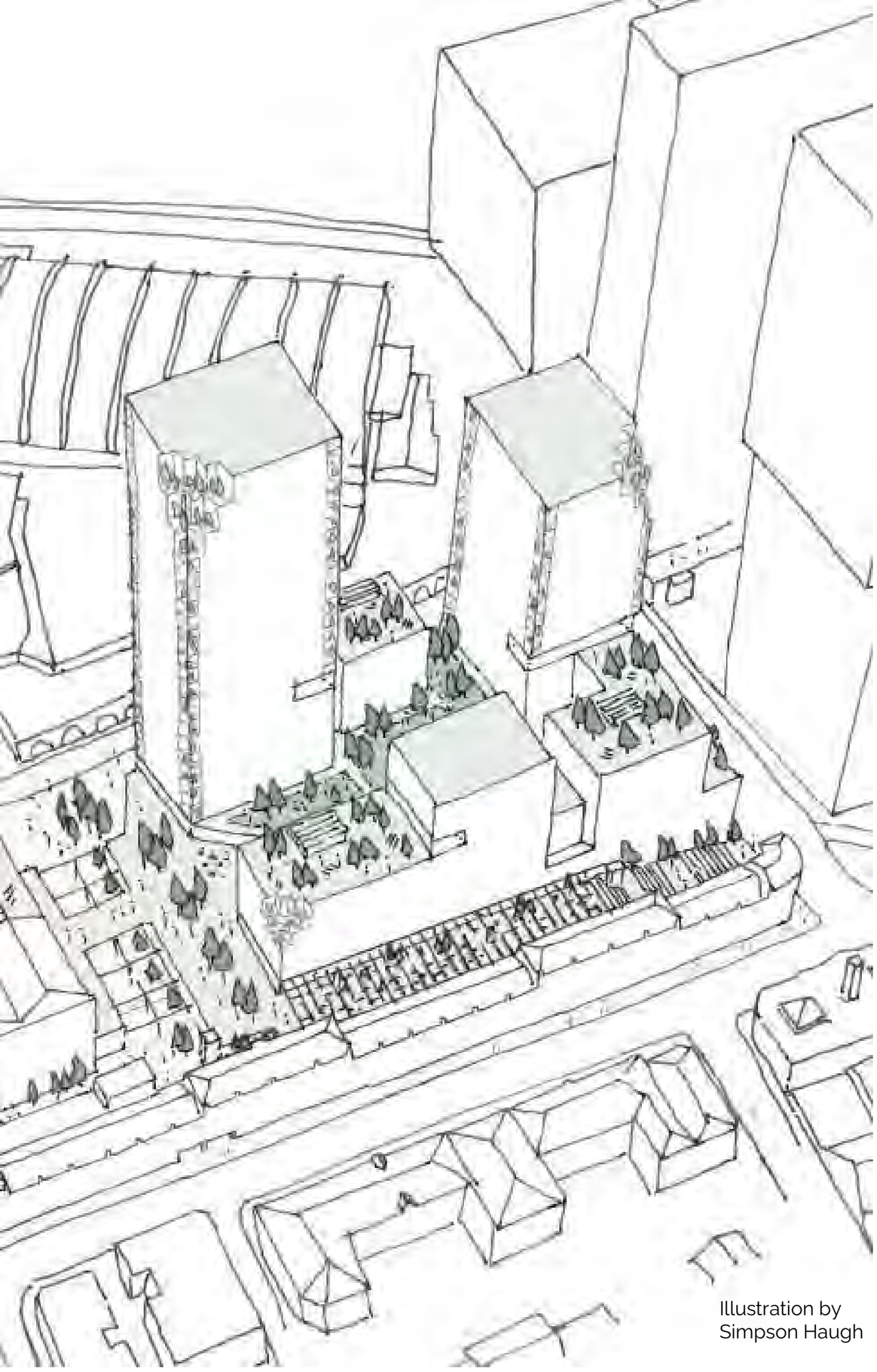


Illustration by
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Civic Engineers

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Flood Risk Assessment and Drainage Strategy

Prepared by	**Oliver Dodd**
Reviewed by	Robert Webster
Civic Job No.	775-02
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1. Introduction

Civic Engineers (CE) have been appointed by the GNW Developments Limited to undertake a Flood Risk Assessment and develop the Drainage Strategy for the redevelopment of the Leisure Box, Manchester, part of the Great Northern site. CE have been working with Trilogy Real Estate since 2016 on the project, developing an understanding of the existing building and exploring options for redevelopment.

This report has been prepared in support of the planning application for the proposed development and aims to assess it against the risk of flooding and to establish the principles of the drainage scheme in line with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG) and the Non-Statutory Technical Standards for Sustainable Drainage Systems.

2. Development proposal

The Leisure Box building forms part of the Great Northern Leisure complex made up of the Great Northern Warehouse (north), the Leisure Box (south) and the Atrium that provides a link between the two. To the west is the listed Deansgate Terrace, a row of town houses with shops at ground floor level, accessed from Deansgate.

CE have been appointed as structural and civil engineering consultants for the development of the Leisure Box element of the site.

The brief for the Leisure Box includes:

- Retaining the existing basement, ground and first floor car park levels of the existing building.
- Dismantle the existing upper levels of the building, currently occupied by a cinema and other leisure uses.
- Construct two further levels of car parking above the existing car park.
- Construct new residential apartments to upper levels, providing around 700 Build-to-rent apartments, in the form of towers and lower-rise buildings.
- Include new retail units at ground and podium level.
- Associated external works and underground drainage at ground and podium levels.

The proposals at the Leisure Box are being developed alongside the Great Northern Warehouse and Deansgate Terrace. CE are responsible for the Leisure Box development, with Curtins working on the Warehouse and Deansgate Terrace buildings. The drainage systems for the Leisure Box are separate from the new system serving the Warehouse, however, there will be alterations to existing drainage serving both the Leisure Box and Deansgate Terrace. Refer to Curtins Flood Risk Assessment and Drainage Strategy report for information on the Warehouse and Deansgate Terrace.

Graphics by Simpson Haugh, adjacent, show illustrations on the existing site and of the proposed Leisure Box building development.



Figure 1: Existing Leisure Box Building (by Simpson Haugh)

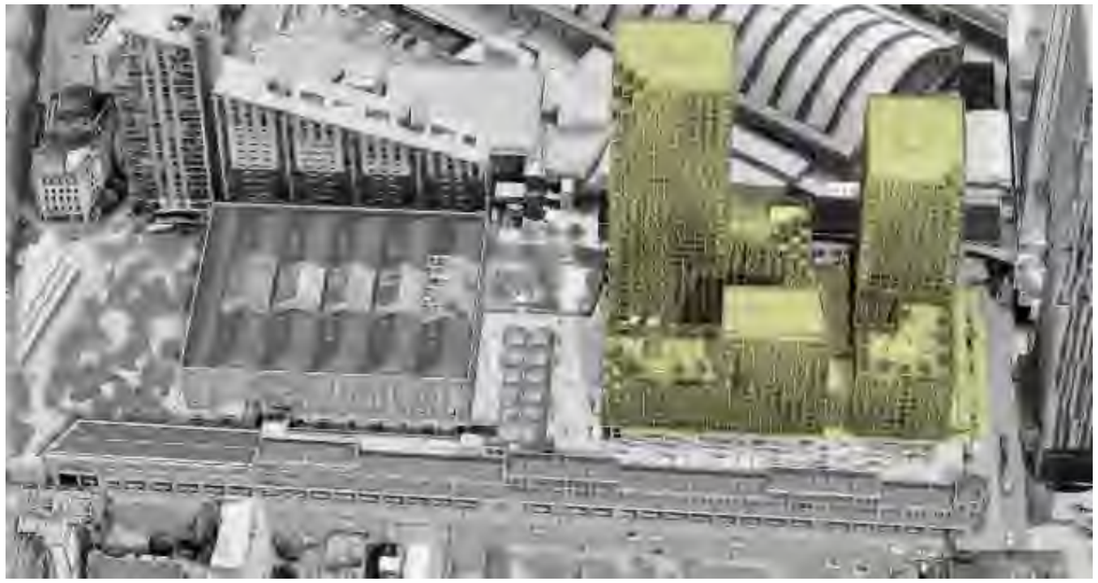


Figure 2: Proposed Leisure Box Development (by Simpson Haugh)

3. Existing site

3.1 Description

The wider Great Northern site is bounded by Peter Street to the North, Watson Street to the East, Great Bridgewater Street to the south, Deansgate to the west, and consists of:

- The Leisure Box – Built in 1990s containing car parking, cinema and other leisure uses,
- The Great Northern Warehouse – 19th Century warehouse built as part of Manchester's network of railway/goods infrastructure. Currently used as leisure space and carparking,
- The Atrium – a glass façade link building between the Leisure Box and the Warehouse and supported on historic steel/cast iron beams and columns that straddle the canal beneath.
- Deansgate Terrace – 19th Century terrace of buildings including shops at ground floor level.

A disused tunnel which used to contain a canal, for servicing the warehouse, runs below the site.

The Leisure Box building at the southern end of the site is bounded by the Atrium to the north with the canal tunnel immediately under, Watson Street to the East, Great Bridgewater Street to the south with the Beetham Tower opposite, and the Deansgate Terrace to the west.

The site is located at grid coordinates E383524 N397748 and the postcode is M3 4EN.

Figure 3 shows the overall site location and Figure 4 highlights the location of the Leisure Box building in relation to the rest of the site.



Figure 3: Satellite image showing the site location



Figure 4: Existing Leisure Box building highlighted red

3.2 Waterbodies

The Rochdale Canal lies 130m south of the site, the River Medlock is around 250m southwest and the Bridgewater Canal approximately 500m to the west. The River Grey Irwell is approximately 600m to the northwest and joins the Manchester Ship Canal approximately 2.5km downstream.

As stated in section 3.1, there is a tunnel containing a canal which runs below the site, just north of the Leisure Box Building as shown in Figure 5. The tunnel is dry and the canal is understood to have been disconnected/blocked off from the Rochdale Canal Lake, adjacent to The Bridgewater Hall.

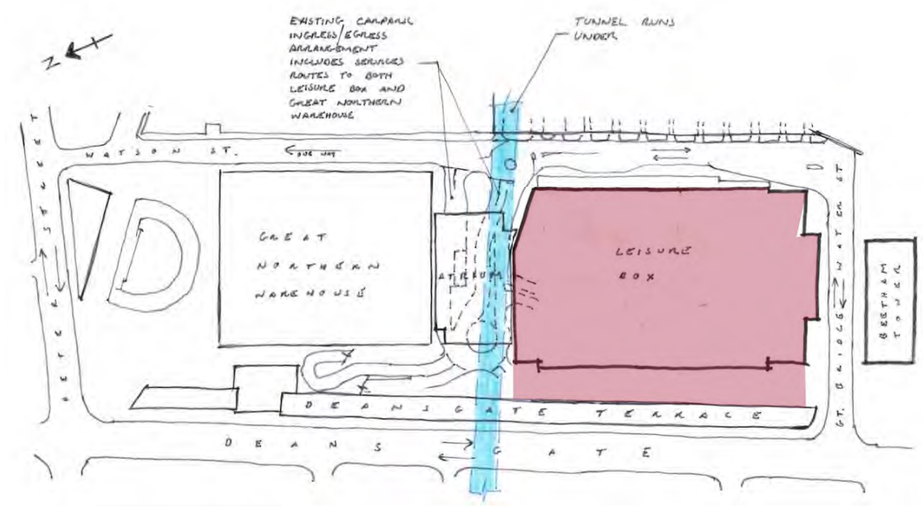


Figure 5: Location of existing canal tunnel



Figure 6: A view inside the canal tunnel

3.3 Existing drainage

There is a 450mm diameter public combined sewer running beneath Watson Street and Bridgewater Street, to the east and south of the site. A large 2300mm diameter public combined sewer lies beneath Deansgate, to the west.

The site has existing surface and foul water drainage, including basement pumps, which discharge to the public sewers in Watson St and Bridgewater St.

A CCTV drainage survey was carried out and is included within Appendix A.

Figure 7 shows the location of the combined sewers around the site, as per United Utilities sewer records (available on Appendix D).

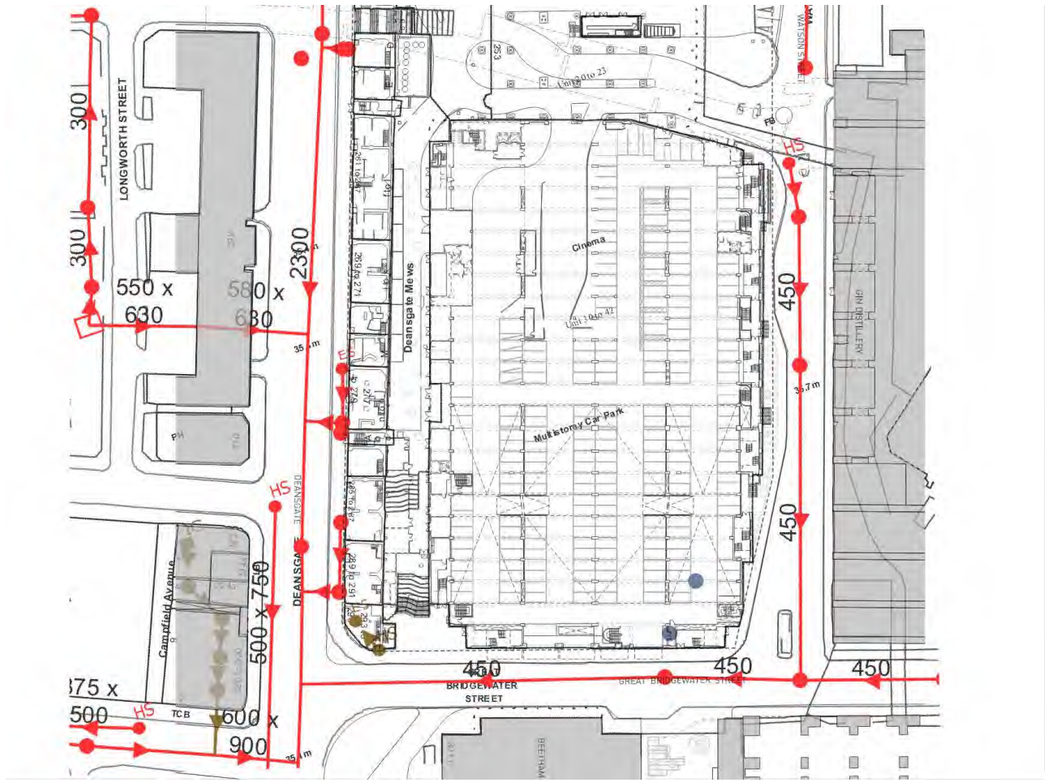


Figure 7: United Utilities sewer record

3.4 Topography

Ground levels around the site are relatively consistent, around +35-35.5mAOD, with exception to the northeast corner on Watson Street where levels are higher, reaching approximately 37mAOD. The existing basement varies in level between approximately +31.8-32.8mAOD.

The footpaths around the building generally have a 100-125mm kerb upstand and the roads have cambered falls towards the kerb line.

There is an existing podium level spanning from the west of the Leisure Box Building to the rear of Deansgate Terrace.

A topographical survey by Survey and Engineering Projects (ref: S13920-T Rev A) is included in Appendix B.

3.5 Geology

The British Geological Survey (BGS) data available online identifies the following geological strata beneath the site:

Superficial Deposits: Glaciofluvial Sheet Deposits, Devensian - Sand and gravel.

Bedrock Geology: Chester Formation – Sandstone.

The BGS geology viewer map suggests the superficial deposits are not present in the northeast corner of the site.

The BGS GeoIndex Onshore has historical records of several boreholes drilled in the vicinity of the site. The borehole logs show generally made ground, underlain by ballast, loose ground and sandstone. There is no indication of whether groundwater was encountered included on the logs, which are shown in Appendix C. Site investigation works will be undertaken at RIBA stage 3 to gather further understanding of the ground conditions below the existing building.

3.6 Hydrology

The Environment Agency (EA) aquifer designations show the bedrock is a principal aquifer and the superficial drift is a secondary A aquifer. The site is in an area of medium – high groundwater vulnerability. The site is not located within a Source Protection Zone.



