's Inn Hotel

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client
ARROWSMITH INVESTMENT LTD

project
APEX TOWER
ALBION STREET, MANCHESTER

project no	drawing no	rev
8158	L(00)104	C

description -

SITE A
MEZZANINE FLOOR PLAN
UPPER MEZZANINE

scale	date drawn	drawn by	authorised by
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purpose of issue
planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐

Albion Wharf

ALBION STREET

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client
ARROWSMITH INVESTMENT LTD

project

APEX TOWER
ALBION STREET, MANCHESTER

project no	drawing no	rev
8158	L(00)116	B

description -

SITE A
TYPICAL FLOOR PLAN
(2-5, 10-13, 18-21)

scale	date drawn	drawn by	authorised by
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purpose of issue
 planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐

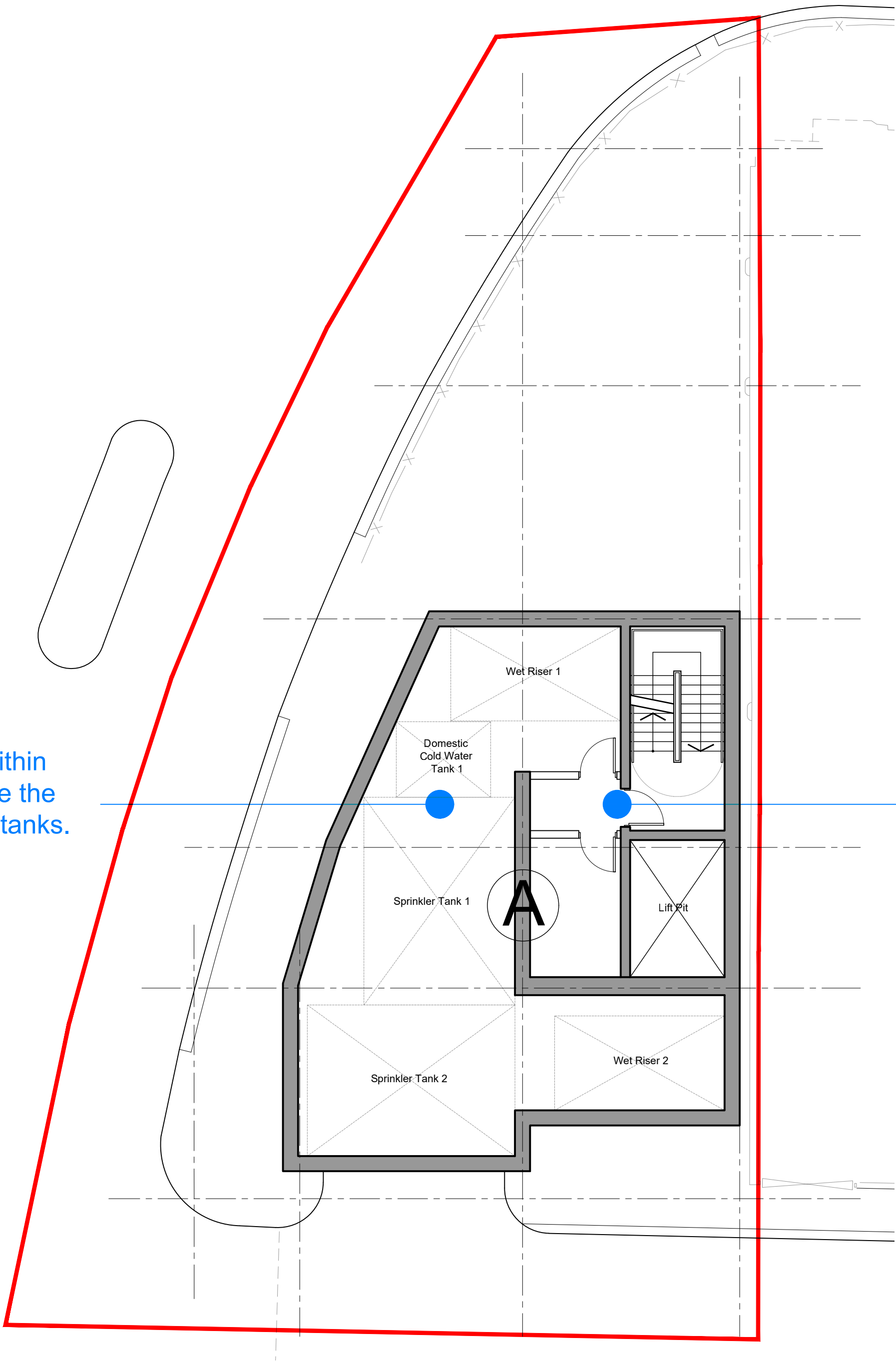
ALBION STREET

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50 Dearnans Place Manchester M3 5LH

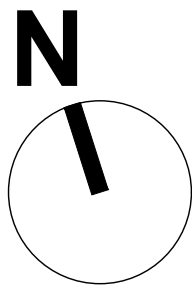
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client			
ARROWSMITH INVESTMENT LTD			
project			
APEX TOWER			
ALBION STREET, MANCHESTER			
project no	drawing no	rev	
8158	L(00)117	B	
description			
SITE A TYPICAL FLOOR PLAN (6-9, 14-17, 22-25)			
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purpose of issue			

M&E to allocate tank space all within the basement and waterproof line the basement. Advise on combining tanks.



