SHEAR design
Consulting Civil and Structural Engineers

# FUSION STUDENT ACCOMMODATION

## FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

LOCALE: JUNCTION OF DEANSGATE, CHESTER ROAD
AND BRIDGEWATER VIADUCT, MANCHESTER M3 4LB

## FOR FUSION MANCHESTER DEVCO LTD



**JUNE 2023**
**20047.02.03.D100B**

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| Issue | Prepared by | Checked by | NOTES | Date |
|---|---|---|---|---|
| - | TU | SJM | D100 - Issue 1 | 21.12.2020 |
| A | TU | DK | D100A – Issue 2 | 13.03.2023 |
| B | TU | BH | D100B – Issue 3 | 23.06.2023 |

# 1.0 INTRODUCTION

Planning consent was granted by the Planning Inspector on 17th May 2022 in relation to a planning application submitted to Manchester City Council by Fusion Manchester Devco Ltd for a proposed new development on land at the junction of Deansgate, Chester Road and Bridgewater Viaduct, Manchester. The development comprises the construction of a landmark high-rise student accommodation building on the approach to Manchester City Centre in an area experiencing growth in high-rise urban redevelopment. Although the development has an area of less than 1.0Ha and is not located within flood zones 2 or 3, it is within a critical drainage area and therefore this drainage strategy document includes a section on Flood Risk.

This document was written to support the Planning Application for development of the site and now that consent has been granted this document has been updated, as recommended by the Planning Inspector in the Appeal Decision APP/B4215/W/21/3287525:

*'57. Suggested condition 12 requires the submission of a Flood Risk Assessment (FRA) even though an FRA was submitted with the application. The application was submitted more than one year ago and it is not therefore unreasonable for the Council to require the submission of an FRA because it may need updating. Item i) of the condition is also not unreasonable and covers the possibility that the drainage strategy for the development might be altered to include discharge of surface water into a main river. If it is not altered then item i) does not come into effect. Suggested condition 12 has not therefore been amended.'*

Surface water, Planning Condition 12 says,

> *i) Where surface water is connected to a Main River, any works within or adjacent to the river that would affect it would require consent from the Environment Agency (EA). An email of acceptance by the EA of proposed flows and/or new connection will suffice;*

A connection to the nearby river has been explored and for reasons given in this report a connection has been found not viable.

A flood risk assessment was prepared in 2015 by Campbell Reith in support of a previous planning application for a 13-storey development of apartments. This previous FRA has been reviewed as part of the assessment of flood risk and the drainage strategy for the current proposed development.

Shear Design Ltd has prepared this report in accordance with the instructions of its Client – Fusion Manchester Devco Ltd for its Client's sole and specific use. This report is not assignable without the prior written permission of Shear Design Ltd. This report should not be relied upon exclusively for decision making purposes and should be read in conjunction with other Engineer's reports, specifications and drawings in addition to all other relevant reports, drawings and specifications.

## 2.0 TOPOGRAPHY AND SITE DESCRIPTION

The site is located on the A56 in Central Manchester en-route from the M56 and Old Trafford and is situated at Grid Reference SJ 83285 97435 or in 6 figures: SJ832974 and the site Eastings and Northings are 383285, 397435. The land is currently a cleared, vacant, brownfield site classified as greenfield for drainage purposes with an area of approximately 620m$^2$. For more details a site location plan can be found in **Appendix A.**

The topographical survey undertaken by Survey Systems was produced in January 2015 and updated in November 2020. This survey shows that the site is situated at an elevation of 30.5m above ordnance datum, with a level range on site not exceeding 0.5m. Surrounding footways and parking areas entirely encompass the site and there is a level range in these surrounding areas of 4.8m. The highest point is adjacent to the Bridgewater Viaduct at 31.0m and the lowest point is in the adjacent parking area at 26.19m. The proposed rear service entrance is in the east corner of the site where access from Deansgate is lowest at a level of between 28.40m and 28.85m. The proposed front entrance is on the front corner where Deansgate is at its highest, between Deansgate and Bridgewater Viaduct where the existing level is 30.20m to 30.80m. A brick wall of varying height surrounds the site measuring up to 6.7m to top of the wall. Some or all of these walls are intended to be demolished as part of the proposals to accommodate the new building.

The site access is currently via a security gated entrance off Deansgate, close to the Deansgate and Bridgewater Viaduct junction. All other perimeters are secured by site hoarding or high brick walls. More detail can be found on the topographical survey located in **Appendix B.**

A further feature has been brought to the Developer's attention and is referred to as the Medlock Tunnel or Medlock Bypass. The position of this feature has been investigated and described under separate documentation and is understood not to pass under the boundary of the development site.

# 3.0 EXISTING DRAINAGE

Historical maps show that in 1851 the site and its adjacent roads, canal and railway network were already established in their current arrangement including the route of the Medlock Tunnel that passes close to the site. A rectangular building occupied the west end of the site and in 1893 smaller buildings had been added at the east end of the site. This arrangement passed largely unchanged until 1948 when mapping no longer shows the building in the west and by 1951 the buildings in the east had also disappeared. In 1960 the site appears to have a new building, filling about half the available space. The outline of the building is visible through to the latest historical map of 1992-95. The extent to which foul drainage discharged from the site is not known. Only the 1851 map shows the Medlock Tunnel and this feature does not appear on any subsequent maps, although it is known to still exist.

The site currently comprises 100% hardstanding and although it is now vacant of all previous development it is thought likely that foul and surface water connections once drained to the existing sewers. Inspection of the topographical survey shows the site is surfaced with concrete and there are three gullies in existence and located at low spots such that surface water runoff from most of the site can still reach these gullies. There is also evidence of inspection chambers and a possible live SW connection to the offsite sewer network. It is therefore possible that the site may be reclassified as brownfield and be subject to a permissible discharge rate based on 50% betterment of the current discharge rate in line with Manchester City Council surface water drainage requirements.

The existing site area is 620m$^2$ (O.062ha). If the site were classified as brownfield this would result in a discharge rate of 1/3600 x 50(mm/hr) x 620(m$^2$) giving 8.61 L/s, to which a 50% betterment would be applied giving a discharge rate of 4.30 L/s. With reference to the greenfield scenario currently applicable to this site, the discharge rate would be based on a rate of 5.0 L/s/ha and proportionately this would restrict the flow to 5.0 x 0.062ha to give a site discharge rate of 0.31 L/s. This is a low discharge rate and is problematic since the constriction at the outlet has to be of a small diameter resulting in greater potential for blockage.

A restricted discharge rate of 2.0 L/s will pose less of a risk of blockage and this rate was originally accepted by United Utilities. United Utilities was consulted further in the summer of 2022 and on the 1$^{st}$ of July 2022 wrote to confirm that:

*'United Utilities accept to discharge surface water from the proposed site to the public combined sewer within Deansgate Road at a maximum 5l/s discharge rate to avoid future blockages.'*

Correspondence to this effect can be found in Appendix E.

United Utilities records show that there is an existing network of public sewers on the south side of the development approaching from Chester Road and heading eastwards into Deansgate and from there heading south-eastwards along Owen Street away from the site. At the junction of Deansgate and Owen Street, the sewer is connected to a combined sewer overflow (CSO) that takes surcharging flows directly to the River Medlock under a permit to discharge which is granted by the Environment Agency (EA). There are restrictions placed on this overflow pipe with regard to the number of times it is used to discharge into the River Medlock with prior agreement made with the EA. Therefore, no surface water connection will be allowed from the development site to this overflow pipe.

A plan of the existing United Utilities sewer network plan can be found in Appendix C together with a CCTV drainage survey that was completed in 2020.

# 4.0 FLOOD RISK

The River Medlock passes approximately 60m north of the site heading westwards where it interacts with, but does not join, the Bridgewater Canal. There is a useful summary given on Wikipedia:

*"At the point where Deansgate and Chester Road (A56) meet (under the Bridgewater Viaduct) the river meets the Bridgewater Canal head on, where a sluice gate (a listed structure) allowed water to feed the canal, until the water quality of the Medlock became too polluted for canal use. Normally the level of the river is several feet below the level of the canal, and the river is carried in a tunnel under the Castlefield canal basin, reappearing at Potato Wharf, where it is supplemented by excess canal water draining into a circular weir. When the river is in spate the tunnel cannot cope and river water enters the canal, flows across the basin, and exits via the weir and manually operated gates. A quarter of a mile further on the Medlock enters the Irwell adjacent to the bottom gate of the disused Hulme Locks."* Source: Wikipedia

Flooding from the river and other sources is shown on the Environment Agency (EA) Flood Mapping and this is separated into three maps covering rivers and sea, reservoirs and surface water. None of these sources of flooding are shown to affect the site. The annual probability of flooding is given as less than 0.1% for the site. Flooding associated with the River Medlock adjoins the site in the north east where the perimeter wall is at its highest. This flooding remains outside the proposed development, with the peak water level sitting several metres below the site level. The Environment Agency has previously provided flood levels for the River Medlock in the vicinity of the site, as given in the following table.

| Event Probability | River Modelling Node | Minimum Proposed Floor Level (mAOD) | Flood Level (mAOD) | Flood Depth (m) |
|---|---|---|---|---|
| 1% (1 in 100 year) | ea013_Model_ BRGW01_00034 | 28.10 Lower Ground Floor Refuse and Bicycle Storage. | 26.04 | -2.06 |
| 1% (1 in 100 year) with climate change | | | 26.22 | -1.88 |
| 0.1% (1 in 1000 year) | | | 26.58 | -1.52 |
| 1% (1 in 100 year) | ea013_Model_ BRGW01_00031 | | 25.84 | -2.26 |
| 1% (1 in 100 year) with climate change | | | 26.00 | -2.10 |
| 0.1% (1 in 1000 year) | | | 26.33 | -1.77 |

With the exception of the basement tank room with a floor level of 24.45m AOD, flood water levels remain considerably below the proposed lowest floor level of the building up to and including the 1 in 1000 year event. The lowest point of access for the site boundary is at a level of 28.4m AOD and therefore the development remains fully accessible during flooding events. The basement is lower than the flood levels but is within the pile cap of the building and is therefore not subject to external flooding. Extracts from the Environment Agency Flood map are located in **Appendix D.**

The Executive Summary within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA from March 2011 provides two paragraphs on Manchester, the latter saying:

*"There is a significant residual risk of flooding from defences overtopping or breaching on the Lower Irwell at Lower Broughton (originating in Salford district) and in extreme flood events from the Grey Irwell. The interactions between different sources of risk are complex, especially between*

*the River Medlock and the Bridgewater Canal. Elsewhere canals are a secondary source of flooding, with the highest potential risk likely to be from a breach on the Ashton Canal."*

The SFRA has assessed the likelihood of strategic development sites passing the "Exception Test". The SFRA presents a summary of flood risk from all sources to groups of strategic sites, referred to as "Strategic Locations", which has been summarised below for the area relevant to this project;

| | | |
|---|---|---|
| Eastern Gateway<br>Sport City<br>Holt Town<br>Chancellors Place<br>Lower Medlock<br>Oxford Road Corridor<br>West Gorton<br>Brunswick<br>Coverdale Crescent/New Bank St | Primary risk from the River Medlock and Corn Brook<br>Secondary risk from canal breach and overtopping, surface water, groundwater and lost watercourses. | Areas of the highest risk within sites affected by flooding from the River Medlock, Bridgewater Canal interactions and Corn Brook should be Sequentially avoided. Development elsewhere should be acceptable on flood risk grounds. Residual risk from extreme events and other sources need to be taken into account when planning developments. |

*Manchester: Regional Centre and Inner Areas South*

Section 2.9 of the SFRA describes flooding along the route of the Medlock. Deansgate is mentioned in the 1 in 1000 year event. The relevant passage of text advises:

*"Downstream of Medlock Bridge flooding will be extensive down to the Bridgewater Viaduct, affecting Corn Street and Deansgate. In a 1 in 1000 year event considering climate change, flooding will become significantly more extensive than the current 1 in 1000 year flood extent at the Industrial Park downstream of the A665 Pin Mill Brow affecting North Western Street and Temperance Street and at the university. Downstream of Bridgewater Viaduct and the Medlock Tunnels flooding on the Lower Medlock is more extensive from the Grey Irwell in a 1 in 1000 year and greater flood events."*

The Medlock summary on page 28 goes on to advise:

*"Flooding in the 1 in 1000 year event… Downstream of Albion Street flood depths of up to 1m are*

*predicted to affect Deansgate and Commercial Street with an associated hazard categorisation of 'dangerous for most'.*

An updated SFRA is understood to be in circulation shortly and may have some additional relevance to the scheme but at the time of writing the new SFRA was not available.

The system of combined drainage serving the immediate area is located in the carriageways of Chester Road, Deansgate and Owen Street. Flooding from the sewers is unlikely due to the presence of the combined sewer overflow to the River Medlock. If surface flooding does occur it will follow the road gradients adjacent to the development, safely passing the access point to the lower ground floor. A footway crossing with a conventional crossfall arrangement ensures that water in the carriageway will flow past the site along existing overland exceedance routes (Appendix J) without causing flood water inundation to the lower ground floor of the development.

According to Buro Happold's Design Note BCG-01, which was prepared to summarise the findings of the ground investigation at the Deansgate South site, the latter having been undertaken by Structural Soils Limited in November/December 2016, the data shows groundwater within the Chester Pebble Beds at BH02. Post fieldwork monitoring data records groundwater within the bedrock at depths ranging between 6.25 m BGL (23.98 m AOD) and 9.06 m BGL (21.17m AOD). Groundwater within the made ground was not recorded, as BH01 and BH03 were dry on the six monitoring rounds.

Based on the current development proposals and the groundwater data reported, it is not anticipated that sump pumping of excavations will be required as groundwater is unlikely to be encountered. However, where more significant water ingress is encountered during excavation, sump pumping or more substantial water control/dewatering measures may be required and appropriate allowances will need to be made.

On the basis of the aforementioned, the site is not prone to groundwater flooding. The highest recorded level of groundwater is 23.98m AOD and this is approximately 4m below the proposed lower ground floor level of the development at 28.10m.

The tank room basement has a level of 24.45m. This area is fully contained within the footprint of the building and specialist structural waterproofing details will protect it from ground water ingress.

# 5.0 PROPOSED SURFACE WATER DRAINAGE

Based on the above commentary, the site is in Flood Zone 1 with very low risk of flooding from rivers or the sea. It will not be affected by groundwater flooding nor local sewer network flooding. The 2015 consented scheme was permitted to have a surface water discharge to the combined sewer in Deansgate. In that scheme the discharge rate was set at 50% of the brownfield runoff rate.

In accordance with United Utilities response to the pre development enquiry, surface water discharging from the site would now be required to follow the surface water hierarchy in line with Government Guidance on flood risk and coastal change, stating that generally the aim should be to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

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.

It was agreed that infiltration was ruled out by United Utilities due to ground contamination and with regard to buildability the full site footprint of the pile cap makes infiltration impractical. Therefore the next method, in line with the surface water hierarchy is to discharge into the River Medlock, the highway drain or the combined sewer.

United Utilities has requested a review of a potential connection direct to the River Medlock. The option of discharging surface water runoff directly into the River Medlock does not appear viable. There are two roads leading from the proposed development site, one in the direction of the Bridgewater Canal and one in the direction of the river. The first road, Bridgewater Viaduct, is a brick arched highway bridge structure and it would be compromised by any retrospective drainage works to construct drainage to a discharge point into the Bridgewater Canal beneath. The second road, Deansgate, has drainage already installed, along with a variety of mains services. Constructing a new drainage system here would require diversions, third party land consents, and consent to construct a new outfall into the River Medlock

adjacent to the existing CSO outfall. As with the Bridgewater Viaduct, there is a highway bridge structure that will be compromised by any drainage works through it, to gain access to the river. In addition to this, directly downstream of any potential outfall on the river lies a flood defence mechanism and consent to discharge upstream of this structure could have implications.

The Environment Agency has been consulted and has stated:

*"…we do not consider the construction of an outfall into the river near that location viable, as it would be facing upstream and we have an access ramp alongside the newly constructed wall by Renaker who have been re-developing the plot of land located south of the river."*

A copy of the Environment Agency's email has been provided in **Appendix E.**

Having established that a connection to the surface water body is proven unfeasible, United Utilities would then require an investigation into discharging surface water from the proposed development into a highway drain by contacting the relevant Highway Authority. Evidence would be required to prove that this method is not possible before connection to the public combined sewer will be allowed. The highway authority has been contacted and has stated that:

*"Unfortunately, the information and records you have requested is not available therefore, to ascertain any drainage connections etc. you will have to arrange for surveys to be undertaken."*

This response raises the possibility that there may be no highway drainage in the area, making it more likely that a connection to highway drainage may be evidenced as not possible. United Utilities would then need to consider a connection to the combined public sewer south of the site. The previous FRA from 2015 did not identify the presence of highway drainage in the area nor did it suggest a highway drainage connection. The CCTV drainage investigation undertaken in 2020 found that the majority of the road gullies had blocked connections and that it was not possible to trace most connections through to a carrier drain. Therefore, at the moment there is no evidence to show whether or not a highway drain is present in the area.