Figure 8: Bedrock Aquifer Designation Map (Source: https://magic.defra.gov.uk/magicmap.aspx)

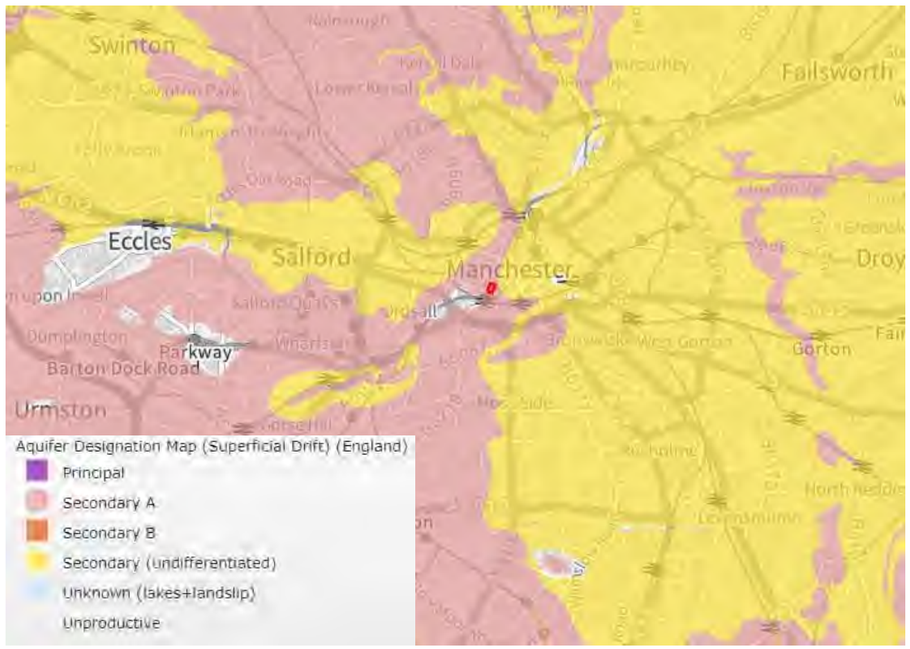


Figure 9: Superficial Drift Aquifer Designation Map (Source: https://magic.defra.gov.uk/magicmap.aspx)

4. Relevant Policy and Guidance

4.1 National Planning Policy Framework 2021 & Planning Practice Guidance 2022

Flood risk categorisation

The NPPF refers to the Flood Zones shown on the EA Flood Map for Planning (Rivers and Sea), and establishes the range of uses which are appropriate, or compatible, for each Flood Zone. Table 1, extracted from the Flood Risk and Coastal Change PPG (Table 1), summarises the Flood Zones.

Table 1: Flood Zones

Flood Zone	Definition
Zone 1 Low probability	Land having a less than 1 in 1,000 (0.1%) annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium probability	Land having between a 1 in 100 and 1 in 1,000 (1% and 0.1%) annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 (0.5% and 0.1%) annual probability of sea flooding. (Land shown in light blue on the Flood Map for Planning)
Zone 3a High probability	Land having a 1 in 100 (1%) or greater annual probability of river flooding; or Land having a 1 in 200 (0.5%) or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map for Planning)
Zone 3b Functional floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 1 in 30 (3.3%) or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

The EA Flood Map for Planning (Figure 10) indicates the site is in Flood Zone 1.



Figure 10: Flood Map for Planning (Source: https://flood-map-for-planning.service.gov.uk)

Flood risk vulnerability and Flood Zone compatibility

Annex 3 of the NPPF defines the type and nature of different development classifications in the context of their flood risk vulnerability. The information in Annex 3 was extracted and is presented in Table 2.

Table 2: Flood risk vulnerability classification

Classification	Description
Essential infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood. • Wind turbines. • Solar farms.

Classification	Description
Highly vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'.)
More vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons, and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels. • Non–residential uses for health services, nurseries, and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable	• Police, ambulance, and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional, and other services; restaurants, cafes, and hot food takeaways; offices; general industry, storage, and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks.
Water-compatible development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas, and wharves. • Navigation facilities. • Ministry of Defence installations. • Ship building, repairing, and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

The flood risk vulnerability and flood zone 'incompatibility', extracted from the PPG (flood risk and coastal change, Table 2) is presented below, in Table 3.

Table 3: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	√	√	√	√	√
Zone 2	√	Exception Test Required	√	√	√
Zone 3a ǂ	Exception Test Required ǂ	x	Exception Test Required	√	√
Zone 3b (functional floodplain)*	Exception Test Required*	x	x	x	√*

√ Exception Test is not required. x Development should not be permitted.

"ǂ" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

"*" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

The proposals for the development of the site are likely to fall within more than one flood risk vulnerability category, summarised in Table 4 below.

Table 4: Site specific flood risk vulnerability classification

Classification	*Description*
More vulnerable	Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels.
Less vulnerable	Buildings used for shops; financial, professional, and other services; restaurants, cafes, and hot food takeaways; offices; general industry, storage, and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
	Car parks

'Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.' This type of development is classed as 'more vulnerable' in the Flood Risk Vulnerability Classification. It is worth noting the residential element of the scheme sits above 5 storeys of car parking, however, the primary residential entrances will be located at ground level.

'More vulnerable' and 'less vulnerable' development in Flood Zone 1 does not require an Exception Test.

4.2 Flood risk assessments: climate change allowances (EA, 2022)

The site lies within the Irwell Management Catchment, as defined by the Department for Environment Food and Rural Affairs (Defra) Climate Change Allowances Map. Table 5 shows the anticipated increases in rainfall intensity over time, for this catchment, for the 3.3% and 1% annual exceedance rainfall events.

Table 5: Irwell Management Catchment peak rainfall climate change allowances

3.3% annual exceedance rainfall event		
Epoch	**Central allowance**	**Upper end allowance**
2050s	25%	35%
2070s	30%	40%
1% annual exceedance rainfall event		
2050s	25%	40%
2070s	30%	45%

3.3% annual exceedance rainfall event		
Epoch	**Central allowance**	**Upper end allowance**
*Use '2050s' for development with a lifetime up to 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125. **Source: https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall		

The EA guidance provides advice on using the peak rainfall intensity allowances to assess surface water flood risk, as quoted below:

'Use the development lifetime guidance to work out the lifetime of your development. You should consider residential development to have a minimum lifetime of a 100 years.

Development with a lifetime beyond 2100:

This includes development proposed in applications or local plan allocations.

For flood risk assessments and strategic flood risk assessments assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).

Design your development so that for the upper end allowance in the 1% annual exceedance probability event:

- *there is no increase in flood risk elsewhere*
- *your development will be safe from surface water flooding'*

The proposed development includes residential and is therefore considered to have a minimum lifetime of 100 years, meaning the 2070s epoch applies. To comply with the previously stated guidance, the surface water drainage system will be designed based on a 45% climate change allowance to the 1% annual exceedance rainfall event and designed to ensure there is no increase in flood risk elsewhere and the development is safe from surface water flooding.

4.3 Manchester Core Strategy 2012 to 2027

Policy EN8 - Adaptation to climate change

'All new development will be expected to be adaptable to climate change in terms of the design, layout, siting and function of both buildings and associated external spaces. In achieving developments which are adaptable to climate change developers should have regard to the following, although this is not an exhaustive list:

- *Minimisation of flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rain water permeability.*
- *Reduction in urban heat island effect through the use of Green Infrastructure such as green roofs, green walls, increased tree cover and waterways.*

- *The need to control overheating of buildings through passive design.*
- *The opportunity to provide linked and diverse green space to enhance natural habitats which will assist species adaptation.'*

Policy EN14 - Flood risk

In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).

In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.

All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.

The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

Policy EN17 – Water quality

With reference to the Manchester-Salford-Trafford SFRA and other relevant documents:

- *Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological;*
- *Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses;*
- *Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site;*
- *Development should, where feasible and appropriate, seek to open up any culverted or hidden watercourse beneath the site to improve the ecological status of that watercourse.*

4.4 Manchester Core Strategy – Sustainability Appraisal Report

Table 11.2 – Assessment Rationale. Item 19 states:

19. Reduce impact of climate change.

Consideration of:

• Whether policies would have positive or negative effects on flood risk to people and property through increased surface water runoff or inappropriate development (such as vulnerable uses including residential accommodation, caravans and mobile homes) in areas of flood risk.

• Whether policies seek to reduce surface water runoff and the risk of flooding through the requirement for Sustainable Urban Drainage Systems.

• Whether policies require buildings to be able to adapt to the changing climate (increased changes in precipitation and temperature) through design measures such as green roofs, and improved insulation (see objective 17).

• Whether policies seek to ensure that development reduces the urban heat island effect through the development of green infrastructure.

4.5 Manchester City Council Local Flood Risk Management Strategy (LFRMS) 2014

LFRM Policy 6 – Ensure that local flood risk is properly considered for new development proposals

5.46 Within Critical Drainage Areas, and consistent with Core Strategy policy EN14 Flood Risk, developers should aim to minimise surface water runoff from developments, and achieve at least the following runoff rates:

• Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, including consideration of climate change.

• A 50% runoff rate reduction for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, including consideration of climate change.

These are not local Sustainable Drainage System (SuDS) standards but adopted planning policy, provided because of the overlapping nature of Planning and SuDS Approving Body processes.

4.6 Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA March 2011 (MST Hybrid SFRA)

Section 9.3.1 'Manchester City Council Regional Centre and Inner Areas West' states the below:

For all sites, development proposals should look at opportunities to incorporate SUDS to reduce the risk of surface water flooding (Sustainability Appraisal indicator). Surface water run-off from these sites should not increase as a result of development (reduced run-off should be sought if possible in some areas) and not discharge into the combined sewer system. Many of these sites lie within the Conurbation Core Critical Drainage Area and managing surface water discharges from development and exceedance flows is critical. The risk of groundwater flooding should be considered when assessing suitable SUDS techniques at a strategic level and in the design of buildings.

5. Critical Drainage Areas

As shown in Figure 11, the MST Hybrid SFRA identifies the whole of the regional centre as part of the Conurbation Core Critical Drainage Area (CDA).

The SFRA identifies CDAs in areas where:

1. *There is a high risk of localised flooding from ordinary watercourses, including culverts surcharging and overland surface water flows, including the potential for flooding from the sewer network due to failure/ blockage or exceedance events when the storm return period is greater than the sewer was designed for; or*
2. *Where there are areas of significant redevelopment planned that could have a significant impact on surface water runoff to local watercourses and the sewer network.*

The SFRA explains that surface water flow paths in the Conurbation Core CDA are primarily linked to the natural floodplains of 'hidden' or 'lost' culverted watercourses that run through the area, particularly in Manchester City Centre.

This flood risk assessment and drainage strategy takes into consideration the potential additional risks associated with the CDA and the recommendations of the LFRMS and MST Hybrid SFRA stated in sections 4.5 and 4.6, respectively.

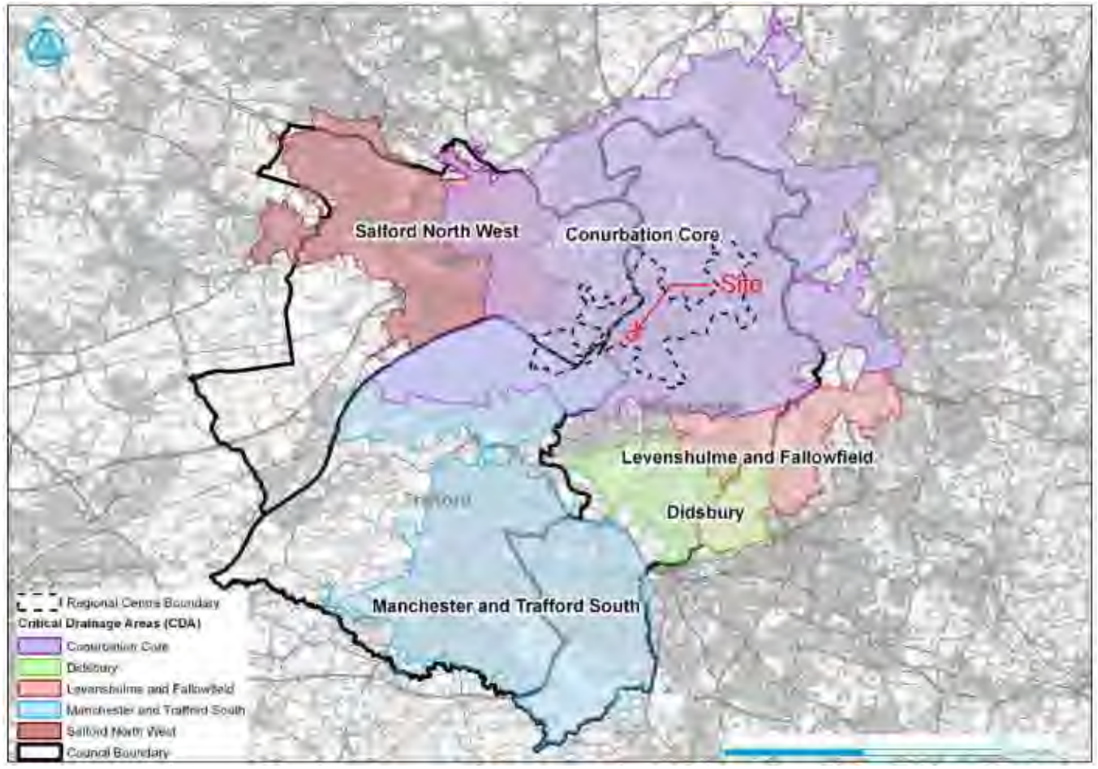


Figure 11: Manchester, Salford and Trafford CDAs overview (https://www.manchester.gov.uk/downloads/download/6981/strategic_flood_risk_assessment_sfra_maps)

6. Hydrological Assessment

6.1 Flooding history

The existing building's manager has confirmed that no significant or serious cases of flooding have previously occurred on site. The only instances of water entering the building in the past were due to failed maintenance and were described as follows:

1) Water entered the basement car park level, forming a small puddle, due to a leak somewhere on one of the upper levels.
2) A threshold channel drain on the south side of the building was blocked and as a result water leaked into an existing core (dead space). There is a small area of paving that falls towards the threshold drain/door; the remaining footpath falls away towards another channel drain and the road. The level in the road is estimated to be lower than the threshold drain, which supports the theory the water was from surface runoff and was not collected due to the drain being blocked, rather than a result of sewer flooding.

6.2 Fluvial flood risk

The EA Flood Risk from Rivers or the Sea Map (Figure 12) indicates the site is at very low risk from fluvial flooding.



Figure 12: EA flood risk from rivers or the sea map (Source: https://check-long-term-flood-risk.service.gov.uk/map)

6.3 Surface water flood risk

The EA flood risk from surface water map (Figure 13) shows that there are some areas around the site at low, medium or high risk of flooding from surface water.

Parts of Watson Street to the east and Great Bridgewater Street to the south are shown as low risk, due to the topography of the roads. The entrances to the existing building at ground level are higher than the adjacent roads with exception to the car park access road off Watson Street, which is mostly covered, and the doorway previously discussed in section 6.1.

To the northeast of the site, at the entrance to the existing multistorey car park, there is an area at medium risk. This is due to the drop in levels at the entrance road as it passes underneath the building into the car park. The flood map data does not consider the continuation of the road underneath the building. Any surface water run-off coming from Watson Street down the entrance road should be collected by the existing car park drainage, rather than ponding at the building edge (as suggested by the flood map). This area is therefore considered to be a low risk from surface water flooding.

Areas of low, medium and high risk of surface water flooding shown to the west of the site are likely to be either incorrect or out of date since the area is covered entirely by a podium (referred to as the level 2 plaza), spanning from the Leisure Box Building to the rear of Deansgate Terrace. Hence, this area is also considered to be at low risk from surface water flooding. Overall, the site is considered to be at low risk from surface water flooding.



Figure 13: EA flood risk from surface water map (Source: https://check-long-term-flood-risk.service.gov.uk/map)

6.4 Tidal flood risk

The site is located approximately 52.5km from the Irish Sea and sits at approximately 35.5m above ordnance datum, meaning the site is considered to be at no significant risk from tidal flooding.

The Manchester Ship Canal runs from the Mersey estuary at Eastham Locks to Salford Quays, 3km west of the site, at the end of the Grey Irwell. Several large locks enable the 18m drop in elevation between Salford and Eastham.

6.5 Reservoir flood risk

The EA flood risk from reservoirs map (Figure 14) shows the site lies outside of the predicted maximum extent of flooding from reservoir failure, and is therefore considered to be at no significant risk of flooding from reservoirs.



Figure 14: EA flood risk from reservoirs map (Source: https://check-long-term-flood-risk.service.gov.uk/map)

6.6 Groundwater flood risk

The Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) March 2011 contains a map (Figure 15) which identifies areas susceptible to groundwater flooding. Based on this information, the site is not located in an area with shallow groundwater and is also not considered to be at significant risk of groundwater flooding.



Figure 15: SFRA groundwater flood risk map (Source: https://www.manchester.gov.uk/downloads/download/6981/strategic_flood_risk_assessment_sfra_maps)

6.7 Public sewer flooding, highway drainage flooding and infrastructure failure

United Utilities (UU) water main records show there is a 90mm diameter main to the west and east of the site, beneath Watson Street and Deansgate, and two mains to the south, 1 x 110mm and 1 x 200mm diameter both beneath Great Bridgewater Street.

United Utilities sewer records show there is 450mm diameter public combined sewer running beneath Watson Street and Bridgewater Street, to the east and south of the site, and a large 2300mm diameter public combined sewer lies beneath Deansgate, to the west.

The 450mm sewers are approximately 3m deep. Based on the UU asset records the depth of the large 2300mm diameter sewer is assumed to be round 13m.

The United Utilities records are shown in Appendix D.

In relation to flood risk from surface water, the Manchester City Council (MCC) LFRMS 2014 states:

There are no extensive records of historical flooding from surface water runoff in Manchester - the SWMP lists only five incidents between 1911 and 2012, all of which were in south Manchester and a number of which included interactions with rivers. However, the recent alignment of drainage and highway functions has revealed that there are hundreds of cases of blocked highway gullies each year, some of which have resulted in properties being flooded. Incidents of surface water flooding will now be better recorded, and this will help inform future maintenance, and where necessary works to increase capacity or attenuation within the City's drainage system. Collaborative working on funding bids and aligning investment through partnership working will help to deliver more coherent benefits.