Means of escape via stairs or hatch tbc. Fire to review

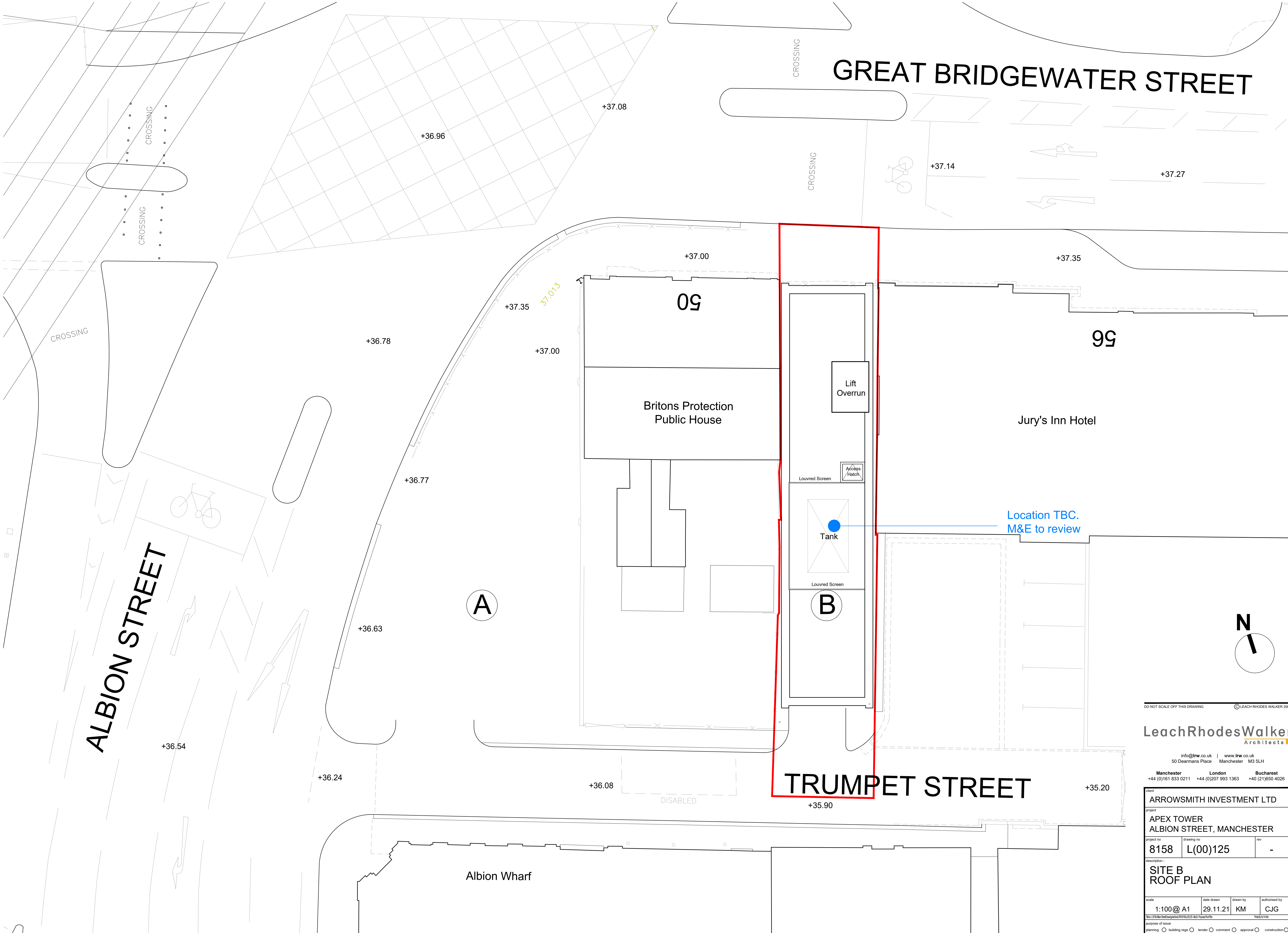


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client ARROWSMITH INVESTMENT LTD			
project APEX TOWER ALBION STREET, MANCHESTER			
project no 8158	drawing no L(00)124	rev -	
description - SITE A BASEMENT FLOOR PLAN			
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purpose of issue ☐ planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐			



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client			
ARROWSMITH INVESTMENT LTD			
project			
APEX TOWER ALBION STREET, MANCHESTER			
project no	drawing no	rev	
8158	L(00)125	-	
description			
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scale	date drawn	drawn by	authorised by
1:100@ A1	29.11.21	KM	CJG
https://www.leachrhodeswalker.co.uk/sitemap.html		rev'd by/ date	
purpose of issue			
planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐			

GREAT BRIDGEWATER STREET

99

Jury's Inn Hotel

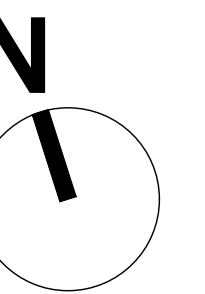
Britons Protection
Public House

Lift
Overrun

B

TRUMPET STREET

Albion Wharf



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client
ARROWSMITH INVESTMENT LTD

project

APEX TOWER
ALBION STREET, MANCHESTER

project no	drawing no	rev
8158	L(00)126	-

description -

**SITE A
ROOF PLAN**

scale	date drawn	drawn by	authorised by
1:100@ A1	29.11.21	KM	CJG

purpose of issue
planning ☐ building regs ☐ tender ☐ comment ☐ approval ☐ construction ☐