For a site to be considered as brownfield, it would have to have been previously developed and been demolished within the last 12 months and continue to pay surface water charges or be a currently developed site with an operational drainage system, none of which apply to this site. As such a greenfield scenario would apply to this site. Regarding the discharge rate, United Utilities would accept a proposed

restricted discharge rate of 5.0 L/s and correspondence to this effect can be found in **Appendix E.**

The previous Flood Risk Assessment undertaken in 2015 identified a proposed site connection to the existing manhole 2403 on the combined sewer in Deansgate near Owen Street, at a maximum flow rate of 11.8 L/s based on a 50% reduction in the rate of surface water runoff from the site.

For the currently proposed development the surface water drainage connections from the lower ground floor level will incorporate a non-return valve and a trap against odours. A proposed 18m$^3$ surface water detention tank and separate flow control chamber will be located below the ground floor slab and will provide the necessary surface water detention volume to attenuate flows to 5.0 L/s. The surface water detention tank will incorporate an emergency overflow pipe connected to the basement water supply tank room. Any overflow will discharge into floor gullies within the basement and be pumped into the drainage system using the pump provided for periodic water tank drain down operations. This process is described later in this document under the section, 'Proposed Foul Water Drainage'. United Utilities records included within the previous FRA show existing sewers with two MH numbers 2401 and 2403 (nearest the development) whose details are as follows:

| Manhole | Cover Level | Invert Level | Depth |
|---|---|---|---|
| 2401 | 29.43 | 26.45 | 2.98 |
| 2403 | 29.24 | 23.16 | 6.08 |

These depths were not recorded on the topographical survey because, as is often the case, the surveyor was unable to lift the manhole covers to gain access to measure the depth inside. The deeper chamber is nearer the site and at an invert of approximately 23.16m. This is deep enough for a gravity connection and may be constructed to include a backdrop connection. The previous drainage strategy from 2015 identified the same point of connection from the site. An email from Waste Water Developer Services at United Utilities on 1st July 2022 confirmed the deeper chamber as the point of connection to the combined sewer within Deansgate Road and an agreed surface water discharge rate of 5 l/s. Therefore, no further CCTV is required in order to determine a point of connection or to progress the discharge of surface water, Planning Condition 12 - correspondence to this effect can be found in **Appendix E.**

The building and its roofs will occupy most of the site with small areas of paving around the perimeter

at ground level including an access area to the rear doors. All roof water flows will be collected into the building drainage system and into the 18m$^3$ capacity detention tank. The access area to the rear doors which will be permeably paved with a controlled outlet, will connect to the piped drainage downstream from the detention tank and flow control device.

Rainfall from the small areas of paving around the perimeter will be collected into the piped drainage serving the permeable paving so that both sets of flows pass the same flow control. A plan of the proposed lower ground floor drainage layout can be found in **Appendix F**.

The scheme is able to accommodate an area of extensive green roof and blue roof detention cells at the top of the building, partly sharing the mechanical and electrical plant area. Although infiltration is not possible, attenuation is possible at roof level, as is treatment and evapotranspiration characteristics of extensive green/blue roofs, the latter being the only available means of reducing runoff volume for the 1 in 100 year, 6 hour event. This green/blue roof area will provide interception to treat rainwater and may be further developed to reduce the rate of discharge from the top of the building and the size of the surface water detention tank below the ground floor. However, at present the surface water detention tank has been scaled to meet, in full, the site attenuation requirement to ensure against flooding during a 1 in 100 year event with allowance for 40% climate change. A plan and a selection of green/blue roof details can be found in **Appendix G**. A set of surface water drainage calculations can be found in **Appendix H.**

# 6.0 PROPOSED FOUL WATER DRAINAGE

The foul water discharge from the building will be collected using internal pipework above ground in accordance with plans developed by the Building Services Engineer. Once at lower ground floor, the discharge will connect to the foul sewer via a gravity lateral connection. The foul drainage will connect to the same sewer that will provide a surface water point of connection inclusive of an anti-backflow valve and odour trap. United Utilities has provided written confirmation that the foul drainage flows can discharge to the sewer system. Correspondence to this effect can be found in **Appendix E.**

The estimated foul flow rate for the development is based on the number of students in residence when

the building is at full capacity (509 people) at a flow rate of 120 L/person/day spread over 24 hours, with a peaking factor of 6x the average flow rate to account for times during the day when the facilities are at their busiest. The calculation is provided in **Appendix I** and this results in an average flow rate of 0.71 L/s and a peak foul flow rate of 4.24 L/s. The overall daily volume of foul discharge is 61.08$m^3$.

The lower ground floor of the building is allocated as service area facilities and includes bin storage, cycle storage, an electrical sub-station and a stair/lift core. Pedestrian circulation, an escape route and an access stairway to the basement tank room are included. Floor gullies connected to the foul drainage are the only foul drainage outlets on the lower ground floor (LGF). These LGF outlets may require their own non-return valves depending on the final configuration of the proposed foul drainage. The rest of the building, from ground floor upwards will be able to connect through to underground drainage and into the existing drainage system by gravity with sufficient elevation to avoid a backflow situation from occuring. The scheme will comply with Building Regulations Part H where it stipulates the relationship between the height of branch connections in multistorey buildings and the provision of separate underground foul drainage within the building curtilage that connects to external drainage.

The basement level incorporates a wet riser tank room for the sprinkler tank and the potable water supply tank. The floor incorporates four floor gullies connected to a pump to remove water from the basement including water from periodic tank drain down operations and from surface water inundation from the detention tank overflow pipe. The M&E engineer will advise on the required pump rating and this will be discussed with Waste Water Developer Services to ensure pumping operations are acceptable and within the capacity of the receiving drainage system.

# 7.0 SUMMARY

The site, with an area of 620m$^2$ has seen previous development at least from 1851, and from historic maps this appears to be on a small to medium scale basis, but details are not known as the site is vacant. The area is fully hard surfaced and three rain gullies appear to currently drain most of the area. A proposed discharge rate has been agreed with United Utilities of 5.0 L/s. This is a 57% betterment compared with the 2015 approved scheme discharge rate of 11.8 L/s.

An existing network of combined flow sewers is present on the south side of the development. At the junction of Deansgate and Owen Street the sewer is connected to an overflow drain that takes surcharging flows directly to the River Medlock but this overflow pipe is not available for a connection from the development due to a flow levy charged by the Environment Agency. The depth of the existing sewers is 6.08m.

The Environment Agency's flood maps show that the site lies within Flood Zone 1 (less than 0.1% annual probability of flooding) but is directly adjacent to land classed as Flood Zone 2 and 3 crossed by the Viaduct. Groundwater is approximately 4m below the existing site level and poses little or no risk to the development. Sewer surcharging levels are not known but may pose a risk to the lower ground floor of the development but there is a combined sewer overflow in place and United Utilities have confirmed that this removes any risk of flooding from the sewer. The level is to be confirmed but this overflow would mitigate any surcharge.

We have reviewed United Utilities hierarchy for the surface water connection and there is unlikely to be a soakaway solution for the scheme and no means of connecting to the Bridgewater Canal / River Medlock due to underground obstructions. Additionally this correlates with the advice from the Environment Agency who provide reasons why they would not wish to see a new outfall in the complex area where the River Medlock approaches and passes under Deansgate. Instead, the surface water discharge connects to the existing combined sewer adjacent to the development. This is in line with the 2015 approved scheme.

The proposed surface water drainage includes an 18m$^3$ detention tank under the ground floor slab to attenuate flows. The scheme can accommodate areas of extensive green/blue roof detention cells at the top of the building, partly sharing the mechanical and electrical plant area and this would provide interception, attenuation and evapotranspiration prior to discharge into the building rainwater

system.

The 18m$^3$ tank is large enough to deal with all attenuation from the roof, so that the roof SUDS can be green only.

Proposed foul drainage is based on 120 L/day per student, spread over 24 hours, with a peaking factor of 6x the average flow rate to account for times during the day when the facilities are at their busiest. The average flow rate is 0.74 L/s and the peak foul flow rate is 4.45 L/s. The overall daily volume of foul discharge is 64.08m$^3$.

United Utilities have provided written confirmation that the foul drainage flows can discharge to the sewer system.

Report prepared by: -
**ON BEHALF OF SHEAR DESIGN LTD**



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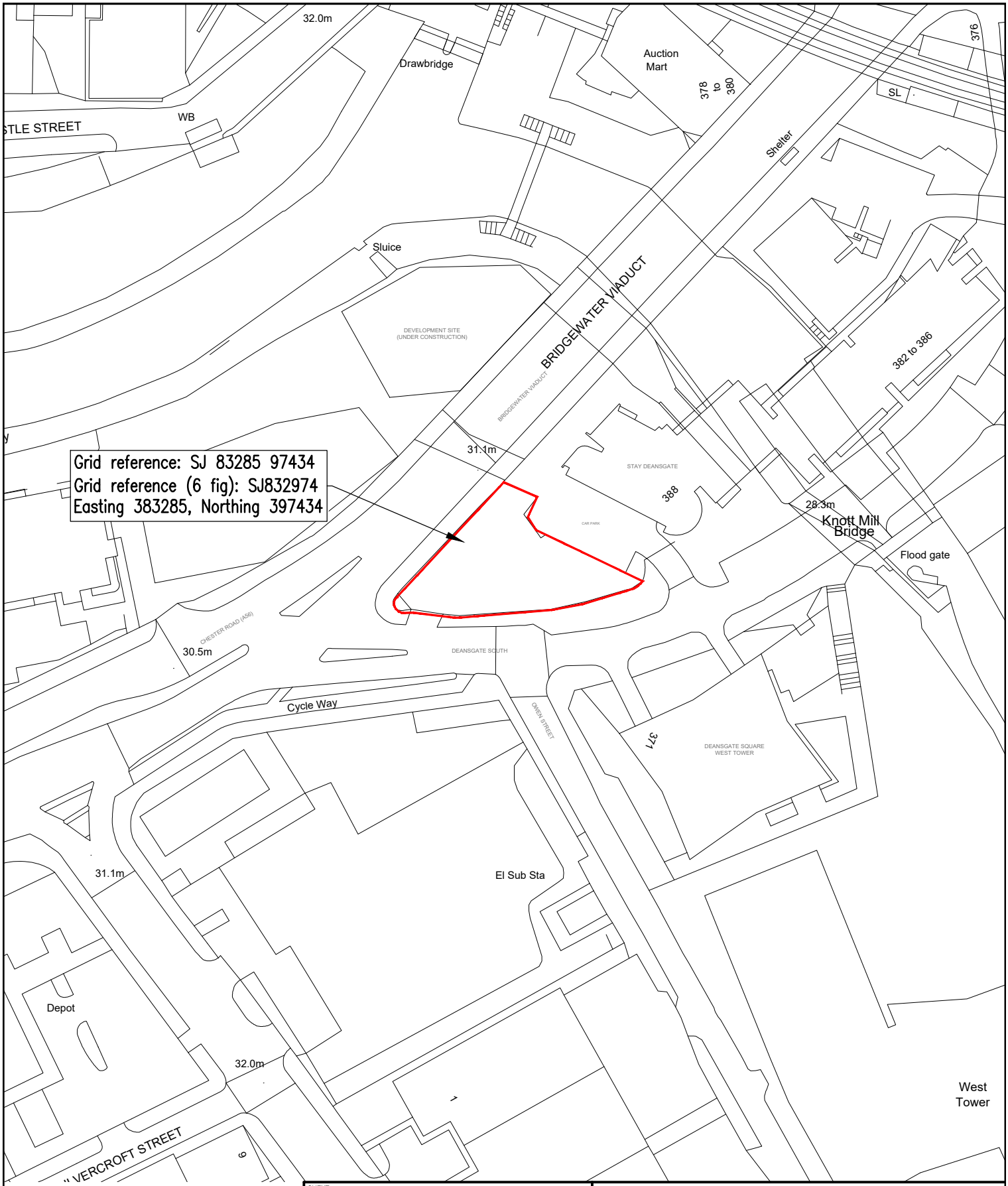
Approved by: -
**ON BEHALF OF SHEAR DESIGN LTD**



**DARREN BADHAM**
**DIRECTOR**

# *APPENDIX A*

## *SITE LOCATION PLAN*




| REV | DATE | DESCRIPTION |
|---|---|---|
| AMENDMENTS | | |

CLIENT: FUSION STUDENT ACCOMMODATION

PROJECT: DEANSGATE SOUTH MANCHESTER

TITLE: LOCATION PLAN

| DRAWN: | TU | DATE: | DEC 2020 |
|---|---|---|---|
| CHECKED: | SJM | SCALE: | 1:1000 @ A4 |

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STATUS KEY: I = INFORMATION P = PRELIMINARY A = APPROVAL CO = CONTRACT T = TENDER C = CONSTRUCTION AB = AS-BUILT

| STATUS: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| I | 20047-100 | - |

# *APPENDIX B*

## *TOPOGRAPHICAL SURVEY WITH GROUND RADAR UTILITY SURVEY*

Original Drawing Size: A0

GRID NORTH

NOTES:-
The accuracy and content of this drawing are dependent on the original specification and EDI should be consulted before use at other scales.

Where underground services are shown, all reasonable care has been taken within the width of the original specification and requirement. Before use of this information the user should verify its accuracy, relevance and completeness for their purposes and should not rely on detail before undertaking any works. Due to the nature of this work and limitations imposed by ground conditions and the detection equipment no guarantee can be given that all services have been recorded. Trial holes should be dug at critical locations.

All reasonable care has been taken in the survey detail represented on this drawing but any discrepancies must be reported to EDI immediately.

Our aim is to produce the best possible results within the specification and cost constraints of our clients. Any comments are most welcome.

Levels shown at kerbs are channel level unless stated.

LEGEND

Features:
AV Air Valve
AB Air Brick
BO Bollard
BH Borehole
BM Bench Mark
BP Boundary Post
BT Box Tank
BT Brit Telecom
CL Cover Level
CO Column
CTV Cover TV Duct
DCH Drainage Channel
DF Drinking Fountain
EM Electric
DL Drop Kerb
DPC Damp proof Course
EP Edge of Path
EX Excavation Joint
FB Farm Box
FH Fire Hydrant
FM Fire Main Riser
FO Flagstaff
GV Gas Valve
GV Gas Valve
IC Inspection Cover
KO Kerb Opening
KM Junction Box
KO Kerb Outlet
LB Light Box
LBX Litter Bin
LLP Low Level LP
LP Lamp Post
MP Marker Post
MB Mile Stone
OP Open Pit Telecom
OHL Overhead Line

OP Overflow Pipe
PB Parking Meter
PP Power Pole
RAD Radiator
RL Reading Lab
RP Reflector Pole
RS Road Sign
RSD Roller Shutter Door
SP Soil Pipe
SD Service Duct
SV Stop Valve
TCB Telecom Cat1 Box
TP Telegraph Pole
TS Traffic Signal
TL Traffic Light
UNK Unknown
UR Urinal
VT Vent to Ift
V Vent
VP Vent Pipe
WM Water Meter
WO Wash Out
WP Waste Pipe

Building Level Details:
D Door
GL Ground Level
FFL Floor Level
FRL Flat Roof Level
PL Parapet
PFL Parapet Level
RL Ridge Level
SL Sill Level
SP Springer of Arch
TA Top Of Arch
W Window
FF.CL Ceiling/Beam Soffit

Boundary Details:
BW Barbed Wire
CB Close Boarded
CH Chainlink
CI Corrugated Iron
CP Concrete Post
IR Iron Railing
IN Intersection
PA Palisade
PAL Palisade
PW Post & Rail
RW Retaining Wall
TW Timber Knee Rail
WF Wattle/Hurdle Fence
WW Wire Mesh Fence
WWF Wire Mesh Fence

Surfaces & Finishes:
BI Brickwork
CB Concrete Block
CO Concrete
CLT Ceiling Tile
GL Glass
GPS Grasscrete Paving Slabs
CPT Carpet Tiles
QT Quarry Tile/Tiler
CT Ceramic Tiles
FT Floor Tiles
PT Painted
L Linoleum
P Plaster
PAV Paved Pastore
S Steel Kerb
T Tarmac
TPP Tactile Paving Paving
VT Vinyl Tiles

Services:
CATV cables
CCTV cables
Data cables
Electric cables
Foul sewer
Gas pipes
Heating duct
Service ducts
Storm sewer
Telecom cab.
Unidentified
Water pipes
Pipe Diameter/Flow
Overhead Lines

Survey Station
Fence
Gate
Painted Road Markings
Edge of Vegetation
Kerb/Drop Kerb
Tree
Trees
Bollard
Building
Overhead Building Detail
Wall

Control: All levels and co-ordinates are related to the datums described.
The horizontal control of this survey is based on Ordnance Survey grid as translated from GPS coordinates using Leica's SmartNet service. We have applied a reverse scale factor to maintain true ground distances, based on station STAA. The vertical control of this survey is based on OS datum as translated from GPS coordinates using the OSGB15 geoidal model and station STAA. Where GPS was not suitable, due to tree cover or closeness to the area which should be disregarded, all levels should be taken from OS survey stations.

This Survey has been carried out to PAS 128 Detention Method M2 Orthogonal search transects at 2m intervals for both Electro Magnetic Location and Ground Penetrating Radar techniques.