Since the adoption of the LFRMS, MCC allocated extra funding to boost cleaning of roadside gullies. The MCC website states '*We have carried out a full review of more than 116,000 gullies in the city and have put together a programme of works to be completed by winter 2019. Every gully in the city will be inspected and cleaned, with follow-up repairs made if needed. We will also monitor the build-up of silt following the first of two proposed cleanses. This will enable us to gather information on the gullies that are more likely to fill with silt and debris quickly and potentially cause flooding. We can then prioritise these locations for future planned maintenance.*'

Additionally, there is no evidence to suggest United utilities are failing to maintain their infrastructure.

The existing development includes a basement level with existing pumped outfalls to the external drainage. There will be no new connections to the existing basement pumps, and some existing connections may be disconnected, as part of the proposed development. Proposed plant situated at basement level will be served by new pumps, with suitably sized emergency storage, and outlets equipped with non-return valves. New rising mains will be routed with backflow loops to prevent flooding from the outfall sewer surcharging during exceedance events.

As such, the site is considered to be at low risk from sewer or infrastructure failure flooding.

6.8 Canal and culvert flood risk

As described in section 3.2, there are several canals and watercourses within 500m of the site, including the Manchester and Salford Junction canal, which runs east to west underneath the site as shown in Figure 16. It is approximately 6m wide by 5.5m high with an invert level up to 10m BGL. The tunnel is no longer in use and is dry; the canal is understood to have been backfilled from the Rochdale Canal Lake, adjacent to The Bridgewater Hall.

The Manchester and Salford Junction canal links with the Rochdale canal, which is the next nearest canal to the site. The Rochdale canal is a controlled water body. According to the MST Hybrid SFRA the risk of overtopping from the Rochdale canal is considered to be low and has never been recorded in the vicinity of the site. The SFRA includes a map identifying potential canal breach/overtopping zones, which is shown in Figure 17.

Based on online LiDAR data, the site is estimated to sit an estimated minimum 6m above the Rochdale canal tow path levels (closest to the site). and is therefore considered to be at no significant risk of canal flooding.



Figure 16: Historic map showing the Manchester Salford Canal route



Figure 17: SFRA canal hazard zones (Source: https://www.salford.gov.uk/media/385901/mst_sfra_canal_hazard_map_32b.pdf)

7. Summary of flood risk

A summary of the flood risk to the site is shown in Table 6, based on the evidence collated and assessment provided in section 6. Overall flood risk to the site is low.

Table 6: Summary of flood risk

Source of flooding	Risk to the site
River	Very low
Surface water	Low
Sea	Insignificant
Reservoir	Insignificant
Groundwater	Insignificant
Infrastructure	Low
Canal	Insignificant

8. Proposed Surface Water Drainage Strategy

8.1 Point of Discharge

The NPPF PPG – Flood risk and coastal change, specifies the following hierarchy of drainage options for the discharge of surface water:

1. *into the ground (infiltration);*
2. *to a surface water body;*
3. *to a surface water sewer, highway drain, or another drainage system;*
4. *to a combined sewer."*

An appraisal of each option of the discharge hierarchy follows.

Infiltration based systems

The existing building occupies the entire site, with the lower levels, basement, existing foundations and drainage being retained and re-used as part of the proposed development.

Given these observations, it is concluded that an infiltration-based system is not viable within the site boundaries.

Surface waterbody

The closest waterbody to the site is the Rochdale Canal, which is located approximately 130m south of the site. As the site is located in a dense urban environment, requisitioning a new system to the canal is deemed unfeasible.

Surface water sewer

As shown in Figure 7 (section 3.3) and the United Utilities sewer records in Appendix D, there are no surface water sewers located in the vicinity of the site.

Combined sewer

A connection to the public combined sewer is required to dispose of surface water runoff from the site. New connections will be made via the three existing outfalls to the existing combined sewers, located south and east of the site, as shown on the proposed drainage layout drawing in Appendix E. The existing basement pumps, indicated on the basement drainage overlay drawing (also in Appendix E), are likely to need relocation and replacement to make way for the new substructure and architectural floorplan.

Discharge location summary

Table 7: Summary of Point of Discharge Suitability

Point of discharge	Suitability
Ground	x
Waterbody	x
Surface water sewer	x
Combined sewer	√
√ suitable × unsuitable	

8.2 Existing run-off rates

Existing run-off rates for the site have been estimated using Causeway Flow+ software and based on the Modified Rational Method (MRM), outlined below.

Q = (2.78 CV Cr I A)

where

Cr is the routing coefficient = 1.3

Cv is the runoff coefficient = 1

I is the average rainfall intensity (mm/hr) for the storm of duration equal to the time of concentration for the network and is generated within the software.

A is impermeable area in ha.

2.78 is a conversion factor.

The existing building has roof catchments which drain unrestricted and directly to external drains, with several outfalls to the public sewer network, so a time of concentration (for the network) of 15 minutes was used. For the 15 minute 1 in 1 year storm event, the rainfall intensity, I = 26.83mm/hr.

The existing site is completely impermeable and measures approximately 7,775m^2.

The brownfield run-off rates are summarised in Table 8. The Causeway Flow+ outputs are available in Appendix F.

Table 8: Brownfield Runoff Rates

Brownfield runoff rates			
Area (ha)	1 in 1-year event	1 in 30-year event	1 in 100-year event
0.7775	75.4 l/s	184.5 l/s	238.2 l/s

8.3 Surface Water Rates and Attenuation

Drainage catchment areas

The lower levels of the existing building are being retained as part of the development and as such, the developed area (which is 100%) of the site will not change. There will be the introduction of planted areas and landscaping on some of the proposed podium levels, however, as these areas are positively drained the overall drainage catchment will remain the same.

Surface water attenuation will be provided on the level 4 podium in the form of a blue and green roof with flow restricted outlets. The proposed level 4 podium has a deep profile meaning it can accommodate the attenuation layer as well as soft and hard landscaped build-ups above.

Most of the site catchment is located at level 4 or above, meaning rainwater pipes can be routed to the level 4 podium attenuation layer. There are two small areas of new plaza located at level 2, to the north and west of the building, which are being constructed over the top of the existing structure and tie in with the existing plaza between the Leisure Box and Deansgate Terrace. The new level 2 plaza is constructed over the existing first floor of the Leisure box Building and does not have a deep profile. It therefore cannot accommodate an attenuation layer.

The different catchment areas for the site are illustrated in Figure 18 and a breakdown is included in Table 9.

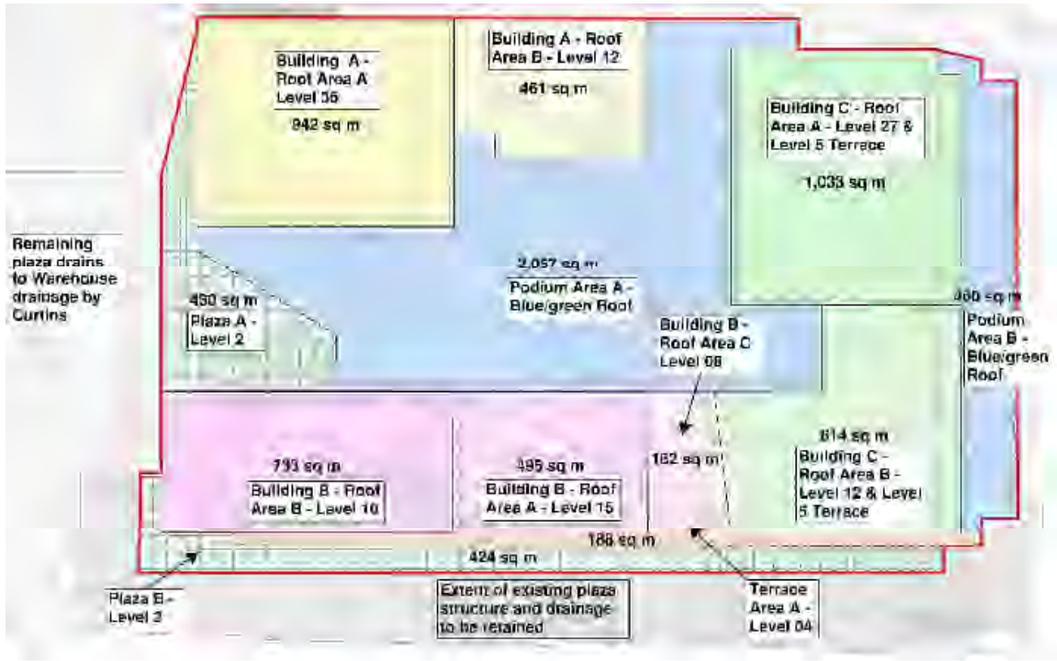


Figure 18: Drainage catchment areas

Table 9: Breakdown of drainage catchment areas

	Roof name	Level	Area (m²)
Attenuated	Building A - Roof A	36	942
	Building A - Roof B	12	461
	Building B - Roof A	15	495
	Building B - Roof B	10	733
	Building B - Roof C	08	162
	Building C – Roof & terrace A	Roof 27 / terrace 5	1033
	Building C – Roof & terrace B	Roof 12 / terrace 5	814
	Podium A – Blue/green roof	04	2057
	Podium B - Blue/green roof	04	460
	Terrace A	04	188
	Total attenuated area	**Varies**	**7345**
Not attenuated	Plaza A	02	430
	Plaza B	02	424
	Total area not attenuated	**02**	**854**
		Total area	**8199**

Table 10 below shows the brownfield runoff rates by catchment type i.e. attenuated vs not attenuated.

Table 10: Brownfield runoff rates by catchment type

Brownfield runoff rates by catchment type				
Roof name	Area (ha)	1 in 1-year event	1 in 30-year event	1 in 100-year event
All	0.8199	79.5 l/s	194.5 l/s	251.1 l/s
All attenuated	0.7345	71.3 l/s	174.3 l/s	225.1 l/s
Not attenuated	0.0854	8.2 l/s	20.2 l/s	26 l/s

Water quantity & attenuation

Discharge from the attenuated area will be restricted to 31.55 l/s for all storm events, with approximately 360m³ of attenuation designed to accommodate the 1 in 100-year plus 45% climate change rainfall event.

In line with Manchester City Council LFRMS policy 6 (stated in section 4.5), it is proposed to reduce the surface water discharge from site to at least 50% of the existing runoff rate.

The brownfield run-off rate for the site for a 1 in 1-year event is estimated at 79.5 l/s.

50% of the 1 in 1-year brownfield rate for the whole site would be 39.75 l/s. The 1 in 1-year runoff from the area of plaza at level 2 which is not attenuated equals 8.2 l/s, as shown in Table 10. Therefore, the proposed discharge rate from the attenuated areas will be 39.75l/s less 8.2 ls, which is 31.55 l/s, to account for the unrestricted catchment area at level 2.

Table 11: Runoff betterment achieved for each storm event

Runoff betterment achieved for each storm event					
Roof name		Area (ha)	Surface water discharge rate (ls)		
			1 in 1-year event	1 in 30-year event	1 in 100-year event
Existing site		0.8199	79.5 l/s	194.5 l/s	251.1 l/s
Proposed site	Attenuated	0.7345	31.55 l/s	31.55 l/s	31.55 l/s
	Not attenuated	0.0854	8.2 l/s	20.2 l/s	26 l/s
	Total	0.8199	39.75 l/s	51.75 l/s	57.55 l/s
Betterment on existing		n/a	50%	73.4%	77%

As shown, the surface water discharge rates from the proposed site represent a 50% betterment in the 1 in 1-year event, 73% for the 1 in 30-year event and 77% betterment for the 1 in 100-year event.

A pre-planning enquiry has been submitted to United Utilities and their response is awaited.

As described previously, the podium attenuation will be located at the level 4 podium areas A and B (as Figure 18), forming a blue and green roof of approximately 2517m².

Calculations using Causeway Flow+ software show an approximate depth of attenuation of 150mm is required to attenuate the 1 in 100-year + 45% climate change storm event for the design catchment area and maximum allowable discharge rate.

The hydraulic drainage calculations are included in Appendix F and the attenuation volumes are summarised in Table 12.

The total estimated attenuation required for the development is approximately 360m³.

Table 12: Attenuation volume summary

SuDS Feature	Area (m²)	Catchment (m²)	Discharge rate (l/s)	Attenuation volume (m³)**	Attenuation depth (m)
Blue/green roof (m²)			1 in 100-yr +45% CC	1 in 100-yr +45% CC	1 in 100-yr +45% CC
Podium Area A	2057	6002.5*	25.80	293	0.15
Podium Area B	460	1342.5*	5.75	65.5	0.15
Total blue/green roof	2517	7345	31.55	358.5	0.15

**Catchments based on proportional split between podium areas.*

***Attenuation volumes based on 95% voids within blue roof structure.*

The table above assumes 100% of the podium area is available for use with the blue roof system. This could end up being slightly lower, and if so, the attenuation depth will be adjusted accordingly.

The proposed drainage layout and podium attenuation drawings are available in Appendix E and show the locations of the blue/green roofs and sewer outfalls.

Supporting calculations by blue roof supplier, Bauder, are included within Appendix H.

8.4 Sustainable Drainage Systems (SuDS) & water quality

The SuDS Manual CIRIA report C753 states that 'surface water run-off should be managed for maximum benefit.' The types of benefits that can be achieved by Sustainable Drainage Systems (SuDS) can be put into four categories, the four pillars of SuDS: water quantity, water quality, amenity and biodiversity. Table 13 presents what benefits are likely to be provided by different SuDS features.

Table 13: SuDS Likely Benefits

	SuDS Feature	Water quantity	Water quality	Amenity	Biodiversity
Most Benefits	Living roofs	√	√	√	√
↑	Infiltrations systems	√	√	√	√
↑	Dry planted features – Swales, bio retentions areas, trees, detention basins	√	√	√	√
↑	Ponds and wetlands	√	√	√	√
↑	Pervious & reservoir pavements	√	√		
↑	Filter strips	√	√		
↑	Filter drains	√	√		
↑	Proprietary treatment systems		√		
Least Benefits	Attenuation storage tanks	√			

Table 14 shows what SuDS techniques are proposed to manage surface water on-site. These features are being designed in collaboration with the architect, landscape architect and MEP engineers to control water quantity, improve water quality, provide amenity and promote biodiversity.

Table 14 Summary of SuDS Techniques Proposed

SuDS Technique	Proposed?	Comment
Living roofs	Y	Blue and green roofs have been proposed on the level 4 podiums.
Infiltration systems	N	The existing basement and lower floors are retained as part of the development and therefore do not allow for infiltration.
Dry planted features	Y	Planted features are proposed on the podium level 4 and will drain directly into the attenuation layer beneath.
Open water features	N	There are no suitable external areas at ground level and open water features would impose loads too heavy for the podium structure.
Pervious & reservoir pavements	N	Pervious and reservoir pavements not proposed and external ground floor spaces are minimal.
Attenuation storage tanks	N	Attenuation tanks are not required as storage is provided on the podium level.

Blue & green roof benefits

In terms of attenuation, a standard blue roof typically consists of 150mm thick interlinked geo-cellular crate structures, laid above a waterproofed, zero fall roof, providing approximately 0.143 m^3 of storage per m^2 (assuming 95% voids ratio). This means just over 7 m^2 of (150mm thick) blue roof is required per m^3 of attenuation to be provided. Flow restricted outlets allow the build-up of water, not exceeding the designed hydraulic head, within the crate structures at roof level. The outlets are installed with an overflow feature to ensure the designed hydraulic head (depth of the system) is not surpassed during extreme storm events or if a blockage occurs.

The incorporation of green roofs and planted areas over blue roofs can improve air and water quality, provide supplementary amenity and reduce overall runoff through evapotranspiration.

A green roof can help remove airborne contaminants such as heavy metals, volatile organic compounds and other pollutant particles. Furthermore, green roofs have been found to reduce the urban heat island effect experienced in built-up areas due to the mass development of once permeable surfaces into impermeable surfaces.

Figure 19 shows a section through a Bauder green/blue roof showing the typical build-up. From top to bottom the layers include; planting blanket, soil, filter membrane, drainage/irrigation layer, attenuation crate, protection layer, waterproofing system and flow restrictor outlet.

The proposed strategy includes the provision of blue roof attenuation and soft landscaping (green roof) areas on the level 4 podiums, to enhance run-off water quality. There will also be landscaped areas on the upper terraces, although these cover limited areas and are designed as raised planters rather than a conventional green roof.

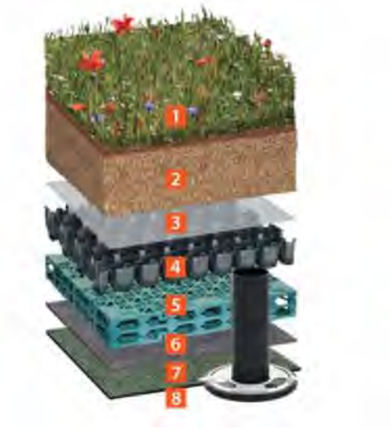


Figure 19: BauderBLUE STORMcell

9. SuDS management & maintenance

9.1 SuDS – Normal function

SuDS generally mimic the natural drainage patterns of the undeveloped site allowing infiltration into the ground/attenuation, improving water quality and controlling outflow rates from the development. This reduces the impact and risk of flooding on downstream developments alongside providing additional benefits such as pollution control, increasing biodiversity and providing water-based amenity.

The sustainable drainage systems proposed for the site are as listed below:

- Blue & green roof,

In short, these drainage features will provide:

- a platform to capture surface water,
- a medium to attenuate, filter and treat surface water,
- and a means of conveying surface water.