APPENDIX D

Microdrainage Greenfield Run-Off Rates

Renaissance Assoc.		Page 1
Carvers Warehouse 77 Dale Street Manchester M1 2HG	Apex Tower Site A Greenfield Run-Off	
Date 27/01/2022 19:32 File	Designed by JB Checked by AI	
Innovyze	Source Control 2020.1	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 SAAR (mm) 856 Urban 0.750 Area (ha) 0.024 Soil 0.450 Region Number Region 10 Results 1/s QBAR Rural 0.1 QBAR Urban 0.3 Q2 years 0.3 Q1 year 0.3 Q30 years 0.5 Q100 years 0.5		
©1982-2020 Innovyze		

Renaissance Assoc.		Page 1
Carvers Warehouse 77 Dale Street Manchester M1 2HG	Apex Tower Site B Greenfield Run-Off	
Date 27/01/2022 19:32 File	Designed by JB Checked by AI	
Innovyze	Source Control 2020.1	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 SAAR (mm) 856 Urban 0.750 Area (ha) 0.017 Soil 0.450 Region Number Region 10 Results l/s QBAR Rural 0.1 QBAR Urban 0.2 Q2 years 0.2 Q1 year 0.2 Q30 years 0.3 Q100 years 0.4		
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APPENDIX E
United Utilities Pre-Development Enquiry Correspondence

JoeBullough

From: Perry, Graham <Graham.Perry@uuplc.co.uk>
Sent: 12 January 2022 15:13
To: JoeBullough
Subject: RE: Pre Development Enquiry for : Apex Tower A Albion Street Manchester M1 5LE
UU reference Number : 4200045826

Hello Joe

I must apologise for my mistake.

Of course you can drain indirectly into the 900mm x 1450mm sewer through Trumpet Street for both A & B sites as proposed below providing the drainage hierarchy is followed and other methods of disposal have been discounted

Thanks

Graham Perry



Graham Perry
Development Engineer
Developer Services
M: 07557 577548
T: 01925 679405
unitedutilities.com

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From: JoeBullough [mailto:JoeBullough@renaissance-ltd.com]
Sent: 12 January 2022 14:50
To: Perry, Graham <Graham.Perry@uuplc.co.uk>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>
Subject: RE: Pre Development Enquiry for : Apex Tower A Albion Street Manchester M1 5LE UU reference Number : 4200045826

EXTERNAL EMAIL This email originated outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi Graham,

Following on from your response regarding site A below and site B (attached) we note that your preferred point of connection is to the 900x1450mm public sewer within Albion Street for foul and surface water (once discharge via infiltration and to a water course have been discounted).

From the United Utilities Sewer Records it is recorded that the sewer that runs beneath Great Bridgewater Street and Albion Street is circa 14m deep which means any proposed connection would require extensive temporary works to form this safety. Also due to the busy nature of the highway junction between Great Bridgewater Street and Albion Street any road closure would likely have a wider impact on the traffic within the City whilst also impacting the local construction traffic required for the site/s. We would therefore deem a connection to the 900x1450mm public sewer within Albion Street as not viable.

We have therefore proposed a connection from Site A and Site B to the public sewer beneath Trumpet Street which has a positive connection to the 900x1450mm public sewer within Albion Street. Please can you confirm that once discharge via infiltration and to a water course has been discounted that a connection into the Trumpet Street sewer for surface water and foul water is acceptable?

Kind Regards,

Joe Bullough | Engineer
MEng

Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG

e: joebullough@renaissance-ltd.com
t: 0161 393 6509
t: @renaissance_ltd.com

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Renaissance Associates Ltd trading as Renaissance, a company incorporated in England and Wales under Company Number: 08149019, Registered Office: Carvers Warehouse, 77 Dale Street, Manchester, M1 2HG, UK

From: Perry, Graham <Graham.Perry@uuplc.co.uk>

Sent: 22 December 2021 14:30

To: JoeBullough <JoeBullough@renaissance-ltd.com>

Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>

Subject: Pre Development Enquiry for : Apex Tower A Albion Street Manchester M1 5LE UU reference Number : 4200045826

Pre Development Enquiry for: Apex Tower A Albion Street Manchester M1 5LE UU reference Number : 4200045826

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 3723223 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 900mmx1450mm diameter public combined sewer within Albion Street located to the west of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

- 1. into the ground (infiltration);**
- 2. to a surface waterbody;**

3. to a surface water sewer or highway drain;

4. to a combined sewer.

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to canal/ located south of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to 900mmx1450mm diameter public combined sewer within Albion Street located to the west of your proposed development at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5 l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

We have reviewed our records and can confirm that there does not appear to be any charted public sewers located within the boundary of proposed development. However, due to the accuracy of the records and the public sewer transfer legislation in 2011, not all public sewers are shown on our records so we would ask that you proceed with caution and carry out your own site investigation works. If any uncharted sewers are identified while carrying out your works we would ask that you contact United Utilities at the earliest opportunity so that we can offer guidance and update our records.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/>

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-connections/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,

Graham Perry



Graham Perry
Development Engineer
Developer Services
M: 07557 577548
T: 01925 679405
unitedutilities.com

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JoeBullough

From: Perry, Graham <Graham.Perry@uuplc.co.uk>
Sent: 22 December 2021 14:31
To: JoeBullough
Cc: Wastewater Developer Services
Subject: FW: Pre Development Enquiry for : Apex Tower B Albion Street Manchester M1 5LE
UU reference Number : 4200045827

Pre Development Enquiry for: Apex Tower B Albion Street Manchester M1 5LE UU reference Number : 4200045827

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 3723223 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 900mmx1450mm diameter public combined sewer within Albion Street located to the west of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**
2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to canal/ located south of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to 900mmx1450mm diameter public combined sewer within Albion Street located to the west of your proposed development at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5 l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

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It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-connections/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,

Graham Perry



Graham Perry
Development Engineer
Developer Services
M: 07557 577548
T: 01925 679405
unitedutilities.com