The Quality levels achieved are indicated on service lines as B1, B2 B3 or B4.

B1 horizontal location accuracy ±150mm or ±15% of detected dept whichever is greater.
B1 vertical location accuracy ±15% of detected depth.
B1 Is achieved by horizontal and vertical location by multiple geophysical techniques.
B2 Horizontal location accuracy ±250mm or ±40% of detected depth whichever is greater.
B2 vertical location accuracy ±40% of detected depth.
B2 Is achieved by horizontal and vertical location by one of the geophysical techniques used.
B3 horizontal location accuracy ±500mm.
B3 vertical location accuracy undefined (no reliable depth).
B3 Is achieved by horizontal location only by one of the geophysical techniques used.
B4 horizontal location accuracy undefined.
B4 vertical location accuracy undefined.
B4 Is a utility segment which is suspected to exist but has not been detected or taken from records and is an assumed route only.

The services on this survey have been traced using a combination of Radiodetection RD8000 and Leica DS2000 Ground Penetrating Radar. Whilst every effort has been made to trace all services shown, it is not always possible to locate 100% of services without excavation. GPR works well in moist soils which are relatively undisturbed but works poorly in dry soils and soils with high clay content. Where a line has been generally detected or built up, and it also seems better with larger diameter cables and pipes - for example it is difficult to trace small bore connections to individual properties. The RD8000 cannot distinguish between services and will often trace more than one service. Detection of plastic pipes/cables adjacent to large mass and can be swamped by radiation from buildings (when very close to them) or high voltage overhead lines.

Station Schedule

| Station | Easting | Northing | Level | Type |
|---|---|---|---|---|
| 1 | 383302.849 | 397477.915 | 26.834 | HDE Nail |
| 2 | 383324.117 | 397472.879 | 26.076 | HDE Nail |
| 3 | 383326.443 | 397472.629 | 26.006 | HDE Nail |
| 4 | 383259.756 | 397412.085 | 30.879 | Road Nail |
| 5 | 383293.535 | 397447.764 | 31.081 | HDE Nail |
| 6 | 383346.261 | 397535.217 | 31.815 | HDE Nail |
| 7 | 383346.261 | 397535.217 | 31.815 | HDE Nail |
| 8A | 383398.858 | 397427.889 | 30.296 | HDE Nail |
| 9 | 383320.200 | 397470.949 | 25.749 | HDE Nail |

ADDITIONAL LEVELS IN FOOTPATH

SURVEY UNDERNEATH ARCHWAYS

| Rev. | Job No. | Date | Revision Detail | Surveyor | Chkd |
|---|---|---|---|---|---|
| A | 19755 | 09/22 | Additional levels and survey extension | LF | TA |

CLIENT
Fusion Manchester Devco Ltd
1st Floor
506 Centennial Park
Elstree
WD6 3FG

PROJECT
Topographic & Utilities Survey
Deansgate
Manchester
M3 4LB

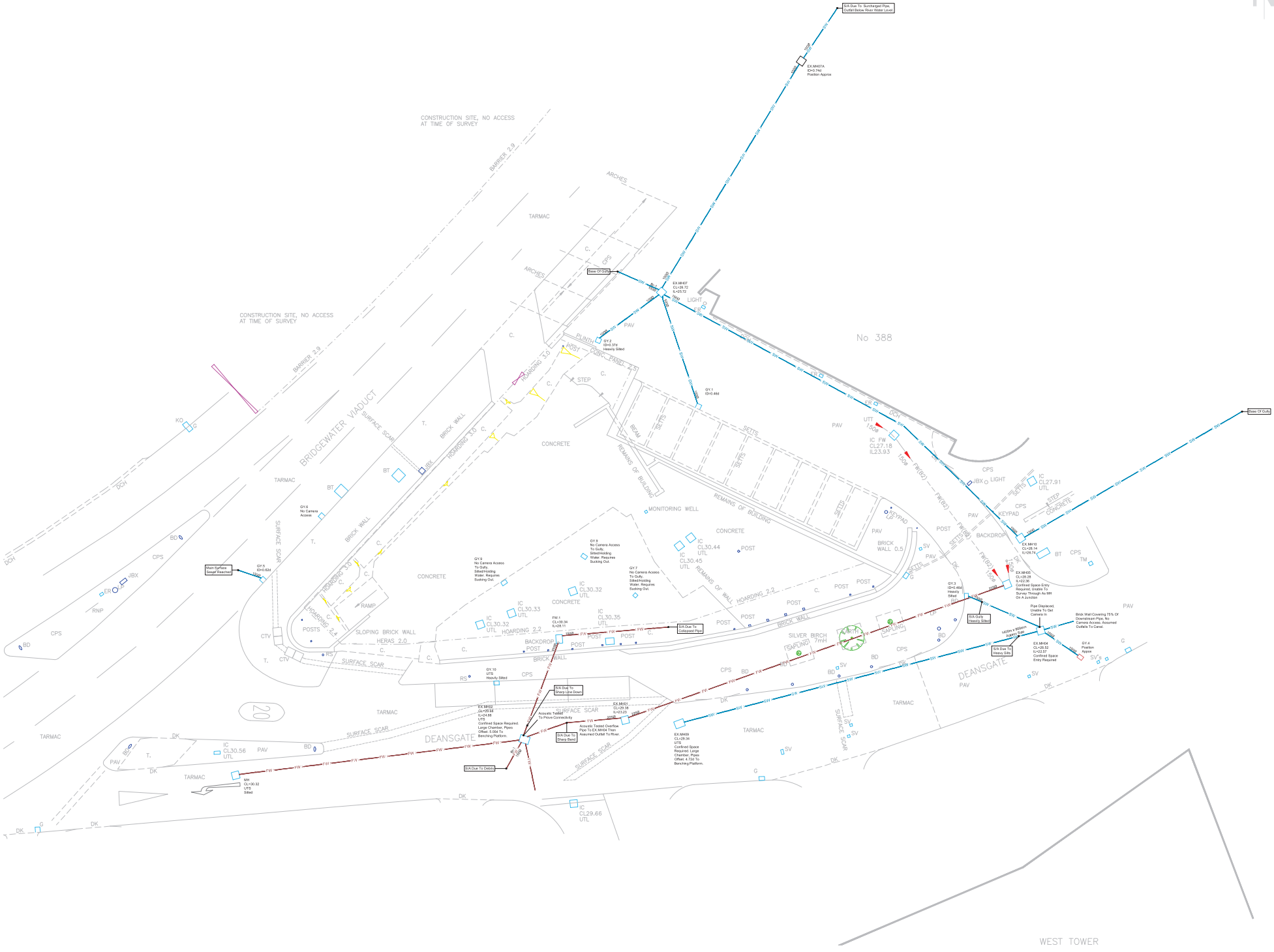
| Job. No. | Surveyor | Checked | Date | Scale |
|---|---|---|---|---|
| 19147 | T.Cosgrove | AR | Nov. 2020 | 1:200 |


EDI SURVEYS LTD
163-165 Ranelagh Road, Ipswich, Suffolk IP2 0AH
Telephone | 01473 211222 Fax | 01473 221660
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DRAWING No. 19147/T/01-01
REV. A

# *APPENDIX C*

## *EXISTING DRAINAGE LAYOUT AND STATUTORY UTILITY RECORDS*




## Notes

Utilities may not show numbers of the survey area. Any points clearly outside of this area are for investigative purposes only and may not represent the complete utility as whole.

Only such surface utility information as provided. Where physical utility information may be shown, where it seems well positioned determining.

**Where sign indicates a utility exists but which cannot be positively confirmed with the appropriate utility company, this is indicated.**

Underline Services: Apart from surface utilities, no private services utility information is held or represented at time of writing, as part of the information services we have a records any such information will be shown on private information requested. Drainage plans should be consulted for completeness of survey.

**Vertical & Horizontal Position** - Vertical position should be in relation to the top of the chamber cover and the invert level of the pipe at the bottom of the chamber, where this is safe to access. Where shown information from the surcharge is unclear, weak or not shown. Chamber entry have been attempted using limestick and the depth indicated could be between the top of the chamber and the invert level of the pipe. It is advisable to the invert of the chamber before use and also invert to be taken as read.

**Warranty** - Any triangulation points are used to mark out the position of the utilities. Before any excavation takes place, the exact position of all utilities should be established. Clear View Surveys extends no guarantee in respect of the accuracy of the plans shown here and that they are not warranted to be free from errors. Clear View Surveys will not be liable for any loss or damage as a result of reference to the survey results.

The drawing shows our principal an electronic representation of the surveyed area. Utilities have been plotted from surface features and manhole covers and the underground may be obstructed, affected by ground, weather and other conditions outside of Clear View Surveys control therefore we cannot guarantee that every utility in the area will be shown on the survey. Whilst every effort to utilities is taken we cannot take total responsibility will be achieved and that appropriate excavation trials will be undertaken prior to any excavation taking place.

Clear View Surveys will not be liable for any loss or damage caused by any interpretation and measurement from the survey and as such cannot be guaranteed. Where services were detected and shown in the above drawings, Clear View Surveys will recommend that only trial excavations are undertaken by hand or by other approved safety methods to confirm their exact nature. These trials are the responsibility of the client.

**Interpretation of the information provided by a utility survey and utilities plans.** Information provided by Clear View Surveys is interpreted in accordance with the guidance given in PAS 128 Guidance - HSG47 Avoiding Danger from Underground Services.

## Additional Notes:

1. The correct identification of the utility types can not be 100% guaranteed, therefore these should be independently verified prior to use in any design or building work.
2. Where chambers and levels are assumed to be cement, but due to non entry of the inspection chambers, these should be verified before any works commence.
3. All dimensions are in metres.
4. All spurious values are in millimeters.
5. Information provided should not be altered. It should not be used for any purpose other than that for which it was originally intended without the express written consent of Clear View Surveys.
6. Clear View Surveys will not be liable for any loss or damage as a result of fabrication, construction or excavation.
7. Any Levels shown on the drawing are indicative only and are in an approximate position.
8. Water Traps Supplied By Client. Accuracy of this cannot be guaranteed as it was not undertaken by Clear View Surveys.

## Key:

| | | |
|---|---|---|
| **STREET FURNITURE** | **UTILITY SUPPLY** | **SURFACE FEATURES** |
| BB Bollard Beacon | E Electricity | AC Access Cover |
| BH Bollard Heritage | GAS Gas Main/Valve | B Bollard |
| BL Bollard Light | TEL Telephone Line | CB Concrete Bollard |
| BS Bollard Stainless | C Cable | CBS Concrete Bollard Stump |
| CCTV CCTV Camera | CH Cable Duct | CC Concrete Cover |
| CP Control Point | TV Cable TV | CH Chamber |
| CPT Control Panel Traffic | FO Fibre Optic | CP Control Point |
| CS Control Box | TL Traffic Control | DC Drain Cover |
| FB Flood Beacon | W Water Main | DP Down Pipe |
| FP Flood Pole | WV Water Valve | EC Electric Cover |
| G Guard Rail | WH Water Hydrant | EP Earth Point |
| GT Guard Rail Terminal | WM Water Meter | G Gas Valve |
| H Handrail | WT Water Tank | GC Gas Cover |
| HP Hydraulic Post | WW Water Well | GT Gas Tank |
| L Lighting | SW Storm Water | H Hydrant |
| LC Lighting Column | FW Foul Water | HC Hydrant Cover |
| LP Lighting Post | CW Combined Water | HP Hydrant Post |
| LT Lighting Tower | SD Soil Drain | IC Inspection Cover |
| M Meter | SP Soil Pipe | LC Lantern Cover |
| MH Manhole | SV Soil Vent | LP Lantern Pole |
| P Post | V Vent | M Manhole |
| PB Pedestrian Barrier | VP Vent Pipe | MC Manhole Cover |
| PC Pedestrian Crossing | | MH Manhole |
| PL Pedestrian Light | **TRADES & MISC.** | MP Marker Post |
| PO Pedestrian Push Button | AP Air Pipe | PC Pedestal Cover |
| PP Pedestrian Post | BH Bore Hole | PL Pedestal |
| R Rail | BP Boiler Plant | SC Stopcock Cover |
| RS Rail Signal | CP Compressed Plant | SP Stop Valve |
| SC Rail Switch Control Box | CT Compressed Tank | SV Sluice Valve |
| SL Rail Switch Lever | CV Compressed Valve | TC Traffic Control Equipment Cover |
| SM Rail Switch Motor | DP Drain Point | TP Traffic Control Equipment Post |
| TB Traffic Light Control Box | GP Gas Plant | TS Traffic Control Equipment Cover |
| TL Traffic Light | GT Gas Tank | UC Unidentified Equipment Cover |
| TP Traffic Light Control Box | GV Gas Valve | UP Unidentified Equipment Post |
| TS Traffic Sign | HP Hydraulic Plant | VC Valve Cover |
| TSB Traffic Sign Bollard | HT Hydraulic Tank | WC Water Cover |
| TSG Traffic Sign Gantry | MP Meter Point | WP Water Post |
| | OP Oil Plant | |
| **PIPES & DUCTS** | OT Oil Tank | **SURFACES** |
| CD Cable Duct | PP Petrol Pump | BRK Brick Paving |
| CDC Cable Duct Cover | PT Petrol Tank | CON Concrete |
| DP Drain Pipe | SP Sump | CP Concrete Paving |
| DT Drain Tank | TP Tank Point | CPS Concrete Paving Slab |
| DW Drain Weir Plate | TV Tank Vent | CS Concrete Slab |
| DWC Drain Weir Chamber | VP Valve Point | DC Drain Cover Slab |
| DWP Duct Warning Plate | WP Water Point | DK Dock |
| FP Foul Pipe | | G Grass |
| GP Gas Pipe | **SURVEY CONTROL** | GR Gravel |
| LP Land Drain Pipe | CP Control Point | PAV Paving |
| MP Main Pipe | FB Flood Beacon | SET Setts |
| SP Soil Pipe | FP Flood Pole | TAR Tarmac |
| SW Storm Water Pipe | HP Hydraulic Post | TS Traffic Sign |
| VP Vent Pipe | MP Marker Post | |
| WP Water Pipe | OTB Ordnance Bench Mark | **MISCELLANEOUS** |
| | PP Pedestrian Post | BUS Bus Stop |
| | RP Reference Point | CAR Car Park |
| | TSB Traffic Sign Bollard | CAV Caravan Site |
| | | FBH Flood Hydrant |

## Linetype Key:



| Rev | Date | Notes | By |
|---|---|---|---|
| | | | |

THIS AREA IS ALLOCATED TO SHOW SHEET LOCATION OF THE WHOLE SITE IF BROKEN DOWN INTO MULTIPLE SHEETS

CLIENT
Shear Design Ltd

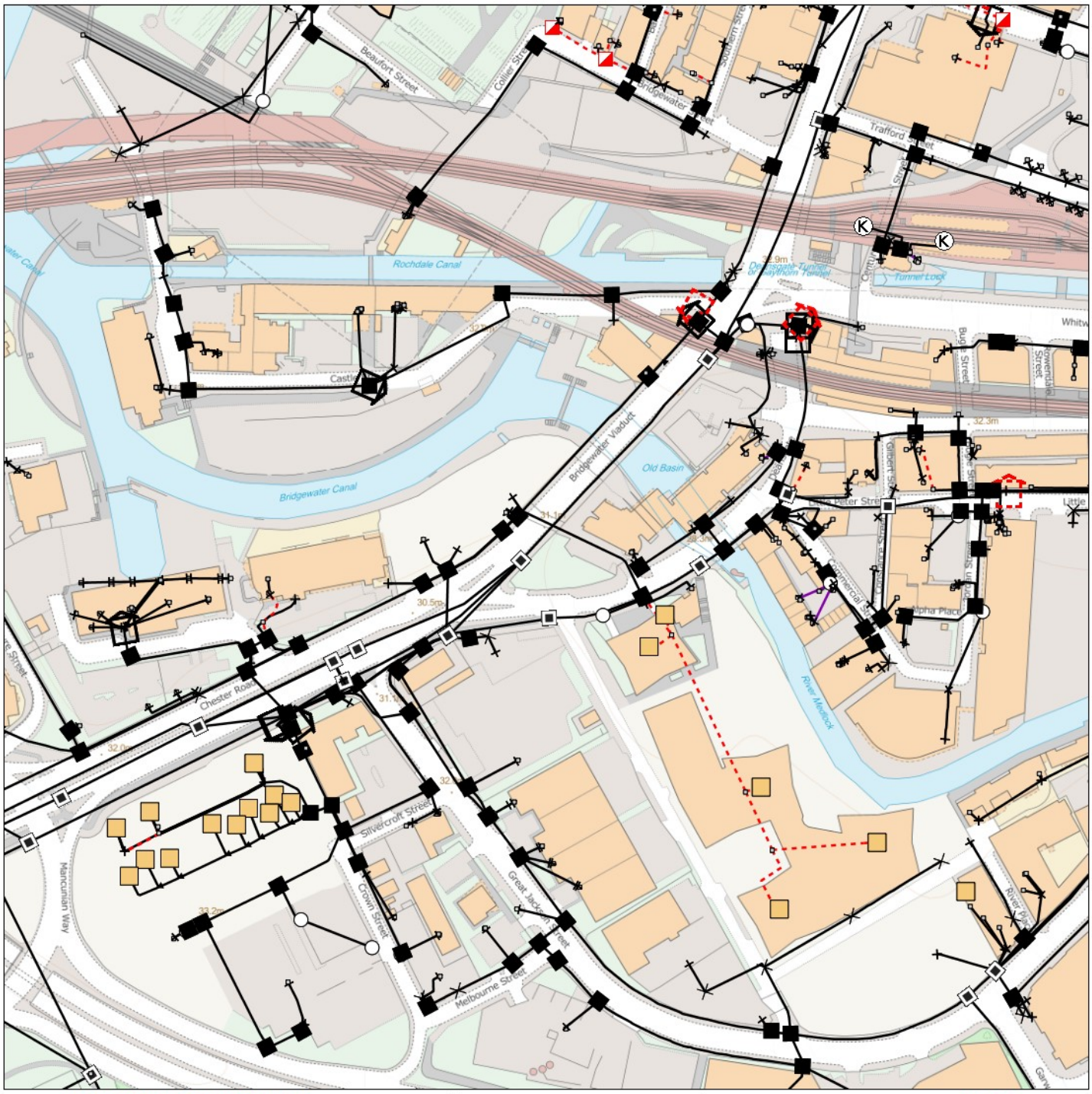
SITE
Deansgate/Chester Road
Manchester

DRAWING TITLE
CCTV Drainage Survey

| PROJECT NUMBER | DRAWING NUMBER | DATE |
|---|---|---|
| 12989 | 12989-F | JAN 2021 |
| SURVEYED BY | DRAWN BY | CHECKED BY |
| JM | DG | AG |
| SCALE | SHEET SIZE | SHEET |
| 1:100 | A0 | 1 of 1 |