9.2 Operation & maintenance requirements

The maintenance regime of the SuDS on site can be divided into three categories: regular maintenance, occasional tasks and remedial works. The frequency of regular maintenance will usually be monthly, the occasional tasks and remedial works should be conducted as required. Specific maintenance needs of the SuDS should be monitored and maintenance schedules adjusted to suit requirements.

Appendix G contains a schedule providing guidance on the type of operational and maintenance requirements that may be appropriate.

The activities listed are generic to the relative SuDS types and represent the minimum maintenance and inspection requirements, however additional tasks or varied maintenance frequency may be instructed by the maintenance company as required.

All those responsible for maintenance should follow the relevant Health and Safety legislation for all the activities listed including lone working, if relevant, and risk assessments should always be undertaken.

Inspection checks shall be carried out by a qualified and competent person, at the minimum intervals listed within the schedules and the appropriate work carried out.

Any parties involved with the disposal of any waste materials from the underground drainage system should hold appropriate management licenses to undertake any such activities. Disposal of any site materials is required to be made in accordance with current legislation and guidance.

The maintenance strategy for specific SuDS proposed at the site will be dependent upon the products used within the installation of the systems and is therefore subject to manufacturer's guidance. The following operation and maintenance requirements have therefore been prepared using guidance provided in 'CIRIA C753 – SuDS Manual' and the manufacturer's recommendations for specialist drainage elements.

Blue & green roofs

Blue and green roofs are the principal SuDS proposed and require appropriate maintenance to ensure they continue to function as expected.

Intensive green roofs are likely to require regular inspection and maintenance. Grassed areas may require mowing weekly or fortnightly, plant beds may require weeding on a weekly or fortnightly basis during the growing season, and wildflower meadows may require annual mowing with the cuttings removed.

Extensive green roofs should normally only require biannual or annual visits to remove litter, check fire breaks and drains and, in some cases, remove unwanted invasive plants. The most maintenance is generally required during the establishment stage (12 to 15 months), and this should usually be made the responsibility of the green roof provider. Maintenance contractors with specialist training in green roof care should be used, where possible.

Actual requirements will depend on the planting, the desired aesthetic and visual effect and the biodiversity objectives for the system. Maintenance specifications and schedules should therefore be specified for any individual green roof.

If mechanical systems are located on the roof, then spill prevention measures should be exercised to ensure that roof runoff is not contaminated. The mechanical system area should be bunded and provided with separate drainage.

All maintenance actions carried out at roof level must be in full compliance with the appropriate health and safety regulations, and particularly those specifically dealing with working at height. Training and guidance information on operating and maintaining the roof should be provided to all property owners and tenants. Safety fastenings will be required for personnel working on the roof.

Access routes to the roof should be designed and maintained to be safe and efficient, and walkways should always be kept clear of obstructions. Secure points for harness attachments should be provided when access near to the roof edges is required.

Manholes, Sewers, Gullies, Grated Linear Channels, Flow Control Devices

Manholes and sewers are located in external spaces around/below the building to collect and convey surface water runoff to the outfalls. Gullies and grated channels will be required in exposed external spaces and maybe be used at podium level to collect runoff from hard landscaped areas and convey it to the blue roof attenuation layer. The

blue/green roof has specialised flow control outlets and although these are part of the blue/green roof system, the maintenance activities listed in Appendix G are still relevant.

Regular maintenance should be undertaken to ensure the performance of the system remains at a satisfactory level, and operates as intended/designed.

All litter and debris should be removed from the stormwater infrastructure, and should be undertaken as part of general landscape maintenance. Removal of litter and debris should be undertaken from the surface without the requirement for entry into confined spaces. If entry into confined spaces is required, a suitably qualified specialist should be engaged to undertake the works.

Monthly inspections/monitoring of stormwater infrastructure should be undertaken to determine silt accumulation rates and establish appropriate removal frequencies. Removal of silt build up from inlets/sumps should be undertaken as necessary.

Occasional maintenance of stormwater devices generally involves the removal of sediment that has accumulated over time within the device. Gullies, Catchpits, Linear channel sumps, and other collection points should be cleaned out when necessary to prevent the re-entry of sediments into the downstream system, and maintain the overall long-term performance of the drainage system. Cleaning can be undertaken by vacuum pumping, whereby sediment is vacuumed from the device and transferred to a tanker to be carried offsite to an approved disposal location. Most suppliers recommend that cleaning operations be undertaken annually or as required.

If defects are found in the drainage infrastructure which are affecting or may affect the performance of the system, the defects should be remedied immediately. Remedial maintenance to manholes, sewers or other drainage infrastructure may be possible using hand tools, but depending upon the nature and severity of the maintenance required, light machinery and hydraulic excavating machinery may be required.

Remedial maintenance for stormwater devices includes repairing erosion or other damage, repairing/rehabilitating inlets, outlets and overflows, repairing access covers and frames and cover and frame seating, and replacing sections of sewer, or other infrastructure that has failed.

9.3 Prohibited activities

Heavy loads are not permitted in areas where the blue roof cellular attenuation is located. Failure to do so may cause structural damage and collapse. The podium is a pedestrian area, without vehicle access so vehicular loads are not anticipated. The risk of overloading during construction i.e. by storing heavy materials/equipment on the blue roof, shall be managed by the contractor.

9.4 End of life maintenance

As part of their normal function, many SuDS features are intended to act as a repository for potential pollutants such as sediment, hydrocarbons and heavy metals, thus improving the water quality of run-off. This includes green roofs, although roof areas do not usually receive runoff with pollutant concentrations as high as other SuDS which are typically used to drain vehicular areas, such as permeable pavements, swales, filter drains etc. Certain pollutants, such as hydrocarbons, can be broken down via biodegradation. However, other pollutants, namely the particulate or sediment type, such as heavy metals, remain trapped within elements of the sustainable drainage feature.

Current evidence does not conclude to what extent pollution entrapment within SuDS will occur or the likely status of materials within their construction at the time of their disposal. For these reasons, it is proposed that at end-of-life, all SuDS are disposed of in accordance with the relevant rules, regulations, and available guidance at the time. If required, at redevelopment stage, consultation with the Environment Agency should be sought and testing of materials and ground, for contamination, should be carried out.

10. Proposed Foul Drainage Strategy

Foul water collected from the development (above ground level) will be routed at high level in the basement to the agreed locations and connect to external drainage, through the basement wall. The external foul water drainage will discharge at three outfall locations: two into the public combined water sewer running in Watson Street and one into the public combined water sewer in Bridgewater Street. Prior to construction, s106 consent for the new (indirect) connections is required from United Utilities. A pre-planning application has been submitted to agree the connections in principle.

The proposed drainage layout drawing is available in Appendix E.

At basement level the proposal will be to install several new sump pumps collecting wastewater from the proposed plant rooms. The pumps will be sized to include sufficient emergency storage (as required by Building Control) and will be installed with non-return valves and backflow loops on the discharge pipes to prevent flooding from surcharging in the external sewer. Foul water from the development above will be routed at high-level to avoid pumping large volumes up from basement level.

Waterproofing for the basement is not fully agreed at this stage in the project, however, if a cavity wall drainage system were to be chosen then additional pumps will be installed in the basement and discharge subject to agreement with United Utilities.

11. Existing drainage alterations

The proposed development includes an extension of the existing basement towards Watson Street, as well as changes to the ground floor and basement layouts, creating new entrances, plant and retail spaces. As a result, there will be alterations to the existing drainage required.

The drainage running at ground level, between the Leisure Box and Deansgate Terrace, and adjacent to Watson Street will require diversion to remove manhole covers from new spaces and avoid the basement extension. Live drainage connections to these manholes will be rerouted as required. An overlay of the existing drainage against the proposed

ground floor layout is included in Appendix E and the areas are highlighted in Figure 1Figure 20 and Figure 21.

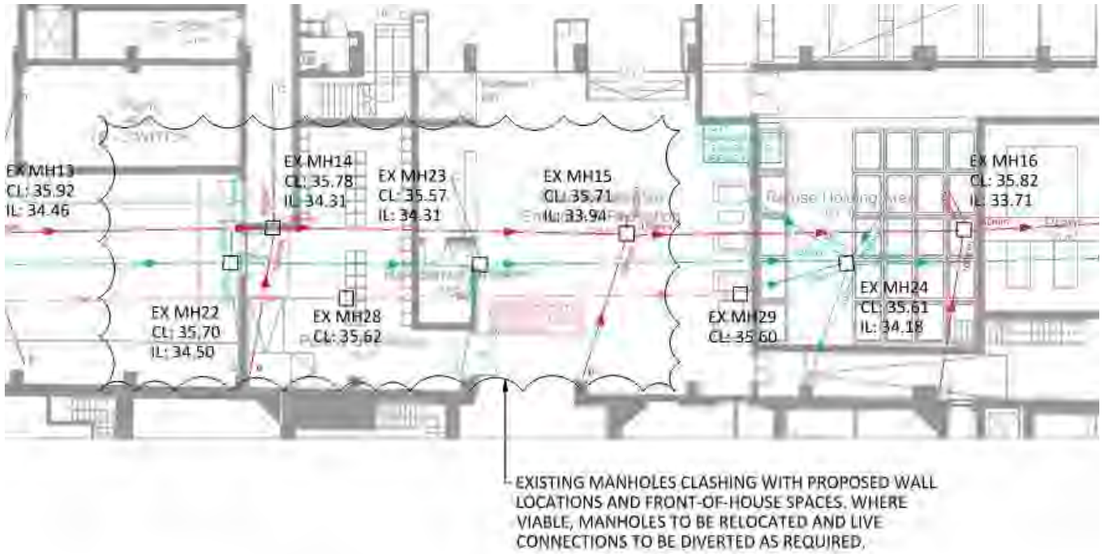


Figure 20: Existing drainage clashes at ground level between the Leisure Box & Deansgate Terrace

At basement level there is existing car park drainage, associated pumps and a petrol interceptor. This drainage will be re-used as much as possible and diverted where required to accommodate the new cores, proposed layout and make space for new foundations. An overlay of the existing drainage against the proposed basement layout is included in Appendix E. The location of two existing pumps (in the southeast corner of the basement), likely to be affected, are shown in relation to the proposed basement layout in Figure 22.

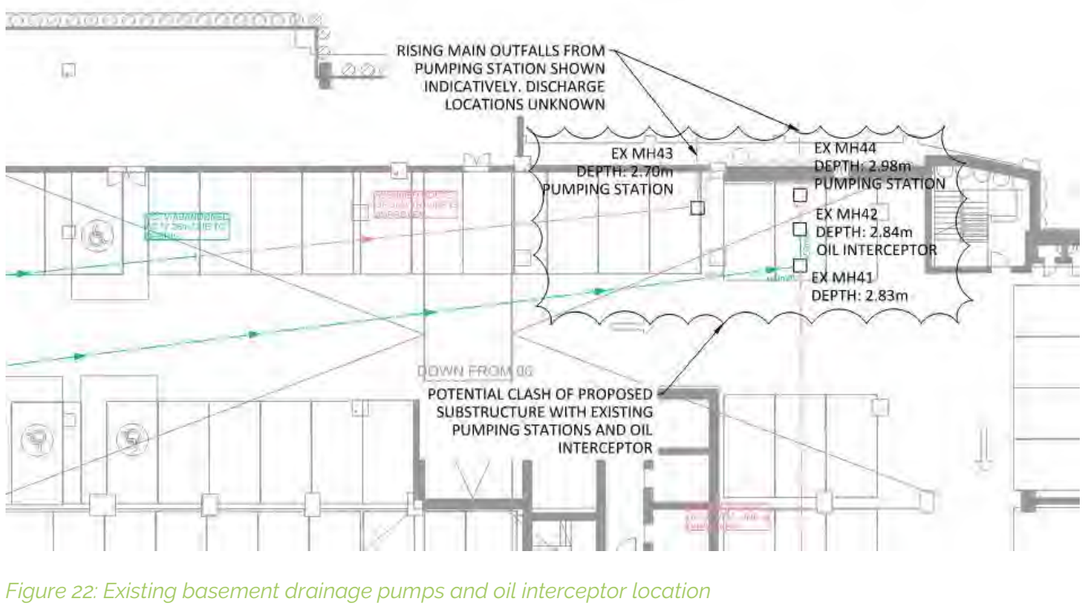
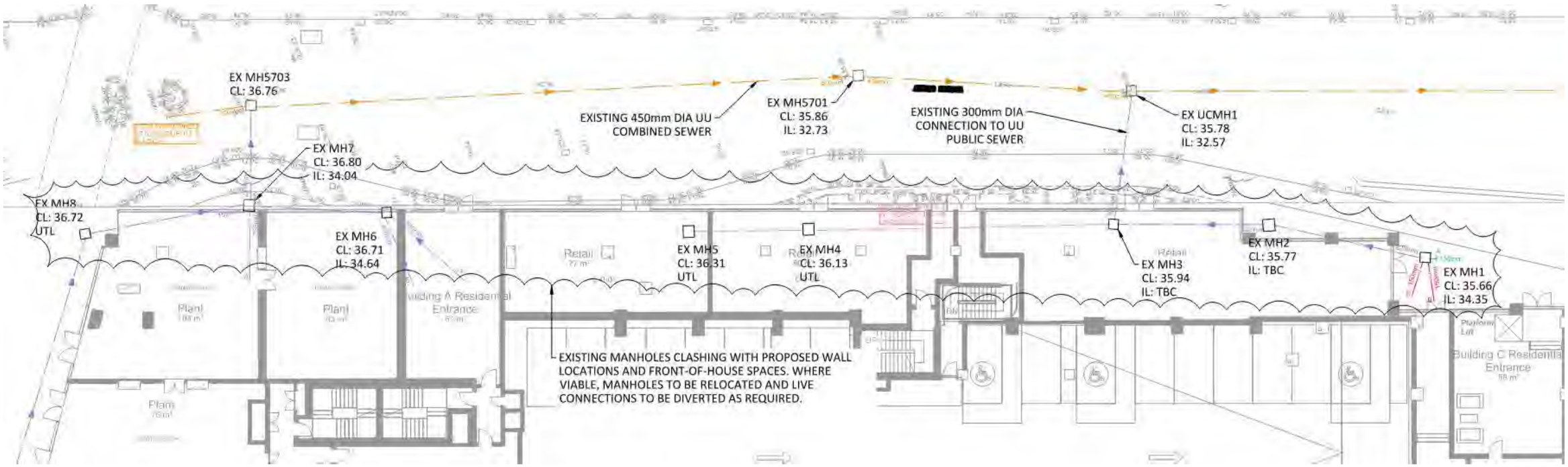


Figure 22: Existing basement drainage pumps and oil interceptor location



12.Conclusions

The site is located in Flood Zone 1 and the proposed development is appropriate for this flood zone.

The FRA has also demonstrated that the proposed development is at no significant risk from flooding from the sea, groundwater, reservoir and canal flooding, is at very low risk from river flooding and low risk from surface water and infrastructure flooding. The proposed surface water drainage strategy reduces the flood risk from surface water to the site and downstream areas by significantly reducing the discharge rate to the public sewer. As the lower levels of the existing building remain unchanged, and external works around the building perimeter are limited, the existing surface water flow routes around the site remain unchanged.

The site is currently served by foul, surface and combined water drainage networks which discharge into the existing United Utilities combined sewers. Separate foul and surface water external drainage is proposed to convey flows to the existing combined water outfalls. The assessment in section 8.1 shows that discharge to ground, a watercourse or surface water sewer are not viable for the site.

In line with the Manchester Core Strategy and MCC LFRMS, surface water will be managed using blue and green roof SuDS features providing a total of 358.5m^3 of effective storage and restrict the discharge rate to 31.55l/s from attenuated areas for up to the 1-in-100-year event and providing up to a 77% betterment on the existing surface water discharge rates. The required attenuation volume has been estimated using the Causeway Flow+ software and verified with a blue/green roof supplier, to ensure there is no flooding for up to the 1 in 100-year storm event +45% allowance for climate change.

The level 4 podium incorporates a layer of blue roof, overlaid with landscaped areas and planted features allowing rainwater to percolate through to the attenuation below. Where feasible, hard landscaped areas of the podium will drain towards the soft landscaped areas, to maximise natural irrigation and sustainable benefits. The SuDS will be designed in collaboration with the landscape architect on the project with the aim to achieve a wide range of benefits including water quality, amenity, and biodiversity.