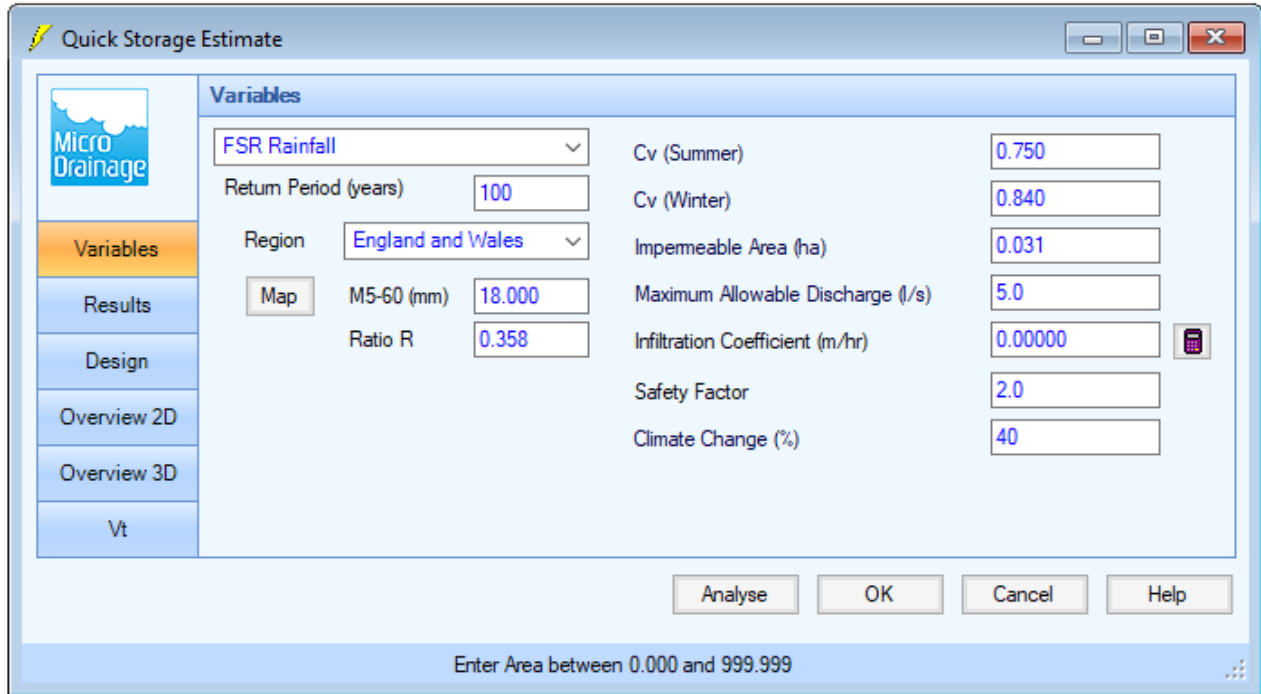
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APPENDIX F
Micro Drainage Quick Storage Estimates



Quick Storage Estimate

Variables

FSR Rainfall (dropdown)

Return Period (years): 100

Region: England and Wales (dropdown)

Map: M5-60 (mm): 18.000

Ratio R: 0.358

Cv (Summer): 0.750

Cv (Winter): 0.840

Impermeable Area (ha): 0.031

Maximum Allowable Discharge (l/s): 5.0

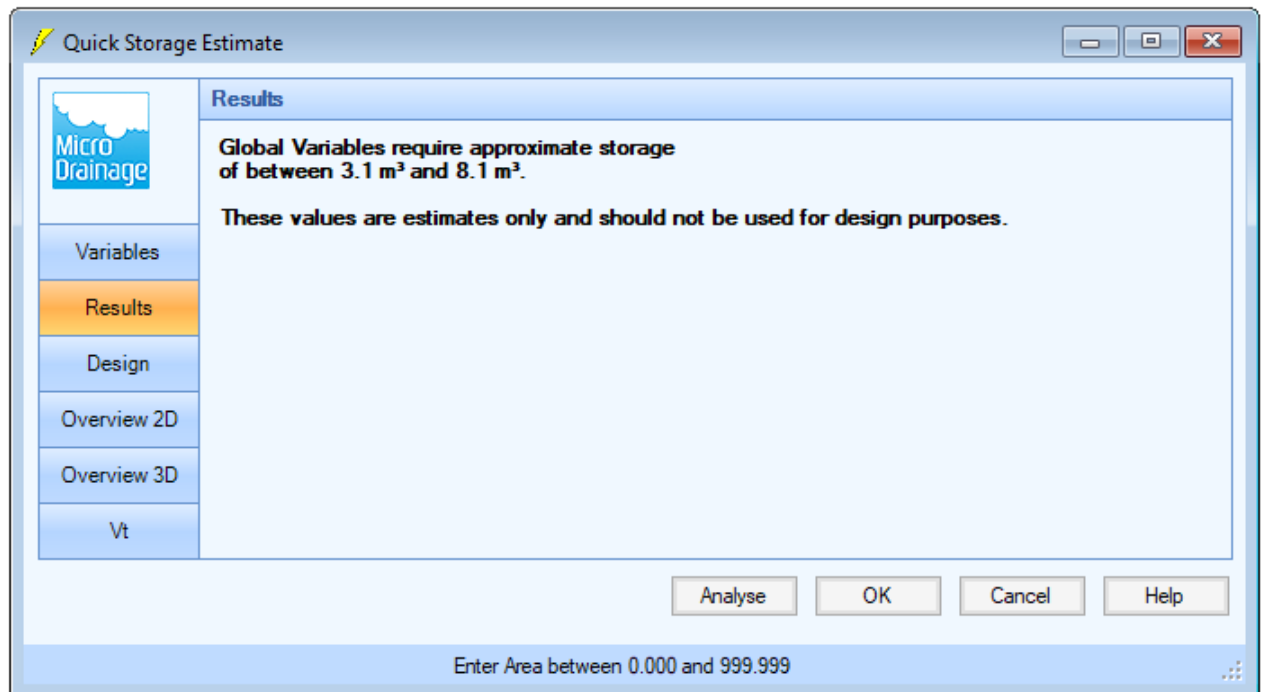
Infiltration Coefficient (m/hr): 0.00000