CLEAR VIEW
UNIT 30L, OLD BARN FARM ROAD
WOOLSBRIDGE INDUSTRIAL PARK
THREE LEGGED CROSS, WIMBORNE, BH21 6SF
T 01202 825031
F 01202 824777
E info@clearviewsurveys.co.uk
W www.clearviewsurveys.co.uk

# Maps by email Plant Information Reply




## IMPORTANT WARNING

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

openreach

### CLICK BEFORE YOU DIG

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

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED
(Office hours: Monday - Friday 08.00 to 17.00)
www.openreach.co.uk/cbyd

### Accidents happen

If you do damage any Openreach equipment please let us know by calling 0800 023 2023 (opt 1 + opt 1) and we can get it fixed ASAP

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### KEY TO BT SYMBOLS

| | Planned | Live |
|---|---|---|
| PCP | | |
| Pole | | |
| Box | | |
| Manhole | | |
| Cabinet | | |

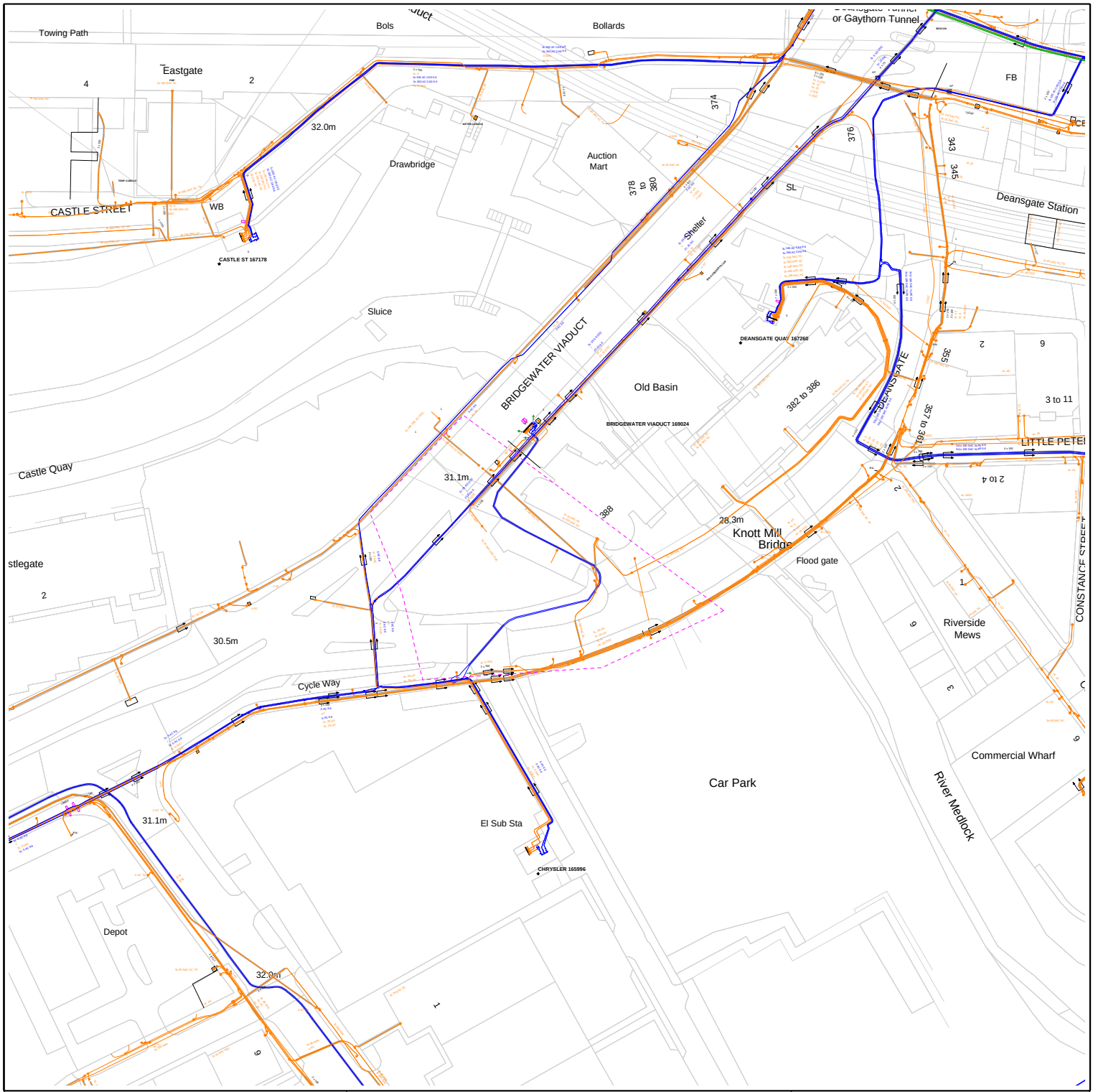
| | | | |
|---|---|---|---|
| Change Of State | + | Hatchings | |
| Split Coupling | × | Built | |
| Duct Tee | ▲ | Planned | |
| Building | | Inferred | |
| Kiosk | Ⓚ | Duct | |

Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

| | Pending Add | In Place | Pending Remove | Not In Use |
|---|---|---|---|---|
| Power Cable | | | | |
| Power Duct | | | | N/A |

BT Ref : SBM10288C
Map Reference : (centre) SJ8328997439
Easting/Northing : (centre) 383289,397439
Issued : 30/06/2020 10:29:03

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk




Requested by: Lindsey Eccleston

Company: Ameon Utilities Ltd

Date Requested: 30/06/2020

Job Reference: 19249217

Your Scheme/Reference: Bridgewater Viadu

Dig Sites:

Area Line

| Operating Voltage | Colour Code | Line Colour |
|---|---|---|
| 132kV | Black | |
| 33kV | Green | |
| 22kV-25kV | Yellow | |
| 11kV | Red | |
| 6kV-6.6kV | Blue | |
| 1kV-6kV | Violet | |
| LV | Orange | |
| Unknown Voltage | Brown | |


Data Management
Electricity North West
Linley House
Dickinson Street
Manchester, M1 4LF
Phone: 0800 195 4141
Email: planrequest@enwl.co.uk


Scales on A4 paper:
1:1250 Area dig site
1:250 Line dig site


Unless otherwise indicated the depth of Electricity North West Limited cables are in accordance with NJUG (450mm for Low Voltage & 600mm for 11kV cables) 33kV and 132kV cables are laid at depths as marked. The depth and positions of Electricity North West Limited equipment was accurate as shown when the equipment was installed. However third parties may have altered the level & other reference data. Therefore Electricity North West Limited accept no responsibility for the position of Electricity North West Limited equipment being different from shown. No person, body or company, shall be relieved from liability for damage caused to Electricity North West Limited equipment by reason of being located differently to the indications on this drawing. Service cables are not necessarily shown but must be assumed to exist to all premises, streetlights and signs. There may be other Electricity North West Limited apparatus in the vicinity which is not indicated on the cable records. Other apparatus may also be present which is owned by a third party other than Electricity North West Limited.

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Reference should be made to HSE Guidance, HS(G)47 "Avoiding Danger from Underground Services" and GS6 "Avoidance of Danger from Overhead Power Lines".

Electricity North West Limited 304 Bridgewater Place, Birchwood Park, Warrington WA3 6XG. Registered in England and Wales. Registered No 02366949


NWGD175355
NWGA210764 In Planning
0081951
0114888
0016629
0060775
0029698
0044336
0015095
0041695
0062989
2074286
0085081
0135795
NW3117718
0024003
0104640
0129018
0011432
NWGD185496
In Planning
in Design
Jacksons Wharf (PH)
Drawbridge
Castle Quay
Castlegate
Bridgewater Canal
Castle Field Coal Wharf
Car Park
Sluice
Old Basin
Bridge
Flood gate
Commercial Wharf
Depot
El Sub Sta
Cycle Track
Towing Path
Tunnel
Viaduct
Bass Warehouse
Eastgate
Dukes 92
Mart
Works
Club
Line of Posts
JOINTS A-B ENCAPSULATED
BRIDGEWATER VIADUCT
CHESTER ROAD
BLANTYRE STREET
ALPHA PLACE
WHITWORTH STREET WEST
River Medlock
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# United Utilities Maps for SafeDig

| | |
|---|---|
| **Date :** | 30/06/2020 10:00:53 |
| **Centre X:** | 383287 |
| **Centre Y:** | 397391 |
| **Scale :** | 1000 |
| **UserName:** | A430NDU |

## Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

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United Utilities
Water for the North West

# United Utilities Maps for SafeDig

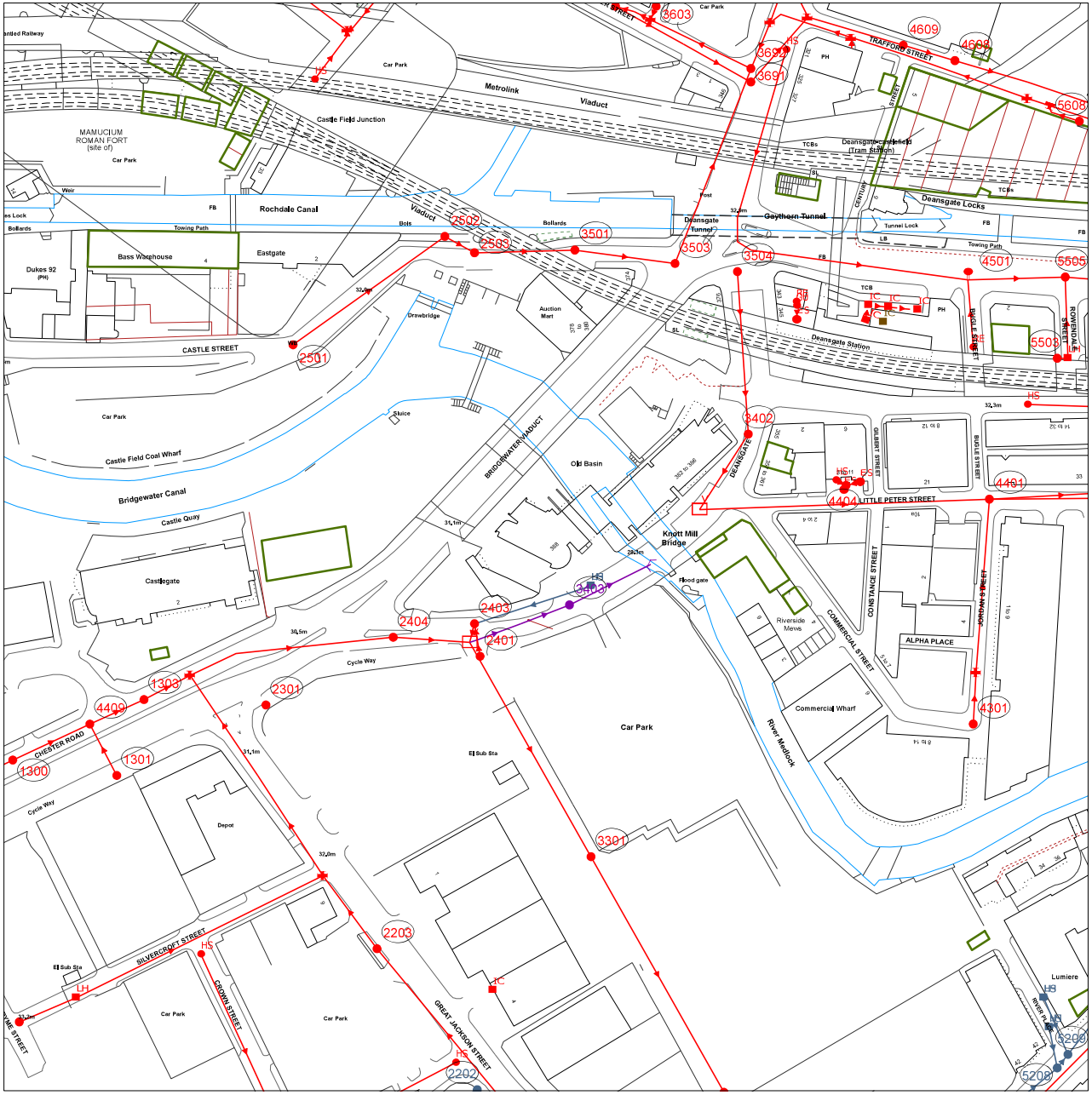
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|---|---|
| Date : | 30/06/2020 10:00:53 |
| Centre X: | 383287 |
| Centre Y: | 397391 |
| Scale : | 1000 |
| UserName: | A430NDU |

## Extract from maps of United Utilities' Underground Assets

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United Utilities
Water for the North West




| Refno | Cover Func | Invert | Size x/Size y | Shape | Mat | Length | Grad |
|---|---|---|---|---|---|---|---|
| 1302 | OO | | | | | | |
| 1301 | 30,98 | OO | 27,92 | 300 | | CI VC | 21,47 |
| 1303 | | OO | | | | | |
| 2301 | 30,7 | OO | | | | | |
| 2401 | 29,43 | OO | 26,45 | 740 | 600 | EG BR | 6,08 4 |
| 2403 | 29,24 | OO | 23,16 | 225 | | CI VC | 7,14 238 |
| 2404 | 30,4 | OO | | | | | |
| 2501 | 31,09 | OO | 24,95 | 300 | | CI VC | 88,82 299 |
| 2503 | 32,18 | OO | 24,69 | 300 | | CI VC | 37,01 |
| 3402 | 28,41 | OO | 25,86 | 225 | | CI VC | 33,15 104 |
| 3403 | 28,38 | OV | 22,35 | 1380 | 870 | RE BR | 33,54 |
| 3501 | 32,11 | OO | 29,33 | 300 | | CI VC | 37,34 4 |
| 3503 | 32,24 | OO | | | | | |
| 3504 | 31,9 | OO | 30 | 300 | 400 | EG VC | 30,07 15 |
| 4301 | 28,73 | OO | 25,33 | 750 | | CI VC | 19,05 |
| 4401 | 30,31 | OO | | | | | |
| 4404 | | OO | | | | | |
| 4501 | 33,52 | OO | | | | | |
| 5503 | 33,4 | OO | 30,67 | 300 | | CI VC | 34,02 8 |
| 5505 | 33,83 | OO | | | | | |
| 1305 | | OO | 0 | 525 | | CI CO | 21,83 |
| 2407 | | OO | | | | | |
| 3406 | | OV | | | | | |
| 3508 | | OO | | | | | |
| 3507 | | OO | | | | | |
| 4402 | | OO | | | | | |
| 4505 | | OO | | | | | |
| 5402 | | OO | 0 | 600 | | CI VC | 58,03 |
| 1304 | | SW | | | | | |
| 3404 | | SW | | | | | |
| 4303 | | OO | | | | | |
| 5502 | | OO | | | | | |
| 2402 | | OO | 22,78 | 375 | | CI VC | 90,88 198 |
| 3401 | | OO | | | | | |

## 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
Ncn Return Valve
Excent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Cachpit
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

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

**ABANDONED PIPE**
MainSewer
Rising Main
Highway Drain
Sludge Main

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

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 |

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available.
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OS Sheet No:
Scale: 1: 1250 Date: 07/07/2015
35 Nodes
Sheet 1 of 1