Appendices

A. CCTV drainage survey

B. Topographical survey

C. Borehole logs

D. United Utilities sewer records

E. Drainage drawings:

- 775-02-CIV-XX-00-D-C-30000 - Existing ground floor drainage overlay
- 775-02-CIV-XX-B1-D-C-30000 - Existing basement drainage overlay
- 775-02-CIV-XX-XX-D-C-30001 - Proposed drainage layout
- 775-02-CIV-XX-04-D-C-30010 - Podium SuDS attenuation strategy

F. Drainage calculations

G. SuDS management & maintenance schedule

H. Bauder blue roof calculation

A. CCTV drainage survey

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N

PLAN GRID NORTH

File Name: L:\2022\SHY\001\Dtl\1286.dwg

LEGEND

AV	AIR VALVE	BP	PETROL PUMP
BC	BOLLARD LOCATION COVER	CAT	CATHODIC POINT
CB	CLOSED BOX	CDP	RAINWATER PIPE
CCTV	CCTV CAMERA POSO	SOFF	SOFFIT LEVEL
COM	COMMUNICATIONS COVER	SV	STOP VALVE
CP	CONCRETE COVER	TBC	TELEPHONE CALL BOX
DC	DRAINAGE CHANNEL	TL	TRAFFIC LIGHT
DP	DOWN PIPE	TLB	TRAFFIC LIGHT BOX
DR	DRAIN	TP	TELEGRAPH POLE
ELB	ELECTRIC INSPECTION COVER	WM	WATER METER
ELB	ELECTRIC BOX	WO	WATER OUTLET
EP	ELECTRIC POLE	WSO	WATER STOP VALVE
FCP	FLOOD LIGHT POLE	WSV	WATER STOP VALVE
FFL	FINISHED FLOOR LEVEL	EOT	END OF TRACE
FH	FIRE HYDRANT	OSA	OUT OF SURVEY AREA
G	GULLY	UC	UNABLE TO LIFT
GLT	GROUND LIGHT	UTO	UNABLE TO STAGE
GSV	GAS VALVE	UTT	UNABLE TO TRACE
HP	HAND RAIL	UTS	UNABLE TO USE
IC	INSPECTION COVER	WJ	BLANKED
IL	INVERT LEVEL	NFVI	NO FURTHER GPR CONTACTS
KO	KERB OUTLET	NFV	NO FURTHER VIEW
LP	LAMP POST	NP	NO MARKET PIPE
MH	MANHOLE	ToP	TOP OF PIPE
MKR	MARKER		EST. SYMBOL
OP	OUTFALL PIPE		UNKNOWN DIRECTION
PM	PYLON		DPR EST SYMBOL

BT	
CABLE DUCT	
CABLE TV	
COAL	
GAS	
TELECOMS	
EARTH ROD STRIP	
FIBRE	
FIBRE OPTICS	
FUEL LINE	
HIGH TENSION LINE	
MAINS GAS	
MAINS WATER	
SEWER CW	
SEWER FW	
SEWER SW	
TRAFFIC SIGNAL CABLE	
UNIDENTIFIED TRACE	
UNIDENTIFIED CABLE	
UNIDENTIFIED PIPE	
VEHICLE DETECTION CABLE	
Rail	

Linetypes With Suffixes (S) (A) (R) show Statutory Authority, Assumed and Recorded Underground Data

NOTES:
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Drainage information added to drawing supplied by client.

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0 20m 40m 80m 120m
SCALE BAR 1:200

REV	DATE	DESCRIPTION

Layer Surveys Ltd
See the Complete Picture

Client
Civic Engineers
Corvers Warehouse
77 Dale Street
Manchester.M1 2HG

Project Title
The Great Northern Warehouse
Management Suite
235 Deansgate
Manchester M3 4EN

Surveyed	Drawn	Checked
J.C.	I.T	Layer Surveys

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	June 22	1286	01	A1	

COVER BROKEN, UNSAFE TO LIFT
CHAMBER IS SIDE ENTRY FOR MAIN SEWER IN ROAD
DJ CHAMBER 4805 LIFTED. CHAMBER IS 16m PLUS DEEP. WITH HEAVY FLOW. MAN ENTRY REQUIRED FOR FURTHER INVESTIGATION.
UNABLE TO COMPLETE CCTV SURVEY DUE TO CHAMBER/SEWER BEING BLOCKED WITH WASTE AND RUBBLE. CLEAN REQUIRED IN ORDER TO COMPLETE.
UNABLE TO COMPLETE CCTV SURVEY DUE TO CHAMBER/SEWER BEING BLOCKED WITH WASTE AND RUBBLE. CLEAN REQUIRED IN ORDER TO COMPLETE.
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UNABLE TO COMPLETE CCTV SURVEY DUE TO CHAMBER/SEWER BEING BLOCKED WITH WASTE AND RUBBLE. CLEAN REQUIRED IN ORDER TO COMPLETE.
CHAMBER/SEWER BLOCKED AT TIME OF SURVEY. CLEAN REQUIRED IN ORDER TO COMPLETE.
CHAMBER/SEWER BLOCKED AT TIME OF SURVEY. CLEAN REQUIRED IN ORDER TO COMPLETE. POSSIBLE CLEAN DEFECTOR
CHAMBER/SEWER BLOCKED AT TIME OF SURVEY. CLEAN REQUIRED IN ORDER TO COMPLETE.
UNABLE TO LIFT COVER AT TIME OF SURVEY DUE TO BEING UNABLE TO REMOVE BOLTS.
UNABLE TO LIFT COVER AT TIME OF SURVEY DUE TO BEING UNABLE TO REMOVE BOLTS.
UNABLE TO LIFT COVER AT TIME OF SURVEY.
UNKNOWN USAGE. POSSIBLE REDUNDANT CHAMBER.
CCTV ABANDONED AT 26.71m DUE TO DEBRIS.
CCTV ABANDONED AT 9.95m DUE TO ENCRUSTATION.
CCTV ABANDONED AT 6.70m DUE TO DEPOSITS.
CCTV ABANDONED AT 6.52m DUE TO DEBRIS.
CCTV ABANDONED AT 5.05m DUE TO SLUDGE.
CCTV ABANDONED AT 1.70m DUE TO SLUDGE.
OBSERVED ROUTE OF SEWER LINE IS UNKNOWN.
OBSERVED ROUTE OF SEWER LINE IS UNKNOWN.
OBSERVED ROUTE OF SEWER LINE IS UNKNOWN.
REF MH1
REF MH2
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REF MH5
REF MH6
REF MH7 DEPTH 2.76m
REF MH8
REF MH9 DEPTH 1.29m
REF MH10
REF MH11 DEPTH 0.99m
REF MH12 DEPTH 1.47m
REF MH13 DEPTH 1.09m
REF MH14 DEPTH 1.47m
REF MH17 DEPTH 1.79m
REF MH20 DEPTH 0.83m
REF MH21 DEPTH 1.09m
REF MH22 DEPTH 1.20m
REF MH23 DEPTH 1.26m
REF MH25
REF MH26
REF MH27 DEPTH 0.89m
REF MH28
REF MH29
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REF MH34
REF MH35
REF MH36
REF MH37
REF MH44
REF MH47
REF MH48 DEPTH 0.95m
REF MH49 DEPTH 1.09m
REF MH50
REF MH50A
REF 50 DEPTH 1.30m
REF 5703
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PLAN GRID NORTH

File Name: L:\1286\SW\001286.dwg

LEGEND

AV	AIR VALVE	BP	PETROL PUMP
BH	BOREHOLE/TRIAL HOLE	RAD	RADIUS POINT
CB	CATCH PIT	RWP	RAINWATER PIPE
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ER	ELECTRIC INSPECTION COVER	WM	WATER METER
ESB	ELECTRIC BOX	WO	WATER OUTLET
EP	ELECTRIC POLE	WSC	WATER STOP COCK
FFL	FINISHED FLOOR LEVEL	WSV	WATER STOP VALVE
FH	FIRE HYDRANT	OOA	OUT OF SURVEY AREA
GL	GAS LINE	UTO	UNABLE TO OPEN
GLT	GROUND LIGHT	UTS	UNABLE TO STAKE
GSV	GAS TAP	UTT	UNABLE TO TRACE
IC	INSPECTION COVER	UTL	UNABLE TO LIFT
IC	INSPECTION COVER	BLK	BLOCKED
IL	INVERT LEVEL	NFH	NO FURTHER GPR CONTACTS
LP	LAMP POST	NFD	NO FURTHER DIG
LP	LAMP POST	NP	NO SURVEY PIPE
MH	MANHOLE	ToP	TOP OF PIPE
MKR	MARKER	EST	ESTIMATED
OP	OUTFALL PIPE	DIR	DRAINAGE DIRECTION
PH	PHONE		DPR EXIT SYMBOL

BT	
CABLE DUCT	
CABLE TV	
GAS	
POWER	
TELECOMS	
EARTH ROD STRIP	
FIBRE	
FIBRE OPTICS	
FUEL LINE	
HIGH PRESSURE LINE	
MAINS GAS	
MAINS WATER	
SEWER CW	
SEWER FW	
SEWER SW	
TRAFFIC SIGNAL CABLE	
UNIDENTIFIED TRACE	
UNIDENTIFIED PIPE	
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VEHICLE DETECTION CABLE	
Rail	

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SCALE BAR 1:200

REV	DATE	DESCRIPTION

Layer Surveys Ltd
See the Complete Picture

Client

Civic Engineers
Corvers Warehouse
77 Dale Street
Manchester M1 2HG

Project Title

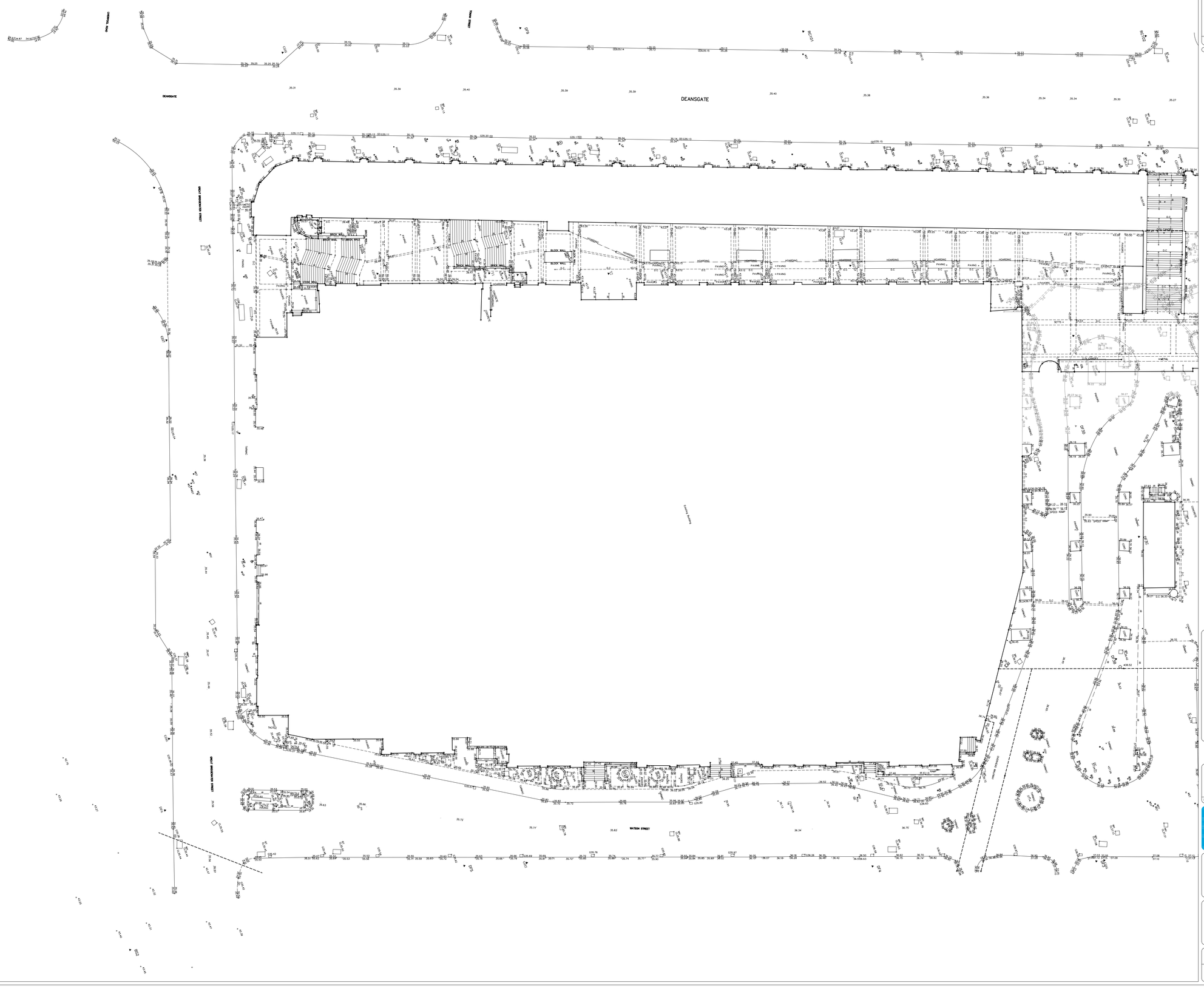
The Great Northern Warehouse
Management Suite
235 Deansgate
Manchester M3 4EN

Surveyed	Drawn	Checked
J.C	I.T	Layer Surveys

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	June 22	1286	00	A1	

B. Topographical survey

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PLAN GRID NORTH

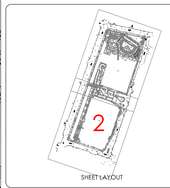
File Name: S13920T_Rev A.dwg

LEGEND

AV	AIR VALVE	LBY	LAYBY
BOL	BOLLARD	MH	MANHOLE
BH	BORE HOLE	MKR	MARKER
BP	BUS PASS	MP	MOORING POINT
BM	BENCH MARK	MP	MOORING POINT
BT	BUS STATION	MW	MONITORING WELL
CP	CONTROL BOX COVER	OP	OUTFALL PIPE
CB	CONTROL BOX	OP	OUTFALL PIPE
CPo	CONTROL BOX POST	PB	PELICAN PUSH BOX
COL	COLUMN	PB	PYLON
CCo	COMMUNICATIONS COVER	PP	PETROL PUMP
CTV	CABLE TV COVER	PT	PITOT
DC	DRAINAGE CHANNEL	RE	RODDING EYE
DP	DOWN PIPE	RG	ROAD GULLY
DR	DRAIN	RS	ROAD SIGN
EC	ELEC INSPECTION COVER	RW	RETAINING WALL
EB	ELECTRIC BOX	SP	SPRINKLER PIPE
ELB	ELECTRIC BOX	SAT	SATELLITE
ER	EARTH ROD	SP	SIGN POST
EP	ELECTRIC POLE	SL	STREET LIGHT
FFL	FINISHED FLOOR LEVEL	SV	STOP VALVE
FP	FIRE POINT	TL	TELEPHONE CALL
FP	FUEL PIPE	TCB	TELEPHONE CALL BOX
GV	GAS VALVE	TK	TANK
GLT	GRATUITY LIGHT	TL	TRAFFIC LIGHT
GP	GATE POST	TLB	TRAFFIC LIGHT BOX
GM	GAS METER	TP	TELEGRAPH POLE
GW	GAS VALVE	TP	TELEGRAPH POLE
IC	INSPECTION COVER	VP	VENT PIPE
KC	KERB CUTOUT	WM	WATER METER
KO	KERB OUTLET	WO	WASH OUT
LAD	LADDER	WSV	WATER STOP TAP
LS	LAMP SPANN	WSV	WATER STOP VALVE
LP	LAMP POST	WCM	TREE WITH COLLAR
		WO	TREE MULTI-TRUNK

PAL	PALISADE		EARTH BANK
RAIL	RAIL BOUNDARY		EDGE OF FEATURE
RCW	RETAINING WALL		FENCE
SCW	SONIC PANEL		KERB
TCW	TIMBER CLAD WALL		SLOPE
PCW	POST AND RAIL		SURFACE CHANGE
CW	PCW &		WALL
CW	BRICK & RENDERED		TOP OF BANK
SWAL	CHAIN LINK		BOTTOM BANK
[98.98]	TOP OF FEATURE		BUILDING
T	TREE		BUILDING CANOPY
S	STATION		OVER HEAD ELECTRICAL
B	BOREHOLE		OVER HEAD TELECOM
	WATER		HEDGE

NOTES:
All levels relate to O.S (Newlyn) Datum, Established using network RTK.
Survey plotted on a plane local grid, orientated to National Grid.



SHEET LAYOUT

0 2m 4m 8m 12m 16m

SCALE BAR

REV	DATE	DESCRIPTION
A	21/7/17	Beat Street Rear Detail Added.

SURVEY & ENGINEERING PROJECTS

Client
2110 Consult
5 Parkway
Porters Wood
St Albans
Hertfordshire
AL3 6PA

Project Title
Topographical Survey of Land at:
The Great Northern
Deansgate
Manchester
M3 4EN

Surveyed	Drawn	Checked
A.N/A.J/G.H	G.Birchall	R.Critchley

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	Mar 17	S13920-T	02	A0	A

C. Borehole logs

G.S.M. No. 75-79

(B11867) WL 17602—5134—5,000 12/26 Sp. 180. O.A.

SJ 89NW 64-68

SECTION OF Sewer Shafts at Deansgate, Manchester

Maps; One-inch 85 Six-inch 1045.W.E. County Lancs.