Safety Factor: 2.0

Climate Change (%): 40

Buttons: Analyse, OK, Cancel, Help

Enter Area between 0.000 and 999.999



Quick Storage Estimate

Results

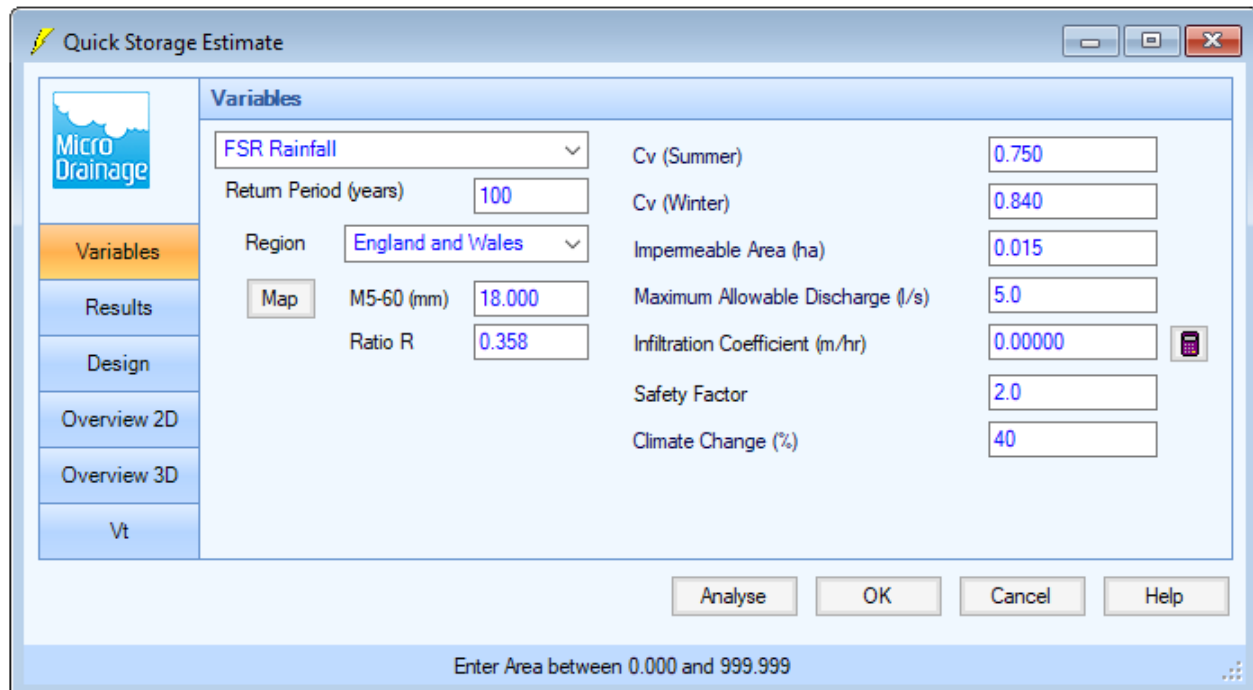
Global Variables require approximate storage of between 3.1 m³ and 8.1 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Area between 0.000 and 999.999

Site A Quick Storage Estimate



Quick Storage Estimate

Variables

FSR Rainfall

Return Period (years)

Region

M5-60 (mm)

Ratio R

Cv (Summer)

Cv (Winter)

Impemeable Area (ha)

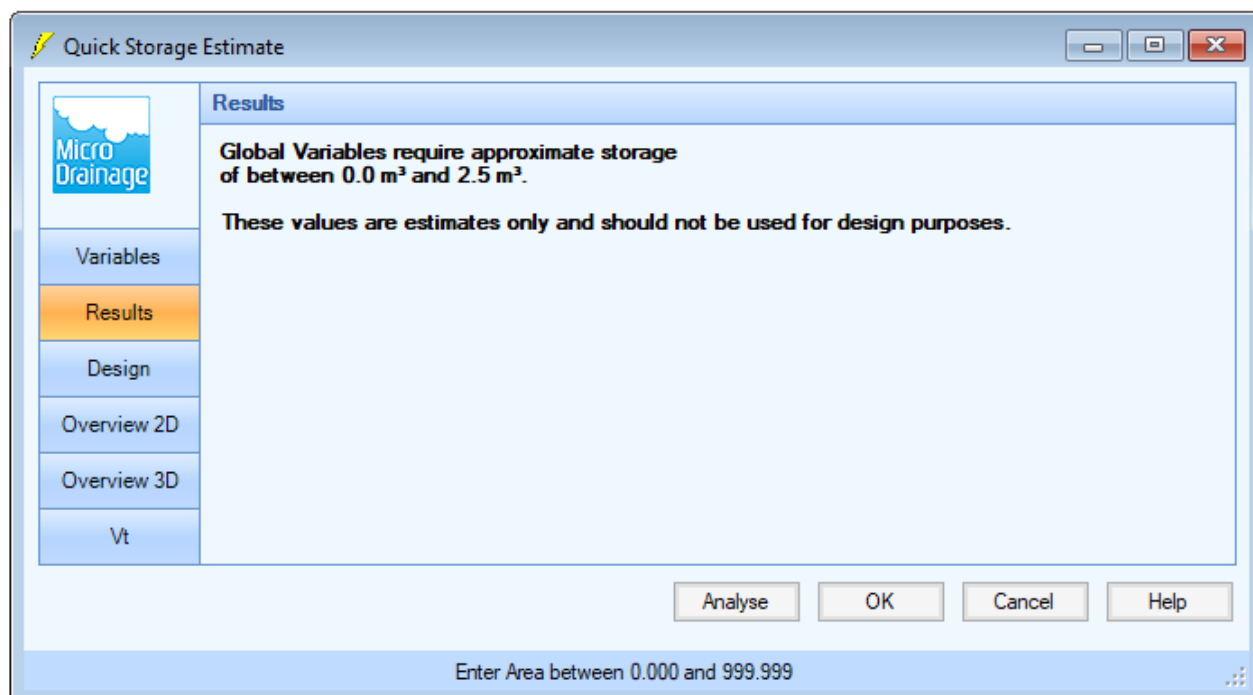
Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