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**SEWER RECORDS**

Printed By: Property Searches

**OS Sheet No:**

Approximately Scale: 1: 1250 Date: 07/07/2015

# *APPENDIX D*

## *ENVIRONMENT AGENCY – FLOOD MAPS*

Back

# Learn more about this area's flood risk

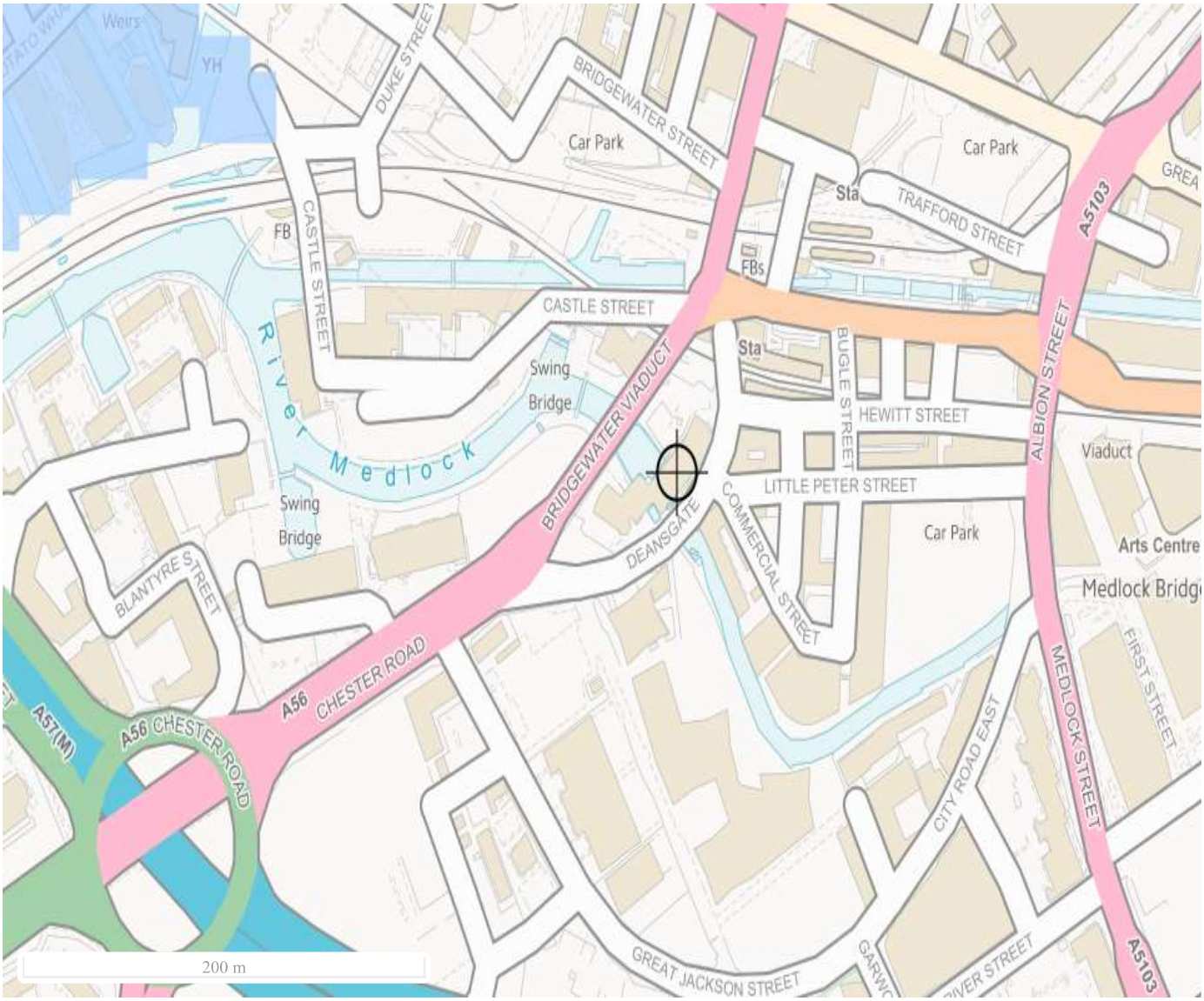
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

Enter a place or postcode




Extent of flooding from reservoirs

Back

# Learn more about this area's flood risk

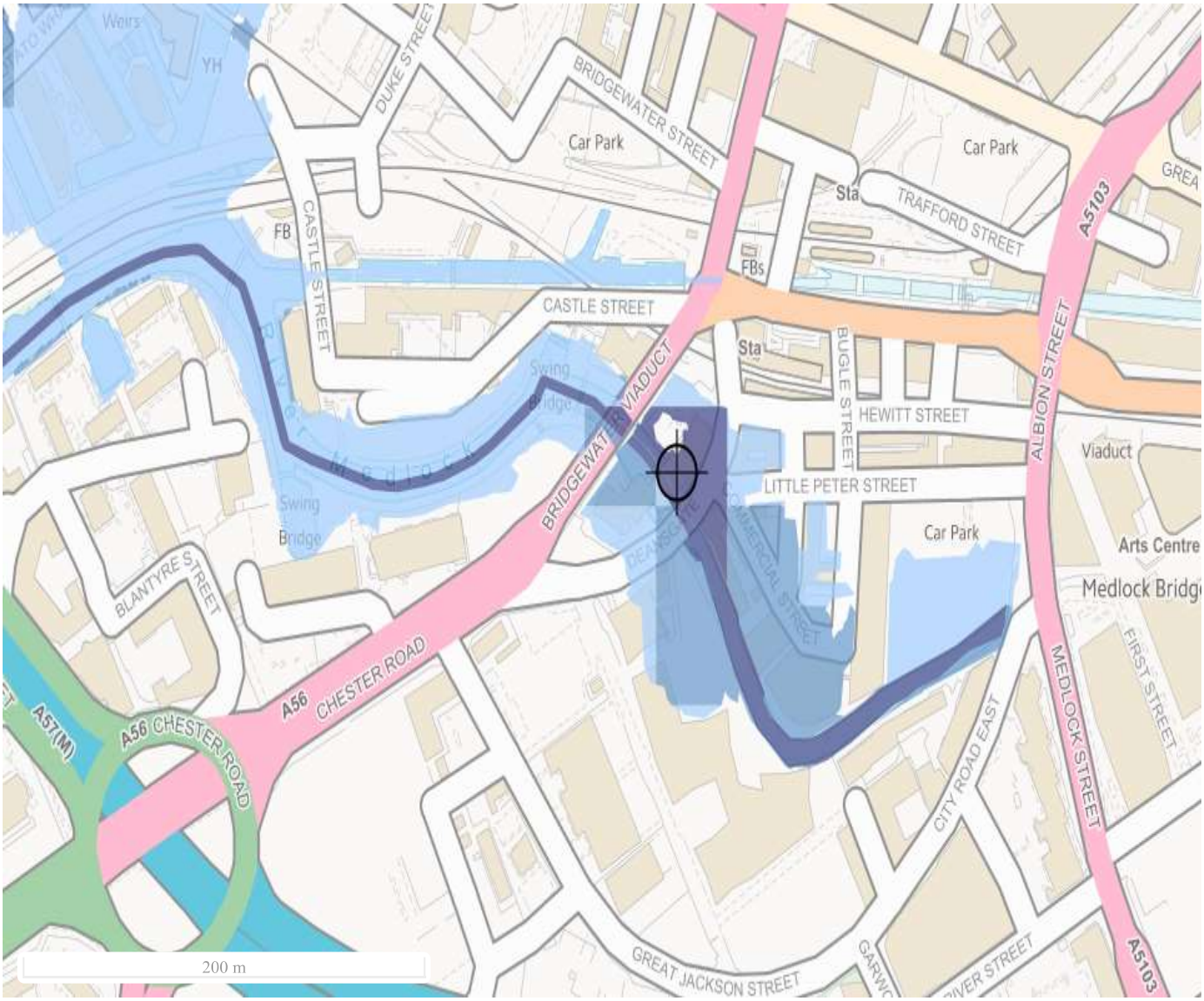
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

Enter a place or postcode




Extent of flooding from rivers or the sea

Back

# Learn more about this area's flood risk

Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

Enter a place or postcode




Extent of flooding from surface water

# *APPENDIX E*

# *CORRESPONDENCE*

## Tara Urding

**From:** Tara Urding
**Sent:** 18 December 2020 11:21
**To:** Tara Urding
**Subject:** FW: 20047 - Deansgate South

---

**From:** Graham Price <g.price@manchester.gov.uk>
**Sent:** 09 July 2020 15:21
**To:** Billy Hayton <Billy@shear-design.com>
**Subject:** Fwd: Fw: 20049 Booth Street - Manchester - Highway Drainage (20049)

Hi Billy,

Please see the email chain below.

Unfortunately the information and records you have requested is not available therefore, to ascertain any drainage connections etc. you will have to arrange for surveys to be undertaken.

Best regards

Graham

---------- Forwarded message ---------
From: **Mike Brogan** <m.brogan@manchester.gov.uk>
Date: Wed, 8 Jul 2020 at 15:51
Subject: Re: Fw: 20049 Booth Street - Manchester - Highway Drainage (20049)
To: Rob Byrne <r.byrne2@manchester.gov.uk>
Cc: Graham Price <g.price@manchester.gov.uk>

Hi Rob,

I'm unable to locate anything for this area.

Michael Brogan
Operations Manager,
Highways,
Neighbourhoods Directorate,
Manchester City Council

Highway Maintenance

Phone: 0161 219 2439 (internal 32439)
Mobile: 07979 242578
e-mail: m.brogan@manchester.gov.uk
www.manchester.gov.uk

Hooper Street Depot,
Off Midland Street,

Ardwick,
Manchester.
M12 6LA

---

On Wed, 8 Jul 2020 at 15:28, Rob Byrne <r.byrne2@manchester.gov.uk> wrote:

> Hi Mike,
>
> Are you aware of any historic drainage records for this location. The only information I have is the location of the surface gullies.
>
> Regards,
>
> Rob Byrne
> Contract Manager
> Highway Services
> Neighbourhoods Directorate
> Block C
> Hooper Street
> Manchester
> M12 6LA
>
> Mob: 07789 984162
> Email: r.byrne2@manchester.gov.uk
>
> Environment on call email: contact@manchester.gov.uk
>
> Web: www.manchester.gov.uk
>
> POSTAL ADDRESS: Highways Service, Growth and Neighbourhoods Directorate, Manchester City Council, PO Box 532, Town Hall, Manchester, M60 2LA

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---------- Forwarded message ---------
From: **Graham Price** <g.price@manchester.gov.uk>
Date: Wed, 8 Jul 2020 at 14:22
Subject: Fwd: Fw: 20049 Booth Street - Manchester - Highway Drainage (20049)
To: Rob Byrne <r.byrne2@manchester.gov.uk>

> Hi Rob,
>
> Hope you and yours are all well?
>
> I've received this enquiry (see below) and wondered if you could help or give me a steer on who might be able to provide the information requested?

From my past experience, I'm assuming they will have to undertake surveys themselves to assess the drainage situation as, if other Authorities are to go by, these records have disappeared over time or there is little information kept on record.

Best regards

Graham

---------- Forwarded message ---------
From: **Billy Hayton** <Billy@shear-design.com>
Date: Tue, 7 Jul 2020 at 16:35
Subject: RE: Fw: 20049 Booth Street - Manchester - Highway Drainage (20049)
To: Graham Price <g.price@manchester.gov.uk>
Cc: Tony Spencer <Tony@shear-design.com>

Hi Graham,

Thanks for getting back to me, much appreciated.

The works are not currently part of an approved planning application. We currently just wish to understand the extent of any highway surface water drainage that may exist in addition to foul system shown on the attached sewer plan?

We have a topographical survey that identifies gullies in the highway but no records the drainage that serves them unless they connect direct to the foul (combined) system?

Anything you can provide us here would be much appreciated.

Thanks in advance,

Kind regards,

**Billy Hayton**

**Project Engineer**

**Shear Design Ltd**

**7 Ashtree Court | Woodsy Close**
**Cardiff Gate Business Park**

**Cardiff | CF23 8RW**

**T: +44 (0)29 2054 7000 M: +44 (0)7979 102252 | F: + 44 (0)29 2054 7001**

**From:** Graham Price <g.price@manchester.gov.uk>
**Sent:** 07 July 2020 12:24
**To:** Billy Hayton <Billy@shear-design.com>
**Subject:** Fwd: Fw: 20049 Booth Street - Manchester - Highway Drainage

Hi Billy,

Are the works you are undertaking part of an approved planning application and, if so, are you undertaking any work on the public highway?

Best regards

Graham

---

---------- Forwarded message ---------
From: <Highways.38.&.278.Agreements.Closure.&.Sign.Agreements/MCC@manchester.gov.uk>
Date: Tue, 7 Jul 2020 at 11:02
Subject: Fw: 20049 Booth Street - Manchester - Highway Drainage
To: <g.price@manchester.gov.uk>

Hi Graham

Please see e-mail chain can you help.

Thanks John
----- Forwarded by John Boardman/Chief.Executives/MCC on 07/07/2020 11:01
---

From: Billy Hayton <Billy@shear-design.com>
To: "'highways278@manchester.gov.uk'"
<highways278@manchester.gov.uk>, "contact@manchester.gov.uk"
<contact@manchester.gov.uk>,
Cc: Tony Spencer <Tony@shear-design.com>
Date: 06/07/2020 15:38
Subject: RE: 20049 Booth Street - Manchester - Highway Drainage

Good Afternoon,

Apologies for chasing but I am yet to receive a response to my email below.

If this requires the attention of an alternative address can the details of
this please be provided so that I can forward on accordingly.

Thanks in advance,

Kind regards,
Billy Hayton
Project Engineer
Shear Design Ltd

7 Ashtree Court | Woodsy Close
Cardiff Gate Business Park
Cardiff | CF23 8RW
T: +44 (0)29 2054 7000 M: +44 (0)7979 102252 | F: + 44 (0)29 2054 7001

---

From: Billy Hayton
Sent: 26 June 2020 09:34
To: highways278@manchester.gov.uk
Cc: Tony Spencer <Tony@shear-design.com>
Subject: 20049 Booth Street - Manchester - Highway Drainage

Good Morning,

I trust you and your colleagues are keeping safe and well.

Firstly please accept my apologues as I understand this unlikely to be 278 related but am hopeful you can forward this onto the relevant body within your team.

We are currently involved with the early stages of a new proposed development of the Gamecock Pub, Booth Street, Manchester.

We have retrieved a full utilities search for the development area and surrounding highways and the only drainage information we have received within the vicinity of the site is foul.

I note on the attached survey there are a number of Gulleys (identified G) along the surrounding highways which presumably are served by a surface water network?

We would therefore be grateful if you could inform us as to whether there are highway drainage records that you have available that may confirm the extent of the surface water drainage in this area.

Thanks in advance for your assistance here, (Embedded image moved to file: pic07609.jpg)

Kind regards,
Billy Hayton
Project Engineer
Shear Design Ltd
7 Ashtree Court | Woodsy Close
Cardiff Gate Business Park
Cardiff | CF23 8RW
T: +44 (0)29 2054 7000 M: +44 (0)7979 102252 | F: + 44 (0)29 2054 7001

## Tara Urding

**Subject:** FW: PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB

**From:** Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
**Sent:** 19 October 2020 17:07
**To:** Hamza Adnany <Hamza@shear-design.com>; Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
**Cc:** Simon Mason <Simon@shear-design.com>; Billy Hayton <Billy@shear-design.com>
**Subject:** PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB

Good afternoon Hamza,

**Pre Development Enquiry for: Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB UU Reference Number : 4200034146**

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

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

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

**Foul Water**

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

Our preferred point of discharge would be to the 225mm diameter public combined sewer within Deansgate located to the South of your proposed development at an unrestricted rate.

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

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

**Surface Water**

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

*Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.*
This is outlined as follows, in order of priority:

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

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

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

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

**Infiltration**

It is noted within the provided ground investigation report the historic use of this site included a petrol filling station and there is current ground contamination within the areas of the former pumps. Therefore, due to existing ground contamination, it is acknowledged that infiltration within the site may not be feasible, but we would request this be deal further with the LLFA who have the ultimate decision with regards to infiltration. I have included the information below for future reference.

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

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

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:
https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs

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

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

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

**Waterbody**

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the open main river located 65m East of the proposed site. It is acknowledged you have provided brownfield runoff rate calculations, we recommend for discharging to a waterbody you discuss discharge rates with the LLFA and/or Environment Agency.

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

**Highway Drainage**

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

**Levels**

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

**Land drainage / Overland flows / track drainage**

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

**Existing Water Assets Crossing the Site**

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:
https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/

**Connection Application**

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

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

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

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

Kind regards,

Shoaib.

**Shoaib Tauqeer**
Developer Engineer
Developer Services & Metering
**M:** 07876745601
unitedutilities.com

**From:** Hamza Adnany [mailto:Hamza@shear-design.com]
**Sent:** 07 October 2020 17:29
**To:** Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
**Cc:** Simon Mason <Simon@shear-design.com>; Billy Hayton <Billy@shear-design.com>
**Subject:** Deansgate (20049)

Good afternoon,

Please find attached as a PDF our wastewater pre-development enquiry.