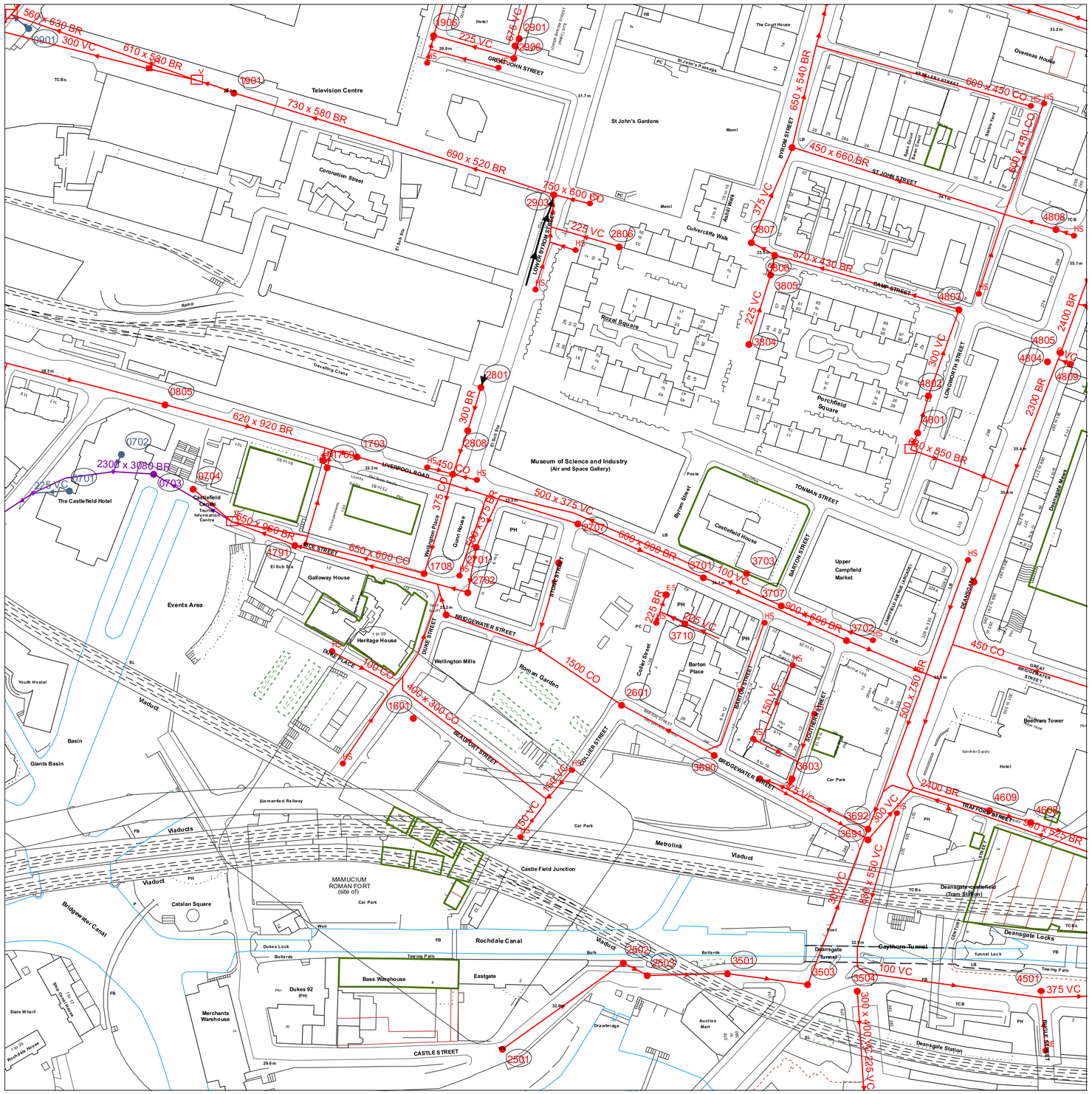
Height above O.D. Latitude Longitude

Communicated by Manchester Corporation Date of Sinking

Made by Dip of Strata

		Thickness.			Depth from Surface.		
		Metres			Metres		
No. 68 68	Deansgate. Corner of Lowland St. Made ground, Sandstone	3·66	12	–	3·66	12	–
		7·01	23	–	10·67	35	–
No. 76 67	02. Deansgate opposite Camp St. Corner. Ballast + made ground.	2·13	7	–	2·13	7	–
	Sandstone.	11·28	37	–	13·41	44	–
No. 77 66 66	03. Deansgate. opposite St. John's Street corner. Ballast + loose ground.	3·66	12	–	3·66	12	–
	Ballast + loose ground	4·27	14	–	7·93	26	–
	Sandstone.	5·18	17	–	13·11	43	–
No. 78 65 65	05. Deansgate, Jackson's Row Corner. Ballast + loose ground	3·66	12	–	3·66	12	–
	Sandstone.	9·14	30	–	12·80	42	–
No. 79 64 64	07. Deansgate, Corner of John Dalton Street. Made ground } Ballast + gravel }	3·35	11	–	3·35	11	–
	Gravel, sand, + marl.	3·05	10	–	6·40	21	–
	Sandstone	7·32	24	–	13·72	45	–

D. United utilities sewer records



OS Sheet No: SJ8397NW

Scale: 1: 1250 Date: 17/01/14

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0701	25.6	SW	24.47	225		CI	VC	17.03	0
0702	25.59	SW	24.74	225		CI	VC	8.94	0
0703	25.81	OV	22.78	2300	3080	UN	BR	126.36	6
0704	26.25	CO	23.77	225		CI	VC	23.54	1
0805	29.54	CO	22.25	620	920	EG	BR	79.82	6
0901	29.68	SW	23.4	400		CI	VC	5	0
1601	33.23	CO							
1703	31.99	CO							
1708	32.57	CO	26.15	650	600	UN	CO	56.75	2
1709	31.39	CO							
1791	29.37	CO	24.12	550	960	FT	BR	30.96	1
1901	28.93	CO	25	750	490	FT	BR	8.54	0
1906		CO	25.93	375		CI	VC	39.1	1
2501	31.09	CO	24.95	300		CI	VC	68.82	3
2502	29.53	CO							
2503	32.16	CO							
2601	33.75	CO	26.77	1500		CI	CO	91.92	4
2701	33.05	CO	28.12	300		CI	BR	10.2	0
2702	33.12	CO	25.87	1500		CI	CO	14.56	0
2703	33.04	CO	25.9	1500		CI	CO	14.56	0
2704	33.44	CO	30.36	710	480	FT	BR	19.65	0
2706	32.91	CO							
2707	33.5	CO	22.19	600	900	EG	BR	63.16	6
2801	33.17	CO	30.67	300		CI	BR	20.88	0
2806	33.42	CO	31.38	225		CI	VC	32.7	1
2808		CO							
2901		CO		225		CI	VC	9.54	
2902		CO	0	675		CI	VC	66.76	22
2903	32.21	CO	29.18	690	520	FT	BR	77.79	3
2906		CO							
3501	32.11	CO							
3503	32.24	CO							
3504	31.9	CO	30	300	400	EG	VC	30.07	1
3601	34.38	CO	26.9	375		CI	VC	28.65	1
3603		CO	0	560	760	UN	BR	5.39	0
3690	34.2	CO	27.14	1500		CI	CO	48.77	2
3691	33.4	CO	0	300		CI	VC	31.89	12
3692	33.74	CO							
3701	34.12	CO							
3702	34.7	CO	22.08	900	600	EG	BR	23.77	2
3703	34.32	CO							
3707	34.62	CO	30.88	100		CI	VC	52.8	2
3710		CO		225		CI	VC	12.82	
3804	34.07	CO	33.04	225		CI	VC	33.53	1
3805	33.63	CO							
3806	33.49	CO							
3807	33.44	CO							
3901	33.28	CO	29.58	650	540	FT	BR	48.27	1
4501	33.52	CO	26.52	375		CI	VC	36.01	1
4608		CO	0	2400		CI	BR	27.9	9
4609		CO							
4704	35.36	CO							
4801	34.39	CO							
4802	34.21	CO							
4803	34.44	CO							
4804	35.23	CO							
4805	35.27	CO							
4808	35.15	CO	31.85	450	660	UN	BR	25	0
4809		CO	0			CI	VC	6.15	
9026		CO	0	750	600	UN	CO	16.81	6
3100		OV	0	150		CI	VC	38.61	4
0708		SW							
0905		SW							
0906		CO							
0907		CO							
1602		CO	0	400	300	UN	CO	48.92	18
1702		CO	0	450		CI	CO	12.37	4
1704		CO	0	100		CI	CO	33.12	15
1902		CO	0	500	750	UN	VC	6.42	3
1904		CO							
1905		CO							
2602		CO	0	150		CI	VC	20	5
2603		CO	0	150		CI	VC	15.62	2
2605		CO							
2606		CO							
2708		CO							
2710		CO	0	100		CI	VC	39.22	7
2711		CO	0	450		CI	CO	11.4	3
2713		CO							
2714		CO							
2715		CO							
2800		CO	0	600	400	UN	CO	12.28	4
2807		CO	0	600	400	UN	CO	23.22	8
2904		CO	0	500	720	UN	VC	32.35	15
3506		CO							
3507		CO							
3600		CO	0	150		CI	VC	3.78	0
3604		CO	0	560	760	UN	VC	31.62	3
3607		CO							
3608		CO							
3704		CO	0	750	500	UN	CO	67.08	8
3705		CO							
3706		CO							
3708		CO							
3709		CO		225		CI	VC	17.33	
3711		CO							
3712		CO		225		CI	BR	5.58	
3801		CO							
3905		CO							
4603		CO	0	830	550	UN	VC	79.39	17
4604		CO							
4605		CO							
4606		CO							
4703		CO	0	500	375	UN	VC	22.47	2
4705		CO							
4792		CO	0	500	750	UN	BR	46.82	3
4806		CO	0	600	450	UN	CO	38.9	11
4807		CO	0	450	660	UN	BR	8.54	2
4901		CO	0	600	450	UN	CO	54.08	18
4902		CO	0	600	450	UN	CO	102.88	31
6400		CO	0	1500		CI	CO	4.52	0
0706		SW							
0890		CO							
0902		CO							
1603		CO							
1605		CO							
1700		CO							
1706		CO							
1707		CO							
1790		CO							
1792		CO							
1903		CO							
2604		CO	0	400	300	UN	CO	88.8	32
2709		CO							
2712		CO							
2790		CO							
2791		CO							
2809		CO							
2900		CO							
3602		CO							
3606		CO							
3609		CO							
3610		CO							
3902		CO							
3903		CO							
4607		CO							
4690		CO							
4691		CO							
4692		CO	0	500	750	UN	BR	18.38	8
4702		CO							
4790		CO							
4791		CO	0	500	750	UN	BR	67.07	8
4800		CO							
4810		CO							
4903		CO							
2802		CO							
2803		CO							
2804		CO							
2905		CO							

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0903		CO	25.45	300		CI	VC	95.49	4
0904		CO							
1701		CO	0	630	930	FT	BR	21.18	6
4701		CO	31.33	630	550	UN	BR	24.72	0

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole
Foul Surface Combined Overflow
Screen Chamber
Discharge Point
Outfall

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO Foul
SW Surface Water
CO Combined
OV Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

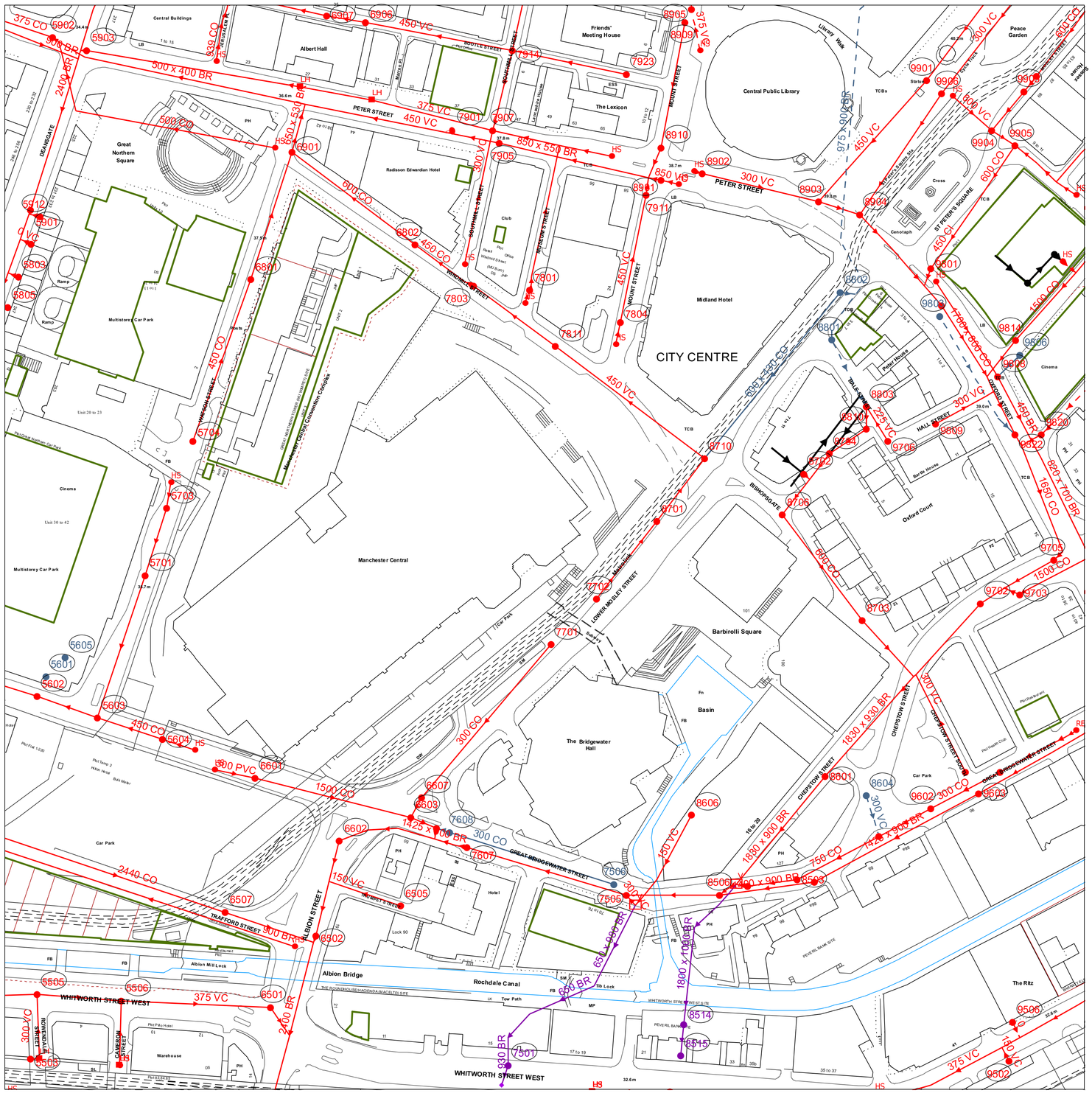
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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OS Sheet No: SJ8397NW
Scale: 1: 1250 Date: 17/01/14
154 Nodes
Sheet 1 of 1

United Utilities

SEWER RECORDS



Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
5503	33.4	CO	30.67	300		CI	VC	34.02	1
5505	33.83	CO							
5506	34.08	CO							
5601	36.03	SW							
5602	35.48	CO							
5603	35.59	CO							
5604	35.71	CO							
5605	35.76	SW							
5701	35.76	CO	32.7	450		CI	CO	69.57	2
5703	17.87	CO							
5704		CO	0	450		CI	CO	79.71	37
5801		CO		0		CI	VC	5.41	
5803		CO		0		CI	VC	5.16	
5805		CO		0		CI	VC	5.45	
5901	34.79	CO	21.81	2400		CI	BR	70.23	8
5902	34.19	CO	31.03	375		CI	CO	55.67	1
5903	34.5	CO							
5912		CO		0		CI	VC	4.98	
6501	34.91	CO							
6502	36.02	CO							
6505	35.94	CO		150		CI	VC	34.92	
6507	9.01	CO							
6601	35.88	CO							
6602	36.37	CO							
6603	37.02	CO	31.39	1500		CI	CO	13	0
6607	38.01	CO							
6801		CO	0	450		CI	CO	61.98	21
6802	18.46	CO							
6901	36.94	CO							
6906	18.09	CO	0	450		CI	VC	18.25	8
6907	27.13	CO							
7501	33.14	SW	27.68	1330	900	EG	BR	9.49	0
7505	37.28	CO							
7506	37.31	SW	34.55	300		CI	CO	79.7	2
7607	37.09	CO							
7608	37.09	SW							
7609	37.12	CO							
7701	39	CO	35.54	300		CI	CO	92.96	3
7702		CO	0	450		CI	CO	22.8	5
7801	39.53	CO							
7803	39.37	CO							
7804	39.52	CO	36.53	450		CI	VC	60.21	1
7811		CO	0	450		CI	VC	47.2	10
7901		CO							
7905	37.89	CO	34.47	300		CI	BR	25.5	0
7907	37.82	CO							
7911		CO							
7914	38.51	CO							
7923		CO	0	450		CI	VC	54.13	17
8502	36.36	CO	23.56	1400	900	EG	BR	44.41	4
8503	36.47	CO	31.55	750		CI	CO	23.19	0
8504	36.91	CO							
8506	36.98	CO							
8514		OV							
8515		OV							
8601	36.5	CO							
8604	35.93	SW	33.35	300		CI	VC	19.92	0
8606		CO	0	150		CI	VC	49.49	44
8701	39.37	CO	35.25	450		CI	VC	36.4	1
8702	37.28	CO	34.68	600		CI	CO	3.8	0
8703	38.76	CO							
8704	37.6	CO							
8706	37.42	CO	32.92	600		CI	CO	61.4	2
8710	39.43	CO							
8801	39.34	SW							
8802	39.51	SW	35.59	600	430	EG	CO	99.49	3
8803	37.76	CO							
8810	37.6	CO							
8901	38.88	CO							
8902	39.04	CO							
8903	39.45	CO							
8904	39.66	CO							
8905	39.82	CO	36.02	375		CI	VC	2	6
8909		CO	0	450		CI	VC	59.03	15
8910		CO							
9502		CO	0	150		CI	VC	7.37	4
9506		CO		0		CI		7.87	
9601	36.54	CO							
9602	36.14	CO							
9603	36.26	CO							
9604	36.45	CO	33.34	300		CI	CO	36.24	1
9609	36.22	CO	29.73	300		CI	VC	50.54	2
9702	38.08	CO							
9703	38.33	CO	29.42	1500		CI	CO	7.62	0
9705	38.49	CO							
9706	37.71	CO	36.36	225		CI	VC	18.87	0
9801	39.33	CO	31	450		CI	CI	8.54	0
9802	39.35	CO							
9803	39.23	SW	35.83	300		CI	VC	54.2	
9806	39.32	SW	36.1	450		CI	VC	14.14	0
9808	39.09	CO							
9809	38.17	CO	30.88	300		CI	VC	30.89	1
9814		CO							
9820	39.27	CO							
9822	38.93	CO							
9901	39.86	CO							
9902	41.04	CO	36.63	600		CI	CO	9.22	0
9903	40.42	CO							
9904	40.27	CO							
9905	40.25	CO							
9906	39.89	CO							
5606		CO	0	450		CI	CO	15.81	5
5607		CO	0	300		CI	PVC	19.42	5
5610		CO	0	2440		CI	CO	106.57	14
5702		CO	0	450		CI	CO	12.17	3
5904		CO	0	939		CI	CO	14.14	9
5908		CO	0	500		CI	BR	32.98	6
5911		CO							
6503		CO	0	900		CI	BR	140.09	19
6904		CO							
6905		CO	0	540		CI	CO	6.08	2
6915		CO	0	500		CI	CO	83.56	21
7502		OV	0	930		CI	BR	27.87	5
7508		OV	0	650		CI	BR	32.7	4
7703		CO							
7802		CO							
7808		CO	0	300		CI	VC	63.35	8
7812		CO	0	800	470	FT	BR	6.32	1
7815		CO	0	450		CI	VC	10.2	3
7920		CO	0	375		CI	VC	24.52	5
8501		CO							
8511		OV							
8809		SW	0	970	920	UN	BR	3.16	0
8906		CO	0	850		CI	VC	8.25	2
8907		CO	0	300		CI	VC	4.12	0
8908		CO		375		CI	VC	19.42	
9501		CO							
9710		CO	0	1830	930	EG	BR	5.66	0
9804		CO							
9813		CO							
9815		CO							
9818		CO	0	450		CI	VC	52.7	9
9907		CO	0	600		CI	VC	24.08	6
9909		CO							
9912		CO	0	600	450	EG	BR	10.82	1
9914		CO							
9915		CO							
5502		CO							
5508		CO							
5609		CO							
5802		CO							
5804		CO							
5905		CO	0	500	500	SQ	BR	3.61	1
5906		CO	0	2400		CI	BR	97.42	7
5907		CO							
5910		CO							
5913		CO							
6504		CO							
6506		CO							
6508		CO							