Enter Area between 0.000 and 999.999



Quick Storage Estimate

Results

Global Variables require approximate storage of between 0.0 m³ and 2.5 m³.

These values are estimates only and should not be used for design purposes.

Enter Area between 0.000 and 999.999

Site B Quick Storage Estimate

APPENDIX G Bauder Blue Roof Calculations

Client:	Renaissance
Project:	Apex Tower
Location:	Manchester
Roof Location:	Block A

Roof Details:			
BlueRoof	256.7 m²	x 100 %	
Additional Area	46.2 m²	x 100 %	
Effective Area	302.9 m²		

Storage Details:	
Length	256.7 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:			
Return Period	100 years		
Climate Change Factor	40 %		
Summer Storm Profile			
Duration	Intensity		Required storage(m³)
	mm	mm/h	
5 min	20.5	245.5	6.2
10 min	29.9	179.6	9.0
15 min	37.4	149.6	11.2
30 min	49.8	99.6	14.8
45 min	57.5	76.7	16.9
60 min	63.2	63.2	18.4
2 hours	75.6	37.8	21.3
6 hours	97.0	16.2	24.1
24 hours	128.2	5.3	22.6

Outflow Details:	
Attenuation Control	BlueRoof Outlet
Control	4 holes
Sump Depth	None
Discharge rate	0.38 l/s
Outlet	1 No

Result:	
Outcome	Pass
Critical Storm Duration	6.75 hrs
Hmax	99 mm
Required Volume	24.2 m³
Time to half empty	8.8 hrs
Roof Loading	94.27 Kg/m²

All results based on input data. Please check that input data has been correctly interpreted.

The Bauder Blue Flat Roof Rainwater Calculation Software will perform calculations in accordance with industry best practice for blue roof design based upon provided data relating to a specific building's dimensions geographical location and the flow rate performance of the selected Bauder rainwater outlet product.

Whilst the information contained herein is to the best of our knowledge true and accurate we specifically exclude any liability for errors omissions or otherwise arising therefrom.

Details practices principles values and calculations should be verified for accuracy and suitability for the required purpose for use.

NOTE: These calculations are valid for a zero fall roof with minimal variation in levels. Any significant variation will affect the volume of water stored and the roofs ability to attenuate extreme rain events. Typically variations in roof level should be less than 0 to +30mm with no back falls. The H-Max is measured from the mean roof level

Overflow discharge requirements based on a CAT1 storm event to BSEN12056-3:2000.

Total flow rate - $302.9\text{m}^2 \times 0.018\text{l/s/m}^2 = 5.45\text{l/s}$

NOTE: Loading requirements stated in the results section are for the blue roof only. For total loading of blue roof and overflows then Hmax + 35mm needs to be factored in.

Date: 17/01/2022

Revision: A (1243)

Page: 2

Client: Renaissance
 Project: Apex Tower
 Location: Manchester
 Roof Location: Block B-1

Roof Details:

BlueRoof	45.3 m ²	x 100 %
Additional Area	41.2 m ²	x 100 %
Effective Area	86.5 m ²	

Storage Details:

Length	45.3 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	40 %

Summer Storm Profile

Duration	Intensity mm	Intensity mm/h	Required storage(m ³)
5 min	20.5	245.5	1.7
10 min	29.9	179.6	2.4
15 min	37.4	149.6	3.0
30 min	49.8	99.6	3.7
45 min	57.5	76.7	4.0
60 min	63.2	63.2	4.2
2 hours	75.6	37.8	4.2
6 hours	97.0	16.2	3.6
24 hours	128.2	5.3	1.7

Outflow Details:

Attenuation Control	BlueRoof Outlet
Control	6 holes
Sump Depth	None
Discharge rate	0.58 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	1.88 hrs
Hmax	99 mm
Required Volume	4.2 m ³
Time to half empty	1 hrs
Roof Loading	92.72 Kg/m ²

All results based on input data. Please check that input data has been correctly interpreted.

The Bauder Blue Flat Roof Rainwater Calculation Software will perform calculations in accordance with industry best practice for blue roof design based upon provided data relating to a specific building's dimensions geographical location and the flow rate performance of the selected Bauder rainwater outlet product.

Whilst the information contained herein is to the best of our knowledge true and accurate we specifically exclude any liability for errors omissions or otherwise arising therefrom.