Also attached as supporting information:

- Site boundary
- Topographical survey
- Ground investigation report

Within the ground investigation report, infiltration rates have not been tested, however based on proximity of the site to the river Medlock a high water table is expected and therefore infiltration has not been considered for this site.

The number of beds within the development is set to be approx. 514. Using a rate of 150 litres per day per person we estimate a peak foul water discharge rate of 6l/s.

Using 50mm/hr rainfall intensity for a 1 in 100 year storm event with 30% climate change and providing a 50% betterment to the brownfield runoff rate, we estimate a surface water discharge rate of 11.8l/s.

Could you please review this enquiry and provide us with the required conditions for connection into your drainage networks?

**Kind regards**

**Hamza Adnany**
**Graduate Civil Engineer**
**Shear Design Ltd**
**7 Ashtree Court | Woodsy Close**
**Cardiff Gate Business Park**
**Cardiff | CF23 8RW**
**T: +44 (0)29 2054 7000 | F: + 44 (0)29 2054 7001**

## Tara Urding

**Subject:** FW: PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB (20047)

**From:** Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
**Sent:** 24 November 2020 10:58
**To:** Hamza Adnany <Hamza@shear-design.com>; Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
**Cc:** Dameon Kilgour <Dameon@shear-design.com>; Simon Mason <Simon@shear-design.com>
**Subject:** PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB (20047)

Good morning Hamza,

It is acknowledged that connection to the surface water body (River Medlock) would not be possible due to the constraints you have mentioned regarding the bridged highway (Bridgewater Viaduct), existing services within the southern road (Deansgate) and also the existing flood gate defence present with the River Medlock. It is noted that Bridgewater Viaduct is not a feasible route. We would require evidence to disregard a new surface water connection via Deansgate. Please would you be able to provide evidence showing the existing services preventing the route of a new surface water sewer to the south of the site (within Deansgate) or evidence proving it will not be possible to discharge to the River Medlock due to EA restrictions with regard to the existing flood gate defence.

In line with our initial pre-development enquiry response (19.10.2020), once connection to the surface water body is proven to be unfeasible, we would then require you to investigate discharging surface water from the proposed development into a highway drain by contacting the relevant Highway Authority. Evidence would be required to prove that this method is not possible before connection to the public combined sewer will be allowed.

If connection to highway drainage is evidenced as not possible, then we would consider connection to the combined public sewer south of your site. For a site to be considered as brownfield, it would have to have been previously developed and been demolished within the last 12 months and continue to pay surface water charges or be a currently developed site with an operational drainage system, and as such greenfield scenario would apply to your site. Regarding the discharge rate we would accept your proposed restricted discharge rate of 2l/s.

Please note for information only regarding a brownfield site - we would not consider a discharge rate to be based on a 1 in 100 + 30% climate change scenario, for example if this site were to be classed as brownfield it would be calculated as such: 2.78 x 50(mm/hr) x 0.06 (ha) giving 8.34 l/s to which a 50% betterment would be applied.

Please feel free to come back to me if you require anything further in the meantime.

Kind regards,

Shoaib

**Shoaib Tauqeer**
Developer Engineer
Developer Services & Metering
**M:** 07876745601
unitedutilities.com

**From:** Hamza Adnany [mailto:Hamza@shear-design.com]
**Sent:** 12 November 2020 12:36
**To:** Wastewater Developer Services ; Tauqeer, Shoaib
**Cc:** Dameon Kilgour ; Simon Mason
**Subject:** RE: PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB (20047)

Good afternoon Shoaib,

Thank you for your response.

We have reviewed the option of discharging surface water runoff directly into the River Medlock and the assessment shows that this solution would not be viable. There are two roads leading from the proposed development site in the direction of the river, the first road (bridgewater viaduct) is a bridged highway and therefore we would not be able to construct drainage within the road. The second road, Deansgate, has drainage already installed along with other various services. Constructing a new drainage system here would require diversions, third party land consents, and consent to construct a new headwall into the River Medlock parallel to your own existing one. Furthermore, directly downstream of your existing headwall lies a flood defence mechanism meaning it will be extremely difficult, if at all possible, to obtain EA consent for discharge into the river along with extreme project costs.

For these reasons, we would like to propose a surface water connection into your combined sewer. The site currently is a hardstanding surface with existing gullies that we believe connect directly into your combined sewer from an existing manhole located within the development site boundary. Our proposal therefore, is to reuse this existing manhole connection if possible or reform the existing connection for the new development needs with your consent. As the site is still draining into your network, we can organise a drainage CCTV survey to prove this if need be, at a brownfield runoff rate of 23.6l/s, we would comply with the Manchester City Council guidelines of providing 50% betterment to brownfield runoff and therefore restrict our discharge rate to 11.8l/s. This restriction will require attenuation on site of $12m^3$.

Greenfield runoff rate for this site has been calculated using ICPSUDS and IH124 methods which state a greenfield discharge rate of 0.8l/s. However, this rate is exceedingly small for a development within the city centre. Furthermore, the development is to be a multistorey building that requires most of the site area and will have internal rainwater pipes which may have issues such as blockages when using this discharge rate. Therefore we would propose a greenfield runoff rate of 2l/s for the site controlled using a hydrobrake, which will require $21m^3$ of onsite attenuation. This would reduce risk of issues such as blockages and internal floods. Whilst this discharge rate is more feasible, we would really appreciate your consideration for allowing us to use brownfield runoff rates with 50% betterment than what is currently entering your network.

I have attached a topographical survey of the site as it currently stands that we have had done recently. Please find the PDF attached, I have circled in blue the existing gullies on site along with the manhole chamber within our site that we believe connects into your network.

If you have any queries or would like to further discuss our proposal please let us know.

**From:** Wastewater Developer Services
**Sent:** 03 November 2020 09:57
**To:** Hamza Adnany
**Cc:** Wastewater Developer Services ; Dameon Kilgour
**Subject:** PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB (20047)

Good morning Hamza,

Thank you for your email. With regards to your enquiry for discharging surface water from your site into the sewer running south of the site which subsequently discharges into the River Medlock, this sewer is a combined sewer overflow spill pipe and is used to discharge excess flows from the combined sewer into the river under a permit to discharge which is granted by the Environment Agency (EA) – there are restrictions placed on this over flow pipe with regards to the number of times it is used to discharge into the River Medlock with prior agreement made with the EA, therefore no surface water connection will be allowed from the development site to this overflow pipe.

As per the response made to the initial pre development enquiry, surface water discharging from the site would be required to follow the surface water hierarchy in line with National Planning Policy Guidance (NPPF) paragraph 80. It is noted is noted that infiltration was ruled out by United Utilities due to ground contamination, therefore the next method in line with the surface water hierarchy is to discharge into the River Medlock.

Furthermore with regards to your brownfield runoff calculation – a brownfield scenario would be considered by United utilities if the site drained to the public sewer network and incurred charges within the last 12 months. It is noted that the site has been demolished for a period greater than 12 months, therefore greenfield scenario would apply to the site with regards to surface water discharge rates.

I hope this answers your query, please feel free to get in contact if you require anything further.

Kind regards,

Shoaib.




**Shoaib Tauqeer**
Developer Engineer
Developer Services & Metering
**M:** 07876745601
unitedutilities.com

**From:** Hamza Adnany [mailto:Hamza@shear-design.com]
**Sent:** 02 November 2020 10:30
**To:** Tauqeer, Shoaib <Shoaib.Tauqeer@uuplc.co.uk>
**Cc:** Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; Dameon Kilgour <Dameon@shear-design.com>
**Subject:** RE: PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB (20047)

Good morning Shoaib,

Thank you for your email. Much appreciated.

The query is in regards to the surface water point of discharge from the proposed development site into your public sewer.

We have identified a public sewer run that spans from the south of our site directly into the river. We would like to propose a connection into this sewer as shown in cyan on the PDF attached.

We have already proposed a surface water discharge rate based on previous brownfield runoff and also provided a 50% betterment as per Manchester Council guidelines. The discharge rate calculated from this method is 11.8l/s.

Should this discharge rate be approved by the local lead flood authority, would we be able to connect into the public sewer as shown in the PDF attached?

**Kind regards**

**Hamza Adnany**
**Graduate Civil Engineer**
**Shear Design Ltd**
**7 Ashtree Court | Woodsy Close**
**Cardiff Gate Business Park**
**Cardiff | CF23 8RW**
**T: +44 (0)29 2054 7000 | F: + 44 (0)29 2054 7001**

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**From:** Tauqeer, Shoaib <Shoaib.Tauqeer@uuplc.co.uk>
**Sent:** 02 November 2020 09:51
**To:** Hamza Adnany <Hamza@shear-design.com>
**Cc:** Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
**Subject:** PDE 4200034146 Junction of Deansgate South, Bridgewater Viaduct and Chester Road M3 4LB

Good morning Hamza,

Further to our telephone conversation this morning regarding the above site, please could you reply all to this email with your repeat enquiry regarding surface water connection and I will have a look into the matter for you.

Kind regards,

Shoaib.

United Utilities
Water for the North West

**Shoaib Tauqeer**
Developer Engineer
Developer Services & Metering
**M:** 07876745601
unitedutilities.com

## Tara Urding

**Subject:** FW: Deansgate, Manchester M3 4LB (20047)

---

**From:** Thomas, Sandrine <sandrine.thomas@environment-agency.gov.uk>
**Sent:** 16 December 2020 17:13
**To:** Tara Urding <Tara@shear-design.com>
**Subject:** RE: Deansgate, Manchester M3 4LB (20047)

Dear Tara

As discussed this morning the main river limit for the Medlock is at NGR SJ 83374 97434 and we do not consider the construction of an outfall into the river near that location viable, as it would be facing upstream and we have an access ramp alongside the newly constructed wall by Renaker who have been re-developing the plot of land located south of the river.

Regards

Sandrine

**Sandrine Thomas**
Flood Risk Officer, Flood & Coastal Risk Management
Greater Manchester, Merseyside & Cheshire Area
**Environment Agency** | Richard Fairclough House, Knutsford Road, Warrington, WA4 1HT

sandrine.thomas@environment-agency.gov.uk
External: 020 30 250 985

---

**From:** Tara Urding [mailto:Tara@shear-design.com]
**Sent:** 15 December 2020 14:45
**To:** PSO_Warrington <PSOWarrington@environment-agency.gov.uk>
**Cc:** Darren Badham <Darren@shear-design.com>; Tony Spencer <Tony@shear-design.com>
**Subject:** Deansgate, Manchester M3 4LB (20047)

Dear Sirs

We are dealing with a development scheme at Deansgate, Manchester M3 4LB not far from the River Medlock flood gate. We are preparing a Flood Risk Assessment and drainage strategy for the scheme and would like to discuss the principle of a surface water outfall with yourselves over the phone. You can contact me directly on 07754 185262 or alternatively if you let me have a name and number I can give you a call.

The site location is:

Grid reference: SJ 83285 97434
Grid reference (6 fig): SJ832974
Easting 383285, Northing 397434

**Kind regards**

**Tara Urding**
**Civil Engineer**
**Shear Design Ltd**

## Tara Urding

**To:** wastewaterdeveloperservices@uuplc.co.uk
**Cc:** Dameon Kilgour; Darren Badham; Billy Hayton; Tony Spencer
**Subject:** RE: PDE 4200034146 Junction of Deansgate South M3 4LB (20047) - New Ref. 0237423

---

**From:** wastewaterdeveloperservices@uuplc.co.uk <wastewaterdeveloperservices@uuplc.co.uk>
**Sent:** 01 July 2022 12:53
**To:** Tara Urding <Tara@shear-design.com>
**Cc:** Dameon Kilgour <dameon@shear-design.com>; Darren Badham <Darren@shear-design.com>; Billy Hayton <Billy@shear-design.com>; Tony Spencer <Tony@shear-design.com>
**Subject:** RE: PDE 4200034146 Junction of Deansgate South M3 4LB (20047) - New Ref. 0237423

Good afternoon Tara,

Thanks for the prompt response.

I confirm that the provided correspondence with EA (Sandrine Thomas) on 16th December 2020 is acceptable as evidence that surface water connection directly to the river is not feasible.

Accordingly, United Utilities accept to discharge surface water from the proposed site to the public combined sewer within Deansgate Road at a maximum 5l/s discharge rate to avoid future blockages.

Kind regards,

United Utilities
Water for the North West

**Mohammed Aljafarawi (He/Him)**
Developer Engineer
Developer Services & Metering
Customer Services
**M:** 07950474499
unitedutilities.com

---------- Original Message ----------
**From:** Tara Urding [tara@shear-design.com]
**Sent:** 01/07/2022 12:20
**To:** wastewaterdeveloperservices@uuplc.co.uk
**Cc:** dameon@shear-design.com; darren@shear-design.com; billy@shear-design.com; tony@shear-design.com
**Subject:** RE: PDE 4200034146 Junction of Deansgate South M3 4LB (20047) - New Ref. 0237423

Hi Mohammed

In our approved drainage strategy we summarised the circumstances associated with trying to make a connection to the River Medlock,

*'United Utilities have requested a review of a potential connection direct to the River Medlock. The option of discharging surface water runoff directly into the River Medlock does not appear viable. There are two roads leading from the proposed development site, one in the direction of the Bridgewater Canal and one in the direction of the river. The first road, Bridgewater Viaduct, is a brick arch highway bridge structure and it would be compromised by any retrospective drainage works to construct drainage to a discharge point into the Bridgewater Canal beneath. The second road, Deansgate, has drainage already installed, along with a variety of mains*

*services. Constructing a new drainage system here would require diversions, third party land consents, and consent to construct a new outfall into the River Medlock adjacent to the existing CSO outfall. Again, there is a highway bridge structure that will be compromised by any drainage works through it to gain access to the river. In addition to this, directly downstream of any potential outfall on the river lies a flood defence mechanism and consent to discharge upstream of this structure could have implications.'*

We made an enquiry with the EA (Sandrine Thomas) on 16th December 2020 who advised us that a connection route to the River Medlock is not possible. I attach her email for your reference. Furthermore the Medlock bypass tunnel, built in a previous era potentially cuts off our route to the river. This tunnel can be seen on the 1851 OS map traversing from Brazil Mill heading north-westerly under the Bridgewater Viaduct. We are hoping to have a length of this tunnel surveyed in the near future as it is noted as passing close to our site.

I attach a set of utility record plans that were appended to our drainage strategy.

Unfortunately a surface water connection directly to the river does not seem possible.

**Kind regards**
**Tara Urding**
**Civil Engineer**
**Shear Design Ltd**
**7 Ashtree Court | Woodsy Close**
**Cardiff Gate Business Park**
**Cardiff | CF23 8RW**
**T: +44 (0)29 2054 7000 | F: + 44 (0)29 2054 7001**

**Take a look at our Website: www.shear-design.com**

---

**From:** wastewaterdeveloperservices@uuplc.co.uk <wastewaterdeveloperservices@uuplc.co.uk>
**Sent:** 01 July 2022 11:42
**To:** Tara Urding <Tara@shear-design.com>
**Cc:** Dameon Kilgour <Dameon@shear-design.com>; Darren Badham <Darren@shear-design.com>; Billy Hayton <Billy@shear-design.com>; Tony Spencer <Tony@shear-design.com>
**Subject:** RE: PDE 4200034146 Junction of Deansgate South M3 4LB (20047) - New Ref. 0237423

Good afternoon Tara,

I tried to call you this morning, but your office mentioned that you are working remotely today, so I have sent this email.