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
6606		CO							
6902		CO							
6903		CO							
6911		CO							
6912		CO							
6913		CO	0	939		CI	CO	5.39	1
7611		CO							
7809		CO							
7813		CO	0	850	450	EG	BR	62.37	13
7921		CO							
7922		CO							
7930		CO							
8705		CO							
8804		SW							
8807		SW							
9503		CO	0	375		CI	VC	78.24	37
9504		CO							
9507		CO							
9612		CO							
9613		CO							
9615		CO							
9616		CO	0	1425	900	EG	BR	38.95	3
9617		CO							
9708		CO							
9709		CO							
9711		CO							
9712		CO	0	820	700	EG	BR	186.15	26
9807		CO							
9811		SW	0	300		CI	VC	11.31	1
9812		CO							
9817		CO							
9823		CO							
9825		CO							
9827		CO	0	550	475	EG	BR	8.49	4
9910		CO							
8707		SW							
8709		CO							
8811		CO							
9805		CO							
9810		CO							
9819		CO							
7504		CO	30.31	300		CI	VC	6.41	0
8507		CO							

LEGEND

MANHOLE FUNCTION

FO Foul
SW Surface Water
CO Combined
OV Overflow

SEWER SHAPE

CI Circular
EG Egg
OV Oval
FT Flat Top
RE Rectangular
SQ Square
TR Trapezoidal
AR Arch
BA Barrel
HO HorseShoe
UN Unspecified

SEWER MATERIAL

AC Asbestos Cement
BR Brick
PE Polyethylene
RP Reinforced Plastic Matrix
CO Concrete
CSB Concrete Segment Bolted
CSU Concrete Segment Unbolted
CC Concrete Box Culverted
PSC Plastic/Steel Composite
GRC Glass Reinforced Concrete
GRP Glass Reinforced Plastic
DI Ductile Iron
PVC Polyvinyl Chloride
CI Cast Iron
SI Spun Iron
ST Steel
VC Vitrified Clay
PP Polypropylene
PF Pitch Fibre
MAC Masonry, Coursed
MAR Masonry, Random
U Unspecified

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OS Sheet No: SJ8397NE
Scale: 1: 1250 Date: 17/01/14
193 Nodes
Sheet 1 of 1

United Utilities

SEWER RECORDS

Printed By: Donna Camblin

OS Sheet No: SJ8397NE

Scale: 1: 1250 Date: 17/01/14

E. Drainage drawings

- 775-02-CIV-XX-00-D-C-30000 - Existing ground floor drainage overlay
- 775-02-CIV-XX-B1-D-C-30000 - Existing basement drainage overlay
- 775-02-CIV-XX-XX-D-C-30001 - Proposed drainage layout
- 775-02-CIV-XX-04-D-C-30010 - Podium SuDS attenuation strategy

EX MH5703
CL: 36.76
CCTV ABANDONED AT 5.05m DUE TO SLUDGE
EXISTING 450mm DIA UU COMBINED SEWER
EX MH5701
CL: 35.86
IL: 32.73
EXISTING 300mm DIA CONNECTION TO UU PUBLIC SEWER
EX UCMH1
CL: 35.78
IL: 32.57
EX MH5603
CL: 35.55
IL: 32.07
EX MH7
CL: 36.80
IL: 34.04
EX MH8
CL: 36.72
UTL
EX MH6
CL: 36.71
IL: 34.64
EX MH5
CL: 36.31
UTL
EX MH4
CL: 36.13
UTL
ASSUMED ROUTE OF SEWER, LINE IS UNKNOWN
EX MH3
CL: 35.94
IL: TBC
EX MH2
CL: 35.77
IL: TBC
EX MH1
CL: 35.66
IL: 34.35
EXISTING MANHOLES CLASHING WITH BASEMENT EXTENSION, PROPOSED WALL LOCATIONS AND FRONT-OF-HOUSE SPACES. WHERE VIABLE, MANHOLES TO BE RELOCATED AND LIVE CONNECTIONS TO BE DIVERTED AS REQUIRED.
EX MH9
CL: 36.53
IL: 35.24
EX MH5602
ASSUMED ROUTE OF 600mm BRICK EGG UU COMBINED SEWER
EX MH10
CL: 35.98
ASSUMED REDUNDANT
EX MH11
CL: 35.90
IL: 34.91
EX MH12
CL: 36.00
IL: 34.84
EX MH13
CL: 35.92
IL: 34.46
EX MH14
CL: 35.78
IL: 34.31
EX MH23
CL: 35.57
IL: 34.31
EX MH15
CL: 35.71
IL: 33.94
EX MH16
CL: 35.82
IL: 33.71
EX MH17
CL: 35.84
IL: 33.37
EX MH18
CL: 35.86
IL: 33.36
EX MH19
CL: 35.45
IL: 32.78
EX MH20
CL: 36.00
IL: 35.17
EX MH21
CL: 35.85
IL: 34.84
EX MH22
CL: 35.70
IL: 34.50
EX MH24
CL: 35.61
IL: 34.18
EX MH25
CL: 35.86
IL: 33.95
EX MH26
CL: 35.51
IL: 32.84
EX MH27
CL: 35.90
IL: 35.01
EX MH28
CL: 35.62
EX MH29
CL: 35.60
ASSUMED ROUTE OF EXISTING 450mm DIA CONNECTION TO PUBLIC SEWER
EXISTING MANHOLES CLASHING WITH PROPOSED WALL LOCATIONS AND FRONT-OF-HOUSE SPACES. WHERE VIABLE, MANHOLES TO BE RELOCATED AND LIVE CONNECTIONS TO BE DIVERTED AS REQUIRED.
GREAT BRIDGEWATER STREET
UP TO 01
DOWN TO B1
UP FROM B1
DOWN FROM 01
Retail 77 m²
Retail 80 m²
Building A Residential Entrance 61 m²
Building C Residential Entrance 58 m²
Retail 48 m²
Plant 103 m²
Plant 83 m²
Plant 75 m²
Plant 24 m²
Plant 34 m²
Plant 23 m²
Plant 14 m²
Tower A Refuse 66 m²
Commercial Refuse & Equipment Store 461 m²
Tower B Refuse 44 m²
Warehouse Equipment Store 27 m²
Store 14 m²
Plant 13 m²
Service Bay
Residential Deliveries 79 m²
Residential Entrance & Reception 319 m²
Refuse Holding Area 127 m²
Plant 58 m²
Plant 24 m²
Plant 41 m²
Plant 22 m²
Plant 35 m²
Plant 16 m²
TB - SUB
TP - SWITCH
Platform Lift

STANDARD NOTES

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   - 1.1. ARCHITECTURAL DWG GROUND FLOOR LAYOUT BY SIMPSON HAUGH '10422-SHP-Z4-A-G200-PL-00-001' RECEIVED 13.10.22.
   - 1.2. CCTV DRAINAGE SURVEY BY LAYER SURVEYS LTD (DRAWING REF 1286 DATED JUNE 22).
   - 1.3. TOPOGRAPHICAL SURVEY BY SEP (DRAWING REF S13920-T REV A DATED 21.07.22).
   - 1.4. COLLATED EXISTING SITE PLAN BY SIMPSON HAUGH '10422-SHP-Z0-A-G100-XP-00-001' RECEIVED 13.06.22.
2. DRAINAGE INVERT LEVELS SHOWN HAVE BEEN DEDUCED FROM THE AVAILABLE SURVEY INFORMATION. ALL COVER AND INVERT LEVELS, PIPE SIZES AND MANHOLE LOCATIONS SHOWN ARE SUBJECT TO ON SITE VERIFICATION.
3. EXISTING DRAINAGE PROVEN TO BE REDUNDANT SHALL EITHER BE REMOVED OR SEALED IN ACCORDANCE WITH BUILDING REGULATIONS APPROVED DOCUMENT H.

LEGEND:

- EXISTING FOUL WATER SEWER
- EXISTING FOUL WATER SEWER (ASSUMED)
- EXISTING SURFACE WATER SEWER
- EXISTING SURFACE WATER SEWER (ASSUMED)
- EXISTING COMBINED WATER SEWER
- EXISTING UNITED UTILITIES PUBLIC COMBINED SEWER
- EXISTING UNITED UTILITIES PUBLIC COMBINED SEWER (ASSUMED)

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28.10.22	P01	ISSUED FOR PLANNING	OD	AG

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Tower Works, Unit D2-01, Globe Road, Leeds, LS11 5QG. Tel: 0113 2025 130
Gresham Chambers, 45 West Nile St, Glasgow, G1 2PT. Tel: 0141 370 1829
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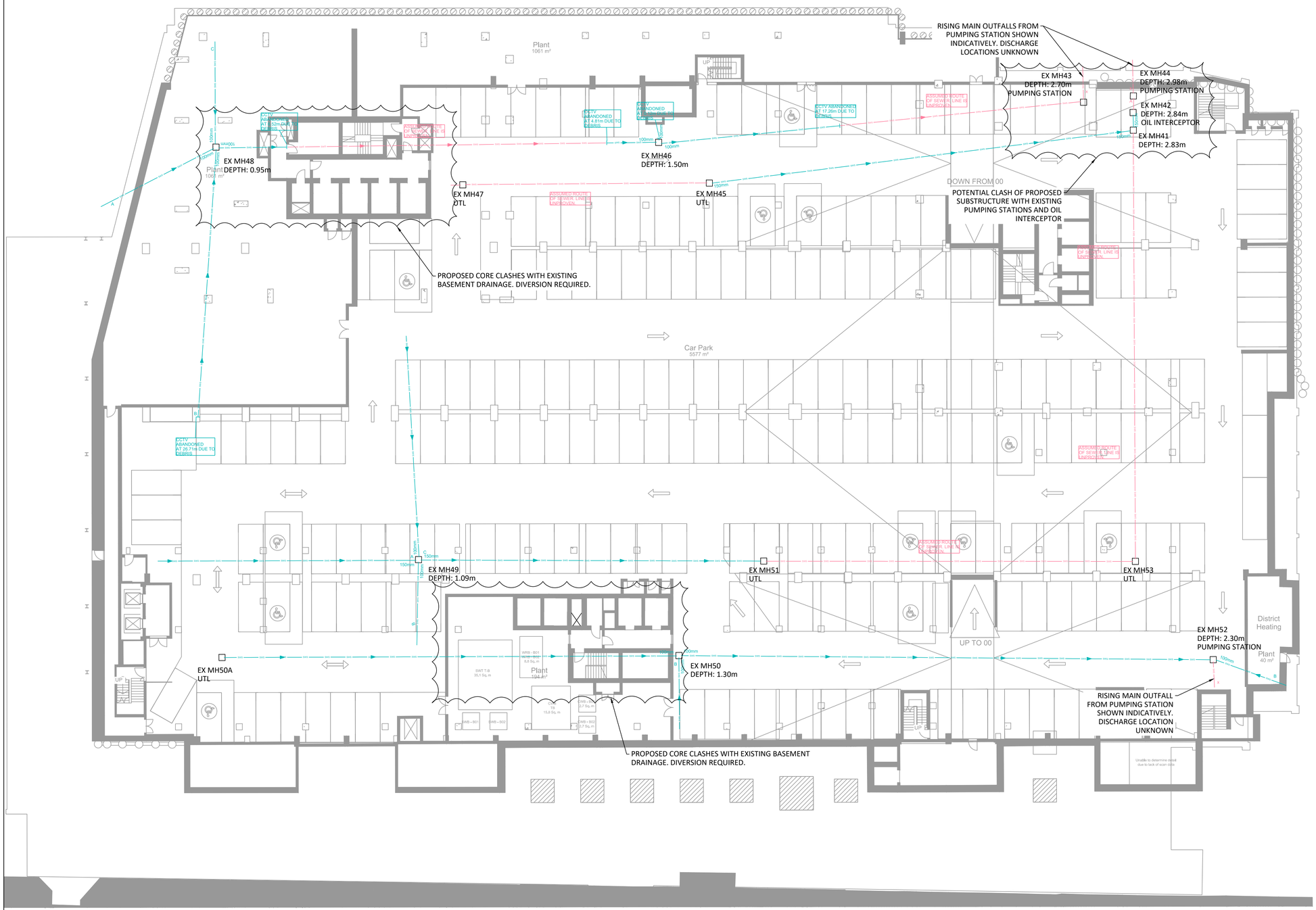
PROJECT
GREAT NORTHERN, MANCHESTER LEISURE BOX

TITLE
EXISTING DRAINAGE OVERLAY GROUND FLOOR

DRAWING STATUS	STATUS CODE
PRELIMINARY	-

CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
775-02	1:200	OCT 22	OD	AG

DRAWING No.: 775-02-CIV-XX-00-D-C-30000
REV: P01



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   - 1.1. ARCHITECTURAL DWG GROUND FLOOR LAYOUT BY SIMPSON HAUGH '10422-SHP-Z4-A-G200-PL-B1-001' RECEIVED 13.10.22.
   - 1.2. CCTV DRAINAGE SURVEY BY LAYER SURVEYS LTD (DRAWING REF 1286 DATED JUNE 22).
2. DRAINAGE INVERT LEVELS SHOWN HAVE BEEN DEDUCED FROM THE AVAILABLE SURVEY INFORMATION. ALL COVER AND INVERT LEVELS, PIPE SIZES AND MANHOLE LOCATIONS SHOWN ARE SUBJECT TO ON SITE VERIFICATION.
3. EXISTING DRAINAGE PROVEN TO BE REDUNDANT SHALL EITHER BE REMOVED OR SEALED IN ACCORDANCE WITH BUILDING REGULATIONS APPROVED DOCUMENT H.

LEGEND:

EXISTING SURFACE WATER SEWER

EXISTING SURFACE WATER SEWER (ASSUMED)

DATE	REV	DESCRIPTION	DRAWN	CHKD
28.10.22	P01	ISSUED FOR PLANNING	OD	AG

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PROJECT

GREAT NORTHERN, MANCHESTER LEISURE BOX

TITLE

EXISTING DRAINAGE OVERLAY BASEMENT LEVEL

DRAWING STATUS				STATUS CODE
PRELIMINARY				-
CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
775-02	1:200	OCT 22	OD	AG
DRAWING No.				REV
775-02-CIV-XX-B1-D-C-30000				P01

DRAINAGE NOTES:

1. THE SITE CATCHMENT AREA IS 0.8199ha.
   - 1.1. 0.7345ha IS ATTENUATED ON THE LEVEL 4 PODIUM BLUE/GREEN ROOF AND RESTRICTED TO A MAXIMUM PEAK DISCHARGE RATE OF 31.55l/s.
   - 1.2. 0.0854ha DISCHARGES UNRESTRICTED FROM THE LEVEL 2 PLAZA AREA.
2. THE DEPTH OF THE LEVEL 4 PODIUM ATTENUATION IS BASED ON THE 100 YEAR +45% CC STORM EVENT.
3. REFER TO CIVIC ENGINEERS FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY REPORT FOR FURTHER INFORMATION ON THE SURFACE WATER CATCHMENT AREAS, ATTENUATION VOLUMES, SUDS AND DISCHARGE RATES.
4. TOTAL FOUL WATER DISCHARGE FROM THE SITE IS ESTIMATED AT 52.94 l/s BASED ON WSP SKETCH '221007 - FOUL WATER DISCHARGE FLOWRATES' AND INCLUDES A 10% ALLOWANCE FOR DESIGN DEVELOPMENT.