Details practices principles values and calculations should be verified for accuracy and suitability for the required purpose for use.

NOTE: These calculations are valid for a zero fall roof with minimal variation in levels. Any significant variation will affect the volume of water stored and the roofs ability to attenuate extreme rain events. Typically variations in roof level should be less than 0 to +30mm with no back falls. The H-Max is measured from the mean roof level

Overflow discharge requirements based on a CAT1 storm event to BSEN12056-3:2000.

Total flow rate - $86.5\text{m}^2 \times 0.018\text{l/s/m}^2 = 1.56\text{l/s}$

NOTE: Loading requirements stated in the results section are for the blue roof only. For total loading of blue roof and overflows then Hmax + 35mm need to be factored in.

Date: 17/01/2022

Revision: A (1243)

Page: 3

Client: Renaissance
 Project: Apex Tower
 Location: Manchester
 Roof Location: Block B-2

Roof Details:

BlueRoof	30.5 m ²	x 100 %
Additional Area	28.1 m ²	x 100 %
Effective Area	58.6 m ²	

Storage Details:

Length	30.5 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	40 %

Summer Storm Profile

Duration	Intensity mm	Intensity mm/h	Required storage(m ³)
5 min	20.5	245.5	1.2
10 min	29.9	179.6	1.6
15 min	37.4	149.6	2.0
30 min	49.8	99.6	2.5
45 min	57.5	76.7	2.7
60 min	63.2	63.2	2.8
2 hours	75.6	37.8	2.9
6 hours	97.0	16.2	2.5
24 hours	128.2	5.3	1.2

Outflow Details:

Attenuation Control	BlueRoof Outlet
Control	4 holes
Sump Depth	None
Discharge rate	0.39 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	1.88 hrs
Hmax	99 mm
Required Volume	2.9 m ³
Time to half empty	1 hrs
Roof Loading	95.08 Kg/m ²

All results based on input data. Please check that input data has been correctly interpreted.

The Bauder Blue Flat Roof Rainwater Calculation Software will perform calculations in accordance with industry best practice for blue roof design based upon provided data relating to a specific building's dimensions geographical location and the flow rate performance of the selected Bauder rainwater outlet product.

Whilst the information contained herein is to the best of our knowledge true and accurate we specifically exclude any liability for errors omissions or otherwise arising therefrom.

Details practices principles values and calculations should be verified for accuracy and suitability for the required purpose for use.

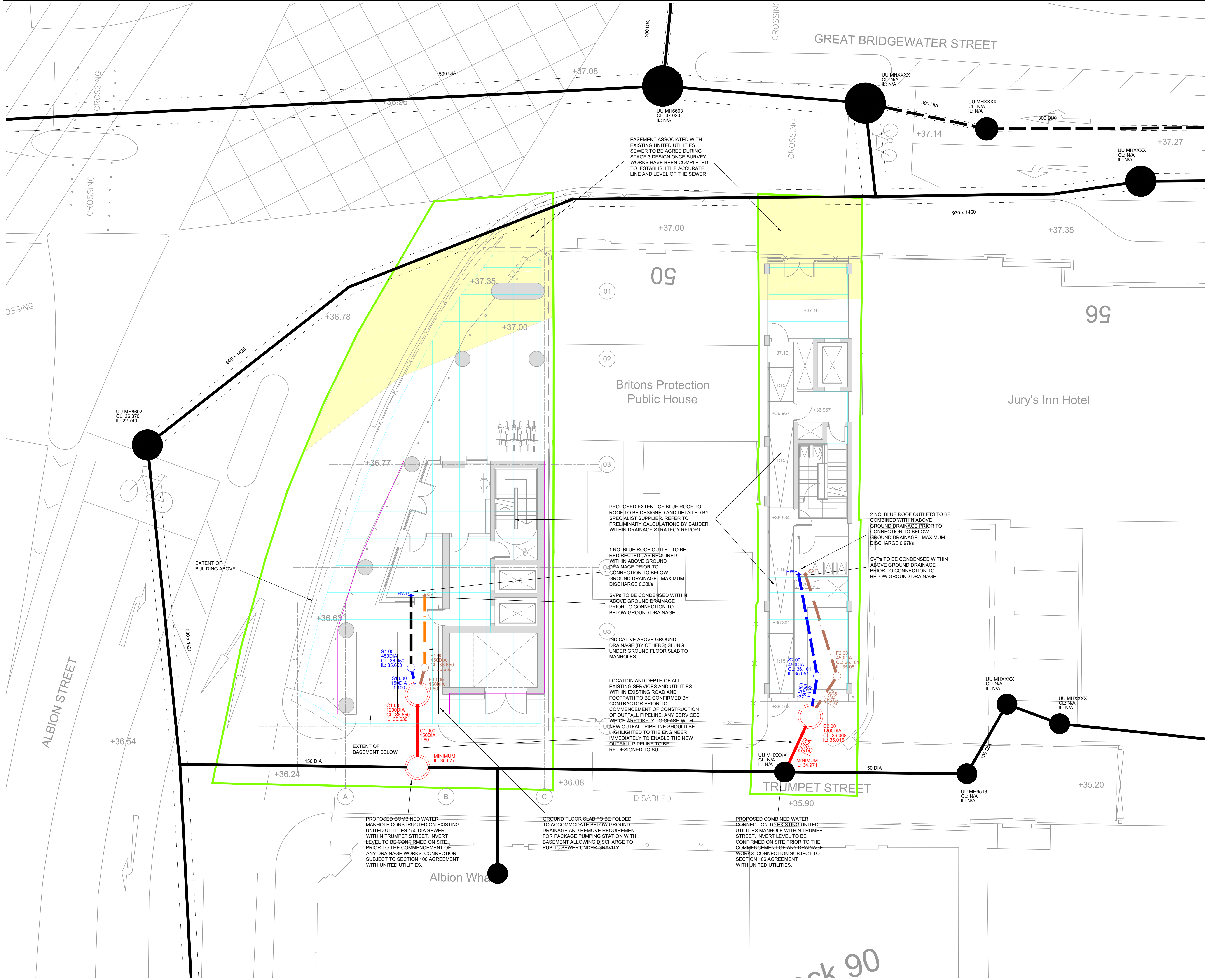
NOTE: These calculations are valid for a zero fall roof with minimal variation in levels. Any significant variation will affect the volume of water stored and the roofs ability to attenuate extreme rain events. Typically variations in roof level should be less than 0 to +30mm with no back falls. The H-Max is measured from the mean roof level