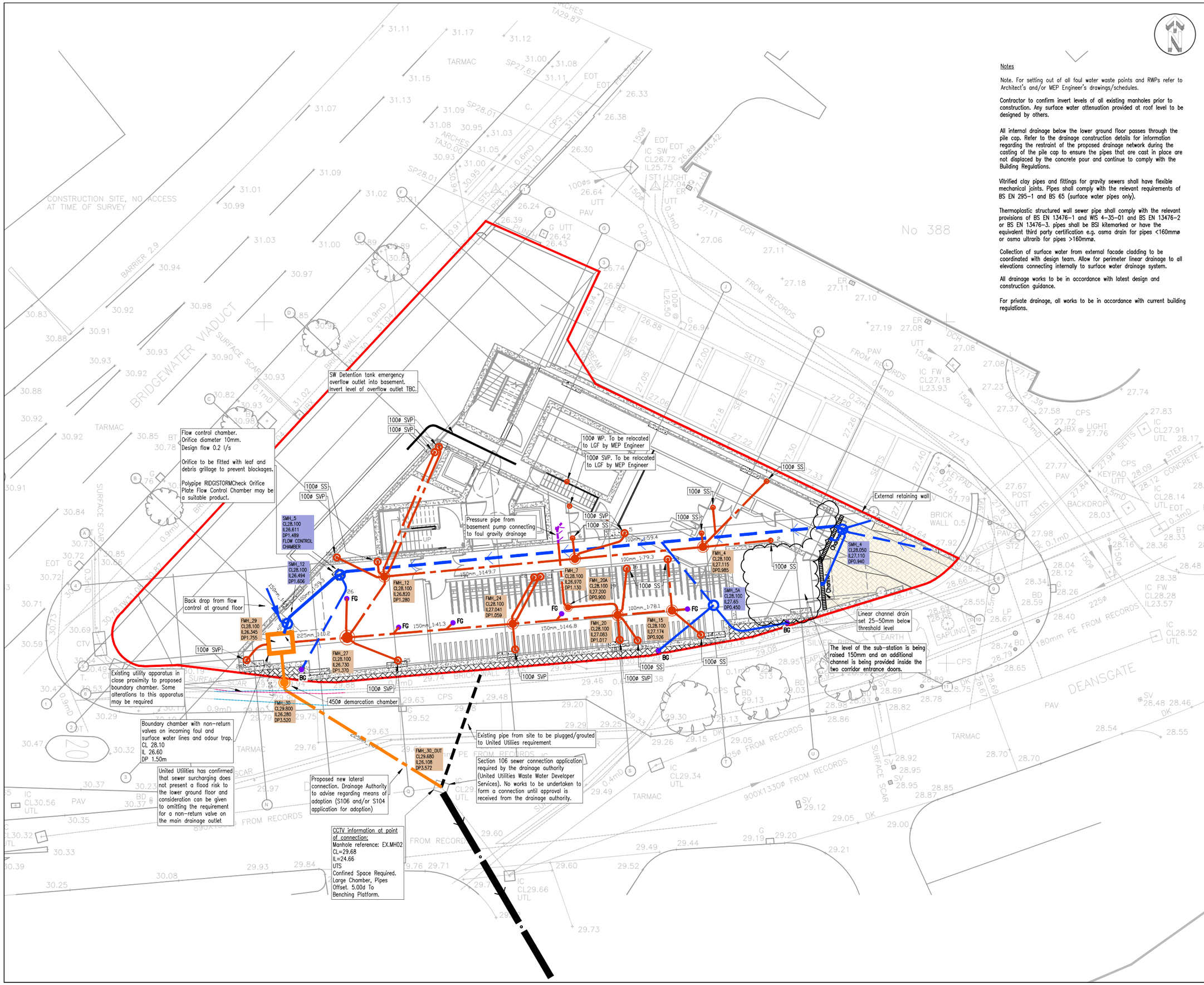
During discussions in November 2020, my colleague Shoaib agreed to discharge surface water to the public combined sewer after providing evidence showing the existing services preventing the route of a new surface water sewer to the south of the site (within Deansgate) or evidence proving it will not be possible to discharge to the River Medlock due to EA restrictions with regard to the existing flood gate defence. (email attached)

I could not find the required evidence, so please clarify this point to be able to comment on the acceptable rate of discharge to the public sewer.

Kind regards,

# *APPENDIX F*

## *DRAINAGE LAYOUT AT GROUND AND LOWER GROUND LEVEL*




Notes

Note. For setting out of all foul water waste points and RWPs refer to Architect's and/or MEP Engineer's drawings/schedules.

Contractor to confirm invert levels of all existing manholes prior to construction. Any surface water attenuation provided at roof level to be designed by others.

All internal drainage below the lower ground floor passes through the pile cap. Refer to the drainage construction details for information regarding the restraint of the proposed drainage network during the casting of the pile cap to ensure the pipes that are cast in place are not displaced by the concrete pour and continue to comply with the Building Regulations.

Vitrified clay pipes and fittings for gravity sewers shall have flexible mechanical joints. Pipes shall comply with the relevant requirements of BS EN 295-1 and BS 65 (surface water pipes only).

Thermoplastic structured wall sewer pipe shall comply with the relevant provisions of BS EN 13476-1 and WIS 4-35-01 and BS EN 13476-2 or BS EN 13476-3. pipes shall be BSI kitemarked or have the equivalent third party certification e.g. osma drain for pipes <160mmø or osma ultrarib for pipes >160mmø.

Collection of surface water from external facade cladding to be coordinated with design team. Allow for perimeter linear drainage to all elevations connecting internally to surface water drainage system.

All drainage works to be in accordance with latest design and construction guidance.

For private drainage, all works to be in accordance with current building regulations.

## NOTES

GENERAL

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KEY

- Existing foul sewer. For further information refer to the drainage strategy document 20047-D100 appendix C and to drawing 20047-105 Existing Drainage Layout.
- Channel — Threshold channel with minimum B125 cover loading. For style refer to Architect.
- Internal surface water drains. Refer to plan for pipe sizes and gradients.
- Proposed surface water inspection chamber.
- Formpave fin drain outlet feature incorporating connectors and top hat seal through membrane
- Formpave Aquaflow permeable block paving. Minimum 480mm thick with 80mm block pavers or similar approved
- Internal foul drains. Refer to plan for pipe size and gradients.
- Proposed 450ø FW inspection chamber.
- Adoptable foul lateral drains. Refer to plan for pipe size and gradient
- Pressure pipe connection from pump to gravity drainage
- Proposed demarcation chamber
- 100mm drop
- 150mm drop

All with roddable access above ground. Refer to Architect and MEP Engineer for confirmation of above ground pipe diameters.

- Rain Water Pipe preliminary position.
- FG — Trapped internal foul floor gully (roddable) with non-return valve
- BG — Trapped external SW bottle gully (roddable)
- FMH_.... CL.... IL.... DP.... — Chamber reference (foul water) Cover Level Invert Level Depth
- SMH_.... CL.... IL.... DP.... — Chamber reference (surface water) Cover Level Invert Level Depth

RIBA STAGE 4

| REV | DATE | DESCRIPTION | BY | CHK |
|---|---|---|---|---|
| F | 22.06.23 | Note and rev cloud amended at rear access doors relating to sub-stn level and internal channel drain. | TU | BH |
| E | 13.06.23 | Updated to suit revised architectural layouts and MEP Engineering plans. | TU | BH |
| D | 04.11.22 | Updated to suit MEP Engineer's current LGF drainage plan. Plant room pumping chamber added. | TU | BH |
| C | 31.08.22 | Notes added in relation to non-return valves protecting lower parts of building and drainage from sewer surcharging and flooding. | TU | TU |
| B | 03.08.22 | Stage 3 Tender | TU/EB | TS |
| A | 18.07.22 | Drawing rescaled to 1:100 at A1 at tender status | TU | TU/TS |

AMENDMENTS

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PROJECT: STUDENT ACCOMMODATION DEANSGATE SOUTH, MANCHESTER

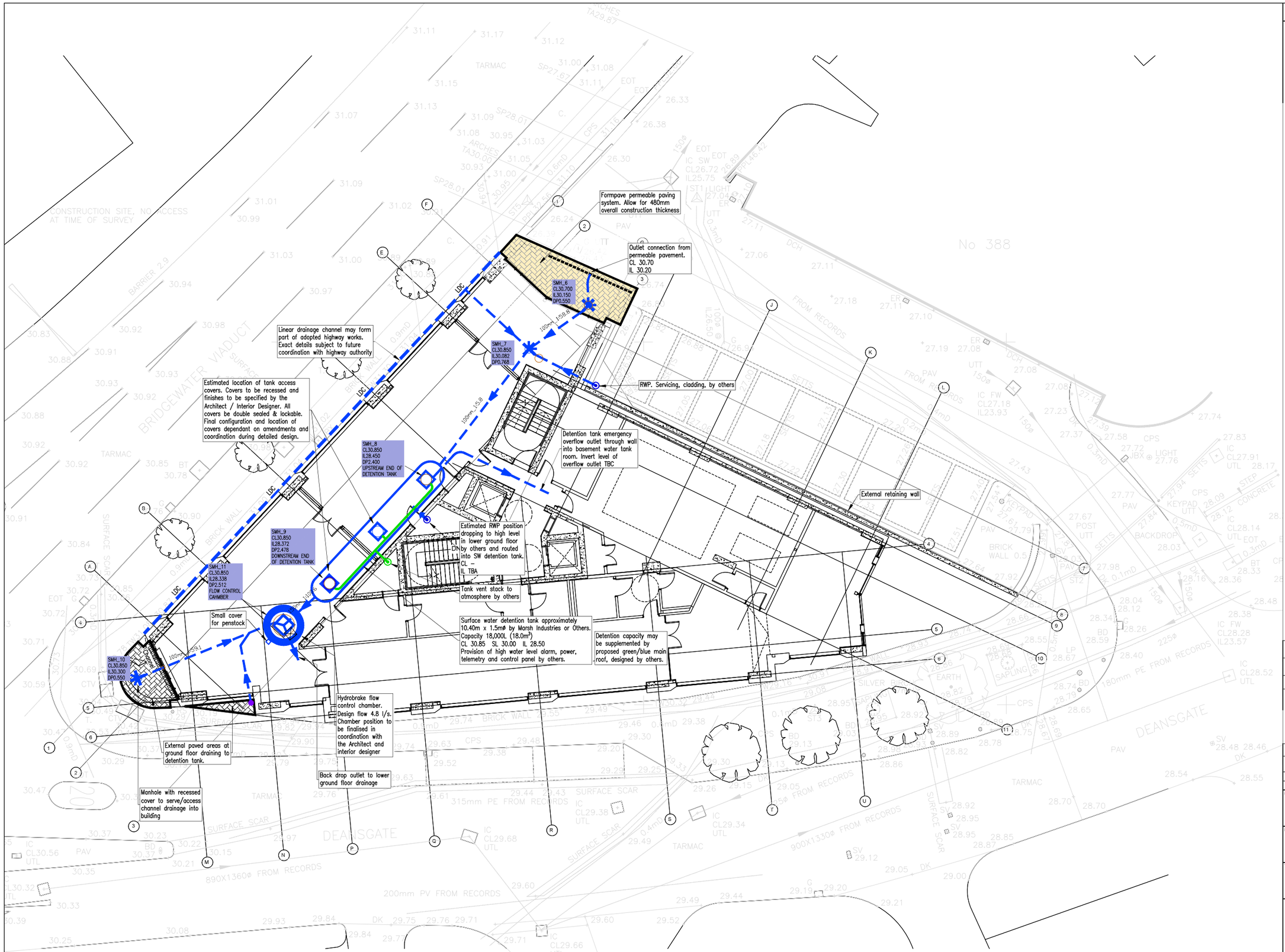
TITLE: DRAINAGE LAYOUT LOWER GROUND FLOOR

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|---|---|---|---|
| TU | SJM | DECEMBER 2020 | 1:100 @ A1 |

| SHEAR DESIGN REF: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| 20047 | 20047-121 | F |

STATUS: T




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For drawing key and notes refer to drawing 20047–121 Lower ground floor drainage layout

**Note**
Locations of all manhole covers in ground floor to be coordinated with interior designer.

RIBA STAGE 4

| REV | DATE | DESCRIPTION | BY | CHK |
|---|---|---|---|---|
| | | AMENDMENTS | | |
| F | 08.06.23 | Updated ground floor layout shown. Minor drainage amendments to suit. | TU | TU |
| E | 01.03.23 | Additional manhole added to the main entrance to assist operational maintenance of drainage | BGH | TU |
| D | 04.11.22 | Minor updates including amended chamber references | TU | TU |
| C | 31.08.22 | Hydrobrake reduced to 4.5 l/s to allow permeable paving to discharge at 0.2 l/s and bottles gullies andeansgate elevation to free discharge at 0.3 l/s. The tank size remains the same due to some spare capacity. Detention capacity may be supplemented by proposed green/blue main roof, designed by others. Further annotation added at control chamber regarding location. | TU | TU |
| B | 28.07.22 | Stage 3 Tender | TU/EB | TS |
| A | 27.07.22 | Drawing rescaled to 1:100 at A1 at tender status Now shows ground floor level rather than roof level. | TU | TS |

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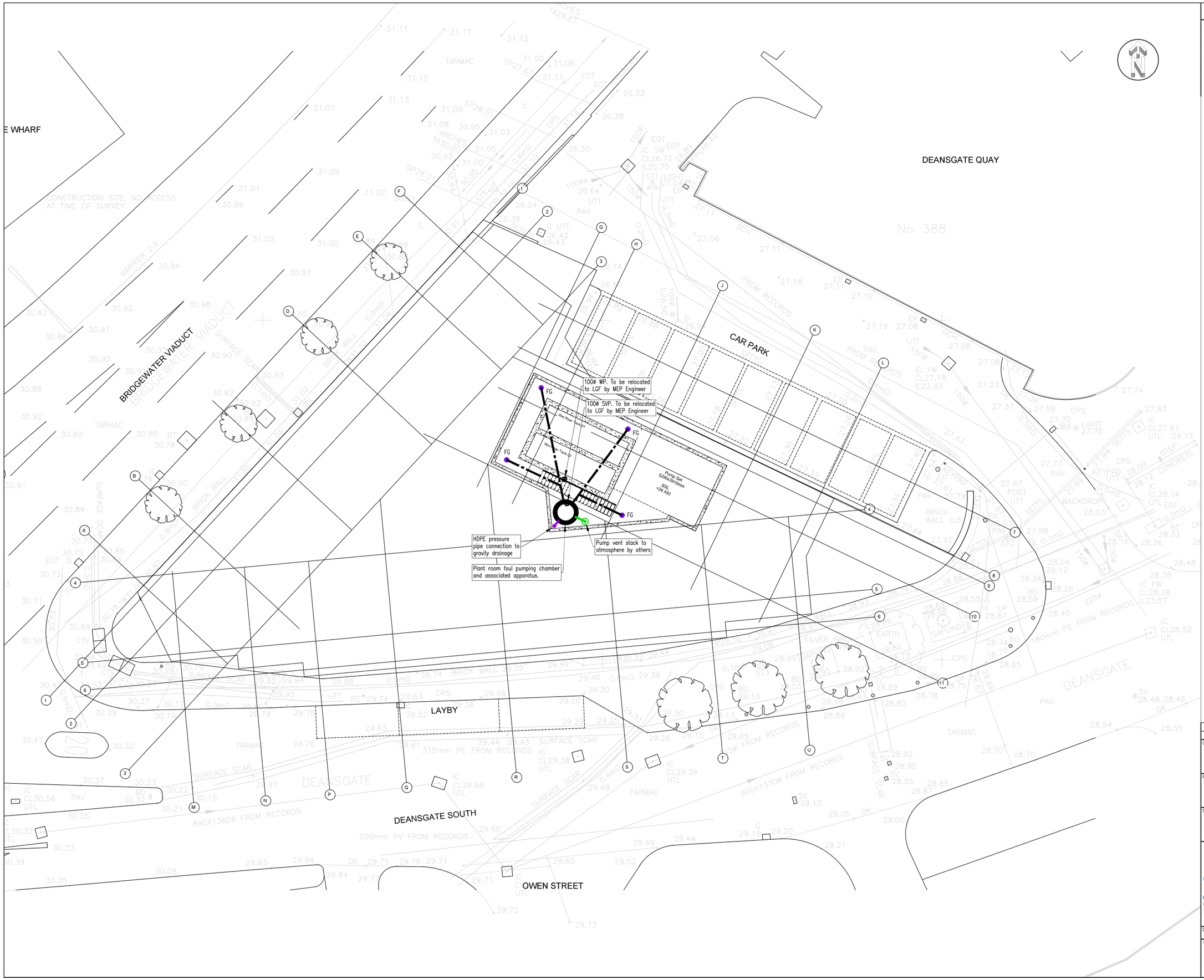
PROJECT: STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

TITLE: DRAINAGE LAYOUT
GROUND FLOOR

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| DRAWN: | CHECKED: | DATE: | SCALE: |
|---|---|---|---|
| TU | SJM | DECEMBER 2020 | 1:100 @ A1 |

| SHEAR DESIGN REF: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| 20047 | 20047-122 | F |
| | | STATUS: T |




## NOTES

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For drawing key and notes refer to drawing 20047–121 Lower ground floor drainage layout

**Note**
Locations of all manhole covers in ground floor to be coordinated with interior designer.

RIBA STAGE 4

| REV | DATE | DESCRIPTION | BY | CHK |
|---|---|---|---|---|
| | | AMENDMENTS | | |

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FUSION MANCHESTER DEVCO LTD

PROJECT:
STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

TITLE:
DRAINAGE LAYOUT
BASEMENT

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| TU | DK | JUNE 2023 | 1:100 @ A1 |

| SHEAR DESIGN REF: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| 20047 | 20047-123 | - |

STATUS: T

# *APPENDIX G*

## *GREEN / BLUE ROOF LAYOUT AND DETAILS*




## NOTES

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### Notes

Blue roof to be designed by specialist sub-contractor. Calculations to be provided to engineer for review and in accordance with the requirement of the FRA.

Maximum available area of blue roof attenuation as set out by design team.