THE PROPOSED EXTERNAL DRAINAGE IS SUBJECT TO COORDINATION WITH PROPOSED AND EXISTING BELOW-GROUND SERVICES (NOT SHOWN FOR CLARITY). REFER TO WSP COMBINED UTILITY DRAWING 'GNW-WSP-Z0-00-DR-M-960103'.

LINE OF EXISTING BASEMENT EXTENDS TOWARDS WATSON STREET, INDICATED BY DASHED LINE

EXISTING 450mm DIA UU COMBINED SEWER

EXISTING 300mm DIA CONNECTION TO UU PUBLIC SEWER

EX MH5703 CL: 36.76

SWMH01. SEALED RUNNING TRAP WITHIN CHAMBER

CCTV ABANDONED AT NON DUE TO SLUDGE

EX MH5701 CL: 35.86 IL: 32.73

EX UCMH1 CL: 35.78 IL: 32.57

EX MH5603 CL: 35.55 IL: 32.07

CWMH01 CWMH02 CWMH03 CWMH04 CWMH05 CWMH06 CWMH07 CWMH08 CWMH09

EX MH7 CL: 36.80 IL: 34.04

EX MH8 CL: 36.72 UTL

EX MH6 CL: 36.71 IL: 34.64

EX MH5 CL: 36.31 UTL

EX MH4 CL: 36.13 UTL

EX MH3 CL: 35.94 IL: TBC

EX MH2 CL: 35.77 IL: TBC

EX MH1 CL: 35.66 IL: 34.35

FWMH01 SWMH02

SEALED RUNNING TRAP WITHIN CHAMBER

150mm SURFACE WATER OUTFALL FROM BASEMENT HIGH-LEVEL.

PUMPED FOUL WATER OUTFALL FROM BASEMENT HIGH-LEVEL

150mm FOUL WATER OUTFALL FROM BASEMENT HIGH-LEVEL

EXISTING LIVE DRAINAGE CONNECTIONS TO BE RE-ROUTED TO DIVERSION AS REQUIRED

150mm FOUL WATER OUTFALL FROM BASEMENT HIGH-LEVEL

PUMPED FOUL WATER OUTFALL FROM BASEMENT HIGH-LEVEL

150mm FOUL WATER OUTFALL FROM BASEMENT HIGH-LEVEL

150mm SURFACE WATER OUTFALL FROM BASEMENT HIGH-LEVEL.

EX MH9 CL: 36.53 IL: 35.24

EX MH10 CL: 35.98 ASSUMED REDUNDANT

EX MH11 CL: 35.90 IL: 34.91

EX MH12 CL: 36.00 IL: 34.84

EX MH13 CL: 35.92 IL: 34.46

EX MH14 CL: 35.78 IL: 34.31

EX MH23 CL: 35.57 IL: 34.31

EX MH15 CL: 35.71 IL: 33.94

EX MH16 CL: 35.82 IL: 33.71

EX MH17 CL: 35.84 IL: 33.37

EX MH18 CL: 35.86 IL: 33.36

EX MH19 CL: 35.45 IL: 32.78

EX MH20 CL: 36.00 IL: 35.17

EX MH27 CL: 35.90 IL: 35.01

EX MH21 CL: 35.85 IL: 34.84

EX MH22 CL: 35.70 IL: 34.50

EX MH28 CL: 35.62

EX MH29 CL: 35.60

EX MH24 CL: 35.61 IL: 34.18

EX MH25 CL: 35.86 IL: 33.95

EX MH26 CL: 35.51 IL: 32.84

EX MH5602

ASSUMED ROUTE OF 600mm BRICK EGG UU COMBINED SEWER

ASSUMED ROUTE OF EXISTING 450mm DIA CONNECTION TO PUBLIC SEWER

EXISTING MANHOLES CLASHING WITH PROPOSED WALL LOCATIONS AND FRONT-OF-HOUSE SPACES. WHERE VIABLE, MANHOLES TO BE RELOCATED AND LIVE CONNECTIONS TO BE DIVERTED AS REQUIRED.

UPSIZE EXISTING 150mm FOUL WATER DRAIN BETWEEN EXMH13 AND EXMH19; EXISTING PIPE TO BE REMOVED AND REPLACED WITH NEW 225mm DRAIN.

GREAT BRIDGEWATER STREET

STANDARD NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATIONS.
2. THIS DRAWING SHOULD NOT BE SCALED.
3. ALL DIMENSIONS ARE TO BE VERIFIED BY THE CONTRACTOR ON SITE.
4. ALL DISCREPANCIES SHOULD BE REPORTED TO C.A./E.A. PRIOR TO THE COMMENCEMENT OF WORKS.

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   - 1.1. ARCHITECTURAL DWG GROUND FLOOR LAYOUT BY SIMPSON HAUGH '10422-SHP-Z4-A-G200-PL-00-001' RECEIVED 13.10.22.
   - 1.2. CCTV DRAINAGE SURVEY BY LAYER SURVEYS LTD (DRAWING REF 1286 DATED JUNE 22).
   - 1.3. TOPOGRAPHICAL SURVEY BY SEP (DRAWING REF S13920-T REV A DATED 21.07.22).
   - 1.4. COLLATED EXISTING SITE PLAN BY SIMPSON HAUGH '10422-SHP-Z0-A-G100-XP-00-001' RECEIVED 13.06.22.
   - 1.5. '220928 - OUTFALL POSITIONS MARK UP' BY WSP RECEIVED 28.09.22.
2. EXISTING DRAINAGE INVERT LEVELS SHOWN HAVE BEEN DEDUCED FROM THE AVAILABLE SURVEY INFORMATION. ALL COVER AND INVERT LEVELS, PIPE SIZES AND MANHOLE LOCATIONS SHOWN ARE SUBJECT TO ON SITE VERIFICATION.
3. EXISTING DRAINAGE PROVEN TO BE REDUNDANT SHALL EITHER BE REMOVED OR SEALED IN ACCORDANCE WITH BUILDING REGULATIONS APPROVED DOCUMENT H.
4. DIVERSION OF EXISTING DRAINAGE SHOWN INDICATIVELY ONLY. FINAL LOCATIONS AND LEVELS OF DIVERTED DRAINAGE TO BE CONFIRMED FOLLOWING FURTHER INVESTIGATION.
5. PROPOSED COVER AND INVERT LEVELS TO BE CONFIRMED AT THE NEXT DESIGN STAGE ONCE EXTERNAL LEVELS ARE AVAILABLE.
6. DRAINAGE OUTFALL LOCATIONS FROM BASEMENT HIGH-LEVEL ARE BASED ON WSP MARK-UP DATED 28.09.22. LOCATIONS AND SIZES ARE INDICATIVE.
7. ALL OUTFALL PIPES FROM BASEMENT HIGH-LEVEL SHALL HAVE A REMOVABLE ACCESS PANEL IMMEDIATELY BEFORE WALL PENETRATION.
8. RISING MAINS SHALL BE DESIGNED WITH A BACKFLOW LOOP UPSTREAM OF WALL PENETRATION.
9. DRAINAGE REQUIREMENTS WITHIN THE BASEMENT ARE TO BE CONFIRMED AT THE NEXT DESIGN STAGE.
10. ALL BELOW GROUND DRAINAGE SHALL BE INSTALLED IN ACCORDANCE WITH APPROVED DOCUMENT H & BS EN 752.
11. ANY WORKS TO ADOPTABLE SEWERS ARE SUBJECT TO THE NECESSARY CONSENTS AND SHALL BE CARRIED OUT IN ACCORDANCE WITH SSG DCG APPENDIX C AND THE WATER AUTHORITY REQUIREMENTS.

LEGEND:

- EXISTING FOUL WATER SEWER
- EXISTING FOUL WATER SEWER (ASSUMED)
- EXISTING SURFACE WATER SEWER
- EXISTING SURFACE WATER SEWER (ASSUMED)
- EXISTING COMBINED WATER SEWER
- EXISTING UNITED UTILITIES PUBLIC COMBINED SEWER
- EXISTING UNITED UTILITIES PUBLIC COMBINED SEWER (ASSUMED)
- EXISTING DRAINAGE TO BE UP-SIZED
- EXISTING DRAINAGE TO BE REMOVED/MADE REDUNDANT
- PROPOSED SURFACE WATER DRAINAGE & PPIC
- PROPOSED FOUL WATER DRAINAGE & PPIC
- PROPOSED COMBINED WATER DIVERSION & PCC MANHOLE
- PROPOSED FOUL WATER RISING MAIN

DATE	REV	DESCRIPTION	DRAWN	CHKD
28.10.22	P01	ISSUED FOR PLANNING	OD	AG

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LEEDS Tower Works, Unit G3-01, Globe Road, Leeds, LS11 5QG. Tel: 0113 2025 130
GLASGOW Gresham Chambers, 45 West Nile St, Glasgow, G1 2PT. Tel: 0141 370 1829
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PROJECT

GREAT NORTHERN, MANCHESTER LEISURE BOX

TITLE

PROPOSED BELOW GROUND DRAINAGE LAYOUT

DRAWING STATUS	STATUS CODE
PRELIMINARY	-

CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
775-02	1:200	OCT 22	OD	AG

DRAWING No. 775-02-CIV-XX-XX-D-C-30001 REV P01

DRAINAGE NOTES:

1. THE SITE CATCHMENT AREA IS 0.8199ha.
   - 1.1. 0.7345ha IS ATTENUATED ON THE LEVEL 4 PODIUM BLUE/GREEN ROOF AND RESTRICTED TO A MAXIMUM PEAK DISCHARGE RATE OF 31.55l/s.
   - 1.2. 0.0854ha DISCHARGES UNRESTRICTED FROM THE LEVEL 2 PLAZA AREA.
2. THE DEPTH OF THE LEVEL 4 PODIUM ATTENUATION IS BASED ON THE 100 YEAR +45% CC STORM EVENT.
3. REFER TO CIVIC ENGINEERS FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY REPORT FOR FURTHER INFORMATION ON THE SURFACE WATER CATCHMENT AREAS, ATTENUATION VOLUMES, SUDS AND DISCHARGE RATES.

PODIUM AREA A - LEVEL 4
2,057m² BLUE AND GREEN ROOF
150mm DEEP ATTENUATION LAYER TO PROVIDE 293m³ STORAGE AT 95% VOIDS.
CATCHMENT = 6,002.5m²
PEAK DISCHARGE FROM AREA = 25.8 l/s

PODIUM AREA B - LEVEL 4
460m² BLUE AND GREEN ROOF
150mm DEEP ATTENUATION LAYER TO PROVIDE 65.5m³ STORAGE AT 95% VOIDS.
CATCHMENT = 1,342.5m²
PEAK DISCHARGE FROM AREA = 5.75 l/s

STANDARD NOTES

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3. ALL DIMENSIONS ARE TO BE VERIFIED BY THE CONTRACTOR ON SITE.
4. ALL DISCREPANCIES SHOULD BE REPORTED TO C.A./E.A. PRIOR TO THE COMMENCEMENT OF WORKS.

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1. THIS DRAWING IS BASED ON THE FOLLOWING:
   - 1.1. ARCHITECTURAL DWG LEVEL 4 LAYOUT BY SIMPSON HAUGH '10422-SHP-Z4-A-G200-PL-04-001' RECEIVED 13.10.22.
   - 1.2. TOPOGRAPHICAL SURVEY BY SEP (DRAWING REF S13920-T REV A DATED 21.07.22).
2. CHAMBERS AND DISTRIBUTION PIPES WILL BE REQUIRED WITHIN THE PODIUM BUILD-UP, TO RECEIVE RWPs FROM THE UPPER TERRACES/ROOFS. THESE ARE TO BE DESIGNED AT THE NEXT DESIGN STAGE WHEN RWP LOCATIONS AND FLOW RATES ARE AVAILABLE.
3. RAINWATER PIPE OUTLETS FROM THE PODIUM STORAGE SHALL BE RESTRICTED TO THE APPROVED DISCHARGE RATES AND INSTALLED TO SUIT THE SPECIALIST BLUE ROOF SUPPLIERS DETAILS. LOCATIONS TO BE DETERMINED BY THE M&E ENGINEER AND ARCHITECT.
4. LANDSCAPED AREAS ON THE PODIUM DRAIN THROUGH TO THE STORAGE LAYER. REFER TO PLANIT-IE LANDSCAPE DETAILS.

LEGEND:

BLUE / GREEN ROOF AREA

DATE	REV	DESCRIPTION	DRAWN	CHKD
28.10.22	P01	ISSUED FOR PLANNING	OD	AG

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PROJECT
GREAT NORTHERN, MANCHESTER LEISURE BOX

TITLE
PODIUM SUDS ATTENUATION STRATEGY

DRAWING STATUS	STATUS CODE
PRELIMINARY	-

CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
775-02	1:200	OCT 22	OD	AG

DRAWING No.	REV
775-02-CIV-XX-XX-D-C-30010	P01

F. Drainage calculations

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	20.548	0.600	0.500	0.397	0.103	200.0	375	4.27	49.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.277	141.1	132.5	0.125	0.228	0.735	0.0	290	1.444

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	18.000	Check Discharge Rate(s)	✓
Ratio-R	0.360	1 year (l/s)	79.5
Summer CV	1.000	30 year (l/s)	194.5
Winter CV	1.000	100 year (l/s)	251.1
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	15.00
Brownfield Method	MRM	Betterment (%)	0
Contributing Area (ha)	0.820	Q 1 year (l/s)	79.5
PIMP (%)	100	Q 30 year (l/s)	194.5
CV	1.000	Q 100 year (l/s)	251.1

Node 1 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	0.500	Design Flow (l/s)	31.6
Replaces Downstream Link	✓	Design Depth (m)	0.150		

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.100	31.550	0.200	31.550

Node 1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.500	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	92	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	25.000	Number Required	1
Porosity	1.00	Pit Length (m)	100.000		

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	1	128	0.640	0.140	192.7	355.5378	0.0000	OK
15 minute summer	2	1	0.397	0.000	26.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
180 minute summer	1	Head/Flow	2	31.5	477.7

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G. SuDS management & maintenance schedule

Great Northern Leisure Box - SuDS Maintenance Schedule

Rev 01 - 28/10/2022

For Planning

The below table is extracted from The SuDS Manual 2015 (CIRIA C753)

Activity / Maintenance Schedule	Required Action	Frequency	Maintenance Responsibility
Green Roofs			
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	Development management team
	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 for 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	
Conventional drainage systems & flow control devices			
Regular maintenance	Remove litter and debris	Monthly (or as required)	Development management team
Occasional maintenance	Monitoring	Inspect monthly (and after large storms)	
	Sediment management. Removal of accumulated silt from system.	Annually or as required	
Remedial actions	Structure rehabilitation/repair	As required	

H. Bauder blue roof calculation

BlueRoofDesign Software

Bauder Ltd, 70 Landseer Road, Ipswich, IP3 0DH. T: +44 (0)1473 257671 e: info@bauder.co.uk

Date: 14/10/2022 Revision: A (1379)

Client:	Civic Engineers
Project:	B194534_Great Northern, Leisure Box
Location:	Manchester
Roof Location:	Podium A/B

Roof Details:

BlueRoof	2517 m²	x 100 %
Additional Area	4828 m²	x 100 %
Effective Area	7345 m²	

Storage Details:

Length	2517 m
Width	1 m
Depth	150 mm
Porosity	95 %
Slope	none

Rainfall Details - FSR Method:

Return Period	100 years
Climate Change Factor	45 %
r value	0.42
M5-60	19 mm

Summer Storm Profile

Duration	Intensity mm	Intensity mm/h	Required storage(m³)
5 min	19.2	230.9	137.5
10 min	28.6	171.4	200.8
15 min	34.4	137.6	238.0
30 min	44.8	89.7	296.8
45 min	51.1	68.2	324.5
60 min	55.7	55.7	339.1
2 hours	67.0	33.5	352.2
6 hours	85.1	14.2	316.0
24 hours	111.6	4.7	163.8

Outflow Details:

Attenuation Control	BlueRoof Outlet
Control	Twist Std. Position 6
Sump Depth	None
Discharge rate	29.64 l/s
Outlet	5 No
Flow Per Outlet	5.93 l/s

Result:

Outcome	Pass
Critical Storm Duration	2.1 hrs
Hmax	147 mm
Required Volume	352.2 m³
Time to half empty	1.7 hrs
Roof Loading	139.93 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: 7345m2x0.018l/s/m2 = 132.21l/s.

NOTE: Roof loading data shown in the results section is for the blue roof only. For total loading of blue roof and overflows then Hmax + 35mm should be factored in.

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