Overflow discharge requirements based on a CAT1 storm event to BSEN12056-3:2000.

Total flow rate - $58.6\text{m}^2 \times 0.018\text{l/s/m}^2 = 1.05\text{l/s}$

NOTE: Loading requirements stated on the results section are for the blue roof only. For total loading of blue roof and overflows the Hmax + 35mm needs to be factored in.

APPENDIX H Below Ground Drainage GA



- NOTES:
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 2. DO NOT SCALE FROM THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS TO BE CHECKED / VERIFIED ON SITE.
 3. ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
 4. THIS DRAWING IS INTENDED TO COMMUNICATE THE OUTLINE DRAINAGE STRATEGY TO SUPPORT THE PLANNING APPLICATION FOR THE PROPOSED APEX TOWER SITE.
 5. THIS DRAINAGE IS TO BE READ IN CONJUNCTION WITH THE FLOOD RISK ASSESSMENT, DATED OCTOBER 2021 AND DRAINAGE STRATEGY, DATED JANUARY 2022.
 6. THE LAYOUT OF THE PRIMARY DRAINAGE RUNS IS INDICATIVE AT THIS STAGE AND SUBJECT TO COORDINATION WITH THE DESIGN TEAM AND REVIEW AS THE DESIGN DEVELOPS.
 7. ALL CONNECTIONS TO THE PUBLIC SEWER ARE SUBJECT TO UNITED UTILITIES APPROVAL AND SECTION 106 APPLICATIONS.
 8. THE DRAINAGE STRATEGY IS SUBJECT TO MANCHESTER CITY COUNCIL APPROVAL.
- CDM NOTES:
1. REFER TO BELOW GROUND SURVEYS AND UTILITY RECORD DRAWINGS FOR KNOWN PAYMENT SERVICES. DESIGN ASSUMES THAT SERVICES CAN BE TEMPORARILY SUPPORTED OR DIVERTED TO ALLOW INSTALLATION OF DRAINAGE WHERE THERE ARE CONFLICTS. MANHOLE POSITIONS HAVE BEEN LOCATED TO AVOID EXISTING KNOWN SERVICES.
 2. GROUND CONDITIONS TO BE CONFIRMED VIA PHASE II SITE INVESTIGATION. DRAINAGE LAYOUT TO BE REVIEWED FOLLOWING RECEIPT OF REPORT.
- INTERNAL DRAINAGE**
ALL SVP AND RWP ARE INDICATIVE AND ARE TO BE CONFIRMED AND SET OUT BY THE ARCHITECT AND M&E CONSULTANT.
- ALL DRAINAGE ABOVE LEVEL 1 IS ASSUMED TO BE COMBINED AT THE SOFFIT OF LEVEL 1 AND COLLECTED INTO VARIOUS POINTS AS INDICATED ON THE GA.
- EXTERNAL DRAINAGE**
ALL EXTERNAL LEVELS, CHANNELS, GULLIES ETC ARE INDICATIVE AND ARE TO BE CONFIRMED AND SET OUT BY THE ARCHITECT / LANDSCAPE ARCHITECT.
- ALL CHANNELS AND GULLIES ARE TO INCLUDE A SILT TRAP.
- CATCHPIT MANHOLES/ INSPECTION CHAMBERS TO BE PROVIDED UPSTREAM OF ALL ATTENUATION TANKS
- DISCHARGE RATES & SEWER CONNECTIONS**
ALL PROPOSED DISCHARGE RATES ARE SUBJECT TO APPROVAL BY THE LEAD LOCAL FLOOD AUTHORITY AND UNITED UTILITIES.
ALL CONNECTIONS TO EXISTING PUBLIC SEWERS ARE SUBJECT TO APPROVAL BY UNITED UTILITIES VIA A S106 APPLICATION.

LEGEND	
REF	DESCRIPTION
	SITE PLANNING BOUNDARY
	EXISTING SURFACE WATER PUBLIC SEWER
	EXISTING COMBINED WATER PUBLIC SEWER
	PROPOSED SURFACE WATER SEWER
	PROPOSED FOUL WATER SEWER
	PROPOSED COMBINED WATER SEWER
	DENOTES EXTENT OF BLUE ROOF SYSTEM ABOVE

P01	ISSUED FOR PLANNING	28.01.22	JB	AI
Rev:	Description:	Date:	By:	Chkd:



Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project: **APEX TOWER MANCHESTER**

Drawing Title: **BELOW GROUND DRAINAGE GENERAL ARRANGEMENT**

Status: **STAGE 2**

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	JAN'22	JB	JB	AI

Scale:	1:100	Project No:	2104-14
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Project - Originator - Volume - Level - Type - Role - Number: Revision:

APT-REN-00-FN-DR-C-01100 P01