RIBA STAGE 4

| REV | DATE | DESCRIPTION | BY | CHK |
|---|---|---|---|---|
| | | AMENDMENTS | | |
| C | 13.06.23 | Updated to suit current Architect's roof layout | TU | TU |
| B | 04.11.22 | Updated to suit current Architect's roof layout | TU | TU |
| A | 16.08.22 | Updated to suit current Architect's roof layout | TU | DK |

CLIENT:
FUSION MANCHESTER DEVCO LTD

PROJECT:
STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

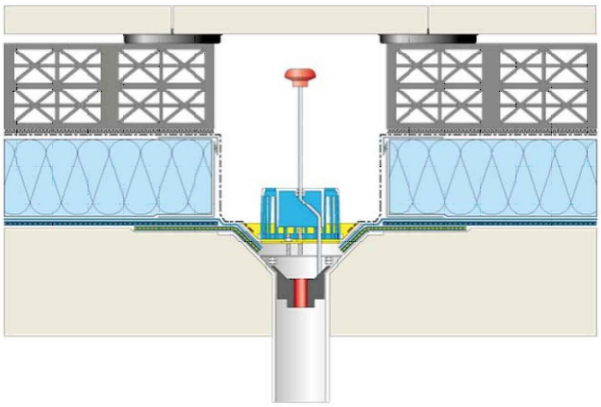
TITLE:
DRAINAGE LAYOUT
TOP ROOF LEVEL

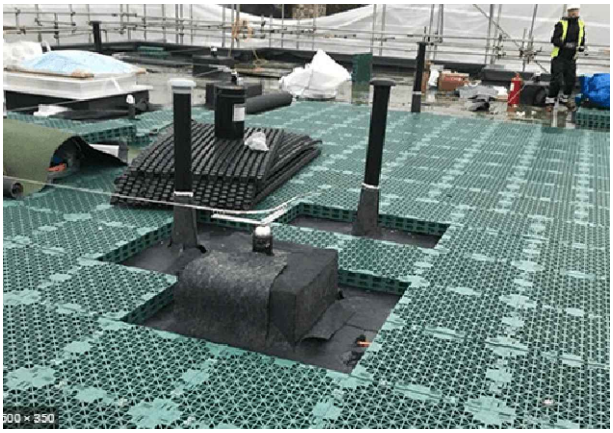
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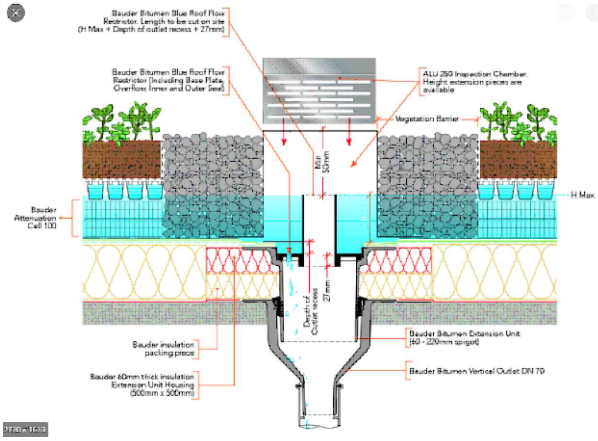
| DRAWN: | CHECKED: | DATE: | SCALE: |
|---|---|---|---|
| TU | SJM | DECEMBER 2020 | 1:100 @ A1 |

| SHEAR DESIGN REF: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| 20047 | 20047-128 | C |
| | | STATUS: T |

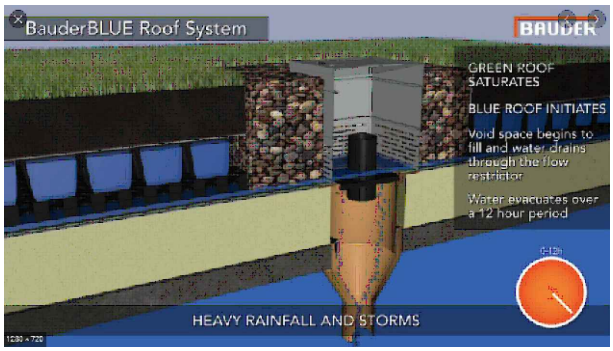


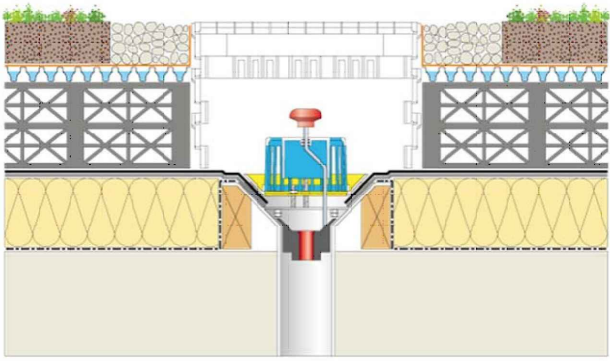








| REV | DATE | DESCRIPTION |
|---|---|---|
| AMENDMENTS | | |

CLIENT:
FUSION STUDENT ACCOMMODATION

PROJECT:
DEANSGATE SOUTH MANCHESTER

TITLE:
TYPICAL BLUE GREEN ROOF DETAILS

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|---|---|---|---|
| CHECKED: | SJM | SCALE: | NTS @ A4 |

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STATUS KEY: I = INFORMATION P = PRELIMINARY A = APPROVAL CO = CONTRACT T = TENDER C = CONSTRUCTION AB = AS-BUILT

| STATUS: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| I | 20047-133 | - |

# *APPENDIX H*

## *SURFACE WATER DRAINAGE CALCULATIONS*

## Summary of Results for 100 year Return Period (+40%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 29.578 | 1.078 | 4.0 | 14.6 | O K |
| 30 min Summer | 29.792 | 1.292 | 4.2 | 17.4 | O K |
| 60 min Summer | 29.867 | 1.367 | 4.3 | 18.2 | O K |
| 120 min Summer | 29.816 | 1.316 | 4.3 | 17.7 | O K |
| 180 min Summer | 29.710 | 1.210 | 4.1 | 16.4 | O K |
| 240 min Summer | 29.600 | 1.100 | 4.0 | 14.9 | O K |
| 360 min Summer | 29.395 | 0.895 | 4.0 | 11.8 | O K |
| 480 min Summer | 29.215 | 0.715 | 4.0 | 9.0 | O K |
| 600 min Summer | 28.995 | 0.495 | 4.0 | 5.5 | O K |
| 720 min Summer | 28.831 | 0.331 | 4.0 | 3.2 | O K |
| 960 min Summer | 28.621 | 0.121 | 3.9 | 0.8 | O K |
| 1440 min Summer | 28.500 | 0.000 | 3.2 | 0.0 | O K |
| 2160 min Summer | 28.500 | 0.000 | 2.3 | 0.0 | O K |
| 2880 min Summer | 28.500 | 0.000 | 1.9 | 0.0 | O K |
| 4320 min Summer | 28.500 | 0.000 | 1.3 | 0.0 | O K |
| 5760 min Summer | 28.500 | 0.000 | 1.1 | 0.0 | O K |
| 7200 min Summer | 28.500 | 0.000 | 0.9 | 0.0 | O K |
| 8640 min Summer | 28.500 | 0.000 | 0.8 | 0.0 | O K |
| 10080 min Summer | 28.500 | 0.000 | 0.7 | 0.0 | O K |
| 15 min Winter | 29.584 | 1.084 | 4.0 | 14.7 | O K |
| 30 min Winter | 29.815 | 1.315 | 4.3 | 17.7 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 118.958 | 0.0 | 18.4 | 17 |
| 30 min Summer | 79.532 | 0.0 | 24.7 | 30 |
| 60 min Summer | 50.812 | 0.0 | 31.6 | 48 |
| 120 min Summer | 31.423 | 0.0 | 38.9 | 82 |
| 180 min Summer | 23.415 | 0.0 | 43.6 | 118 |
| 240 min Summer | 18.891 | 0.0 | 46.7 | 152 |
| 360 min Summer | 13.837 | 0.0 | 51.4 | 220 |
| 480 min Summer | 11.101 | 0.0 | 55.2 | 286 |
| 600 min Summer | 9.350 | 0.0 | 57.9 | 342 |
| 720 min Summer | 8.122 | 0.0 | 60.5 | 392 |
| 960 min Summer | 6.498 | 0.0 | 64.4 | 500 |
| 1440 min Summer | 4.738 | 0.0 | 70.5 | 0 |
| 2160 min Summer | 3.447 | 0.0 | 76.9 | 0 |
| 2880 min Summer | 2.748 | 0.0 | 81.8 | 0 |
| 4320 min Summer | 1.992 | 0.0 | 88.9 | 0 |
| 5760 min Summer | 1.584 | 0.0 | 94.3 | 0 |
| 7200 min Summer | 1.325 | 0.0 | 98.6 | 0 |
| 8640 min Summer | 1.145 | 0.0 | 102.2 | 0 |
| 10080 min Summer | 1.012 | 0.0 | 105.4 | 0 |
| 15 min Winter | 118.958 | 0.0 | 18.4 | 17 |
| 30 min Winter | 79.532 | 0.0 | 24.6 | 30 |

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## Summary of Results for 100 year Return Period (+40%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 29.883 | 1.383 | 4.3 | 18.4 | O K |
| 120 min Winter | 29.771 | 1.271 | 4.2 | 17.2 | O K |
| 180 min Winter | 29.609 | 1.109 | 4.0 | 15.1 | O K |
| 240 min Winter | 29.450 | 0.950 | 4.0 | 12.7 | O K |
| 360 min Winter | 29.130 | 0.630 | 4.0 | 7.6 | O K |
| 480 min Winter | 28.781 | 0.281 | 4.0 | 2.5 | O K |
| 600 min Winter | 28.582 | 0.082 | 3.9 | 0.4 | O K |
| 720 min Winter | 28.500 | 0.000 | 3.5 | 0.0 | O K |
| 960 min Winter | 28.500 | 0.000 | 2.8 | 0.0 | O K |
| 1440 min Winter | 28.500 | 0.000 | 2.1 | 0.0 | O K |
| 2160 min Winter | 28.500 | 0.000 | 1.5 | 0.0 | O K |
| 2880 min Winter | 28.500 | 0.000 | 1.2 | 0.0 | O K |
| 4320 min Winter | 28.500 | 0.000 | 0.9 | 0.0 | O K |
| 5760 min Winter | 28.500 | 0.000 | 0.7 | 0.0 | O K |
| 7200 min Winter | 28.500 | 0.000 | 0.6 | 0.0 | O K |
| 8640 min Winter | 28.500 | 0.000 | 0.5 | 0.0 | O K |
| 10080 min Winter | 28.500 | 0.000 | 0.4 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 50.812 | 0.0 | 31.5 | 50 |
| 120 min Winter | 31.423 | 0.0 | 38.9 | 88 |
| 180 min Winter | 23.415 | 0.0 | 43.5 | 126 |
| 240 min Winter | 18.891 | 0.0 | 46.9 | 162 |
| 360 min Winter | 13.837 | 0.0 | 51.6 | 236 |
| 480 min Winter | 11.101 | 0.0 | 55.1 | 278 |
| 600 min Winter | 9.350 | 0.0 | 58.0 | 320 |
| 720 min Winter | 8.122 | 0.0 | 60.4 | 0 |
| 960 min Winter | 6.498 | 0.0 | 64.5 | 0 |
| 1440 min Winter | 4.738 | 0.0 | 70.5 | 0 |
| 2160 min Winter | 3.447 | 0.0 | 76.9 | 0 |
| 2880 min Winter | 2.748 | 0.0 | 81.8 | 0 |
| 4320 min Winter | 1.992 | 0.0 | 88.9 | 0 |
| 5760 min Winter | 1.584 | 0.0 | 94.3 | 0 |
| 7200 min Winter | 1.325 | 0.0 | 98.6 | 0 |
| 8640 min Winter | 1.145 | 0.0 | 102.2 | 0 |
| 10080 min Winter | 1.012 | 0.0 | 105.4 | 0 |

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## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 1.000 |
| Region | England and Wales | Cv (Winter) | 1.000 |
| M5-60 (mm) | 18.000 | Shortest Storm (mins) | 15 |
| Ratio R | 0.363 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +40 |

## Time Area Diagram

Total Area (ha) 0.062

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.062 |

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## Model Details

Storage is Online Cover Level (m) 30.850

## Pipe Structure

Diameter (m) 1.500 Length (m) 10.000
Slope (1:X) 1000.000 Invert Level (m) 28.500

## Hydro-Brake® Optimum Outflow Control

| | |
|---|---|
| Unit Reference | MD-SHE-0090-4500-1700-4500 |
| Design Head (m) | 1.700 |
| Design Flow (l/s) | 4.5 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 90 |
| Invert Level (m) | 28.300 |
| Minimum Outlet Pipe Diameter (mm) | 150 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) |
|---|---|---|
| Design Point (Calculated) | 1.700 | 4.5 |
| Flush-Flo™ | 0.398 | 4.0 |
| Kick-Flo® | 0.806 | 3.2 |
| Mean Flow over Head Range | - | 3.7 |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.100 | 2.8 | 1.200 | 3.8 | 3.000 | 5.9 | 7.000 | 8.7 |
| 0.200 | 3.7 | 1.400 | 4.1 | 3.500 | 6.3 | 7.500 | 9.0 |
| 0.300 | 3.9 | 1.600 | 4.4 | 4.000 | 6.7 | 8.000 | 9.3 |
| 0.400 | 4.0 | 1.800 | 4.6 | 4.500 | 7.1 | 8.500 | 9.6 |
| 0.500 | 3.9 | 2.000 | 4.8 | 5.000 | 7.5 | 9.000 | 9.9 |
| 0.600 | 3.8 | 2.200 | 5.1 | 5.500 | 7.8 | 9.500 | 10.1 |
| 0.800 | 3.2 | 2.400 | 5.3 | 6.000 | 8.1 | | |
| 1.000 | 3.5 | 2.600 | 5.5 | 6.500 | 8.4 | | |

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## Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 117 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 15 min Summer | 27.718 | 0.148 | 0.0 | 0.2 | 0.2 | 1.3 | O K |
| 30 min Summer | 27.759 | 0.189 | 0.0 | 0.2 | 0.2 | 1.7 | O K |
| 60 min Summer | 27.791 | 0.221 | 0.0 | 0.2 | 0.2 | 2.0 | O K |
| 120 min Summer | 27.799 | 0.229 | 0.0 | 0.2 | 0.2 | 2.1 | O K |
| 180 min Summer | 27.793 | 0.223 | 0.0 | 0.2 | 0.2 | 2.0 | O K |
| 240 min Summer | 27.786 | 0.216 | 0.0 | 0.2 | 0.2 | 1.9 | O K |
| 360 min Summer | 27.769 | 0.199 | 0.0 | 0.2 | 0.2 | 1.8 | O K |
| 480 min Summer | 27.754 | 0.184 | 0.0 | 0.2 | 0.2 | 1.7 | O K |
| 600 min Summer | 27.738 | 0.168 | 0.0 | 0.2 | 0.2 | 1.5 | O K |
| 720 min Summer | 27.723 | 0.153 | 0.0 | 0.2 | 0.2 | 1.4 | O K |
| 960 min Summer | 27.695 | 0.125 | 0.0 | 0.2 | 0.2 | 1.1 | O K |
| 1440 min Summer | 27.648 | 0.078 | 0.0 | 0.1 | 0.1 | 0.7 | O K |
| 2160 min Summer | 27.601 | 0.031 | 0.0 | 0.1 | 0.1 | 0.3 | O K |
| 2880 min Summer | 27.576 | 0.006 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 4320 min Summer | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 5760 min Summer | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 7200 min Summer | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 8640 min Summer | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 119.302 | 0.0 | 1.5 | 18 |
| 30 min Summer | 79.651 | 0.0 | 2.0 | 32 |
| 60 min Summer | 50.812 | 0.0 | 2.5 | 62 |
| 120 min Summer | 31.379 | 0.0 | 3.1 | 106 |
| 180 min Summer | 23.365 | 0.0 | 3.5 | 138 |
| 240 min Summer | 18.843 | 0.0 | 3.8 | 172 |
| 360 min Summer | 13.786 | 0.0 | 4.1 | 240 |
| 480 min Summer | 11.059 | 0.0 | 4.4 | 308 |
| 600 min Summer | 9.311 | 0.0 | 4.7 | 376 |
| 720 min Summer | 8.086 | 0.0 | 4.8 | 442 |
| 960 min Summer | 6.467 | 0.0 | 5.2 | 572 |
| 1440 min Summer | 4.712 | 0.0 | 5.6 | 822 |
| 2160 min Summer | 3.426 | 0.0 | 6.2 | 1168 |
| 2880 min Summer | 2.730 | 0.0 | 6.5 | 1496 |
| 4320 min Summer | 1.979 | 0.0 | 7.1 | 0 |
| 5760 min Summer | 1.573 | 0.0 | 7.5 | 0 |
| 7200 min Summer | 1.315 | 0.0 | 7.9 | 0 |
| 8640 min Summer | 1.136 | 0.0 | 8.2 | 0 |

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## Summary of Results for 100 year Return Period (+40%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 10080 min Summer | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 15 min Winter | 27.719 | 0.149 | 0.0 | 0.2 | 0.2 | 1.3 | O K |
| 30 min Winter | 27.760 | 0.190 | 0.0 | 0.2 | 0.2 | 1.7 | O K |
| 60 min Winter | 27.792 | 0.222 | 0.0 | 0.2 | 0.2 | 2.0 | O K |
| 120 min Winter | 27.802 | 0.232 | 0.0 | 0.2 | 0.2 | 2.1 | O K |
| 180 min Winter | 27.794 | 0.224 | 0.0 | 0.2 | 0.2 | 2.0 | O K |
| 240 min Winter | 27.783 | 0.213 | 0.0 | 0.2 | 0.2 | 1.9 | O K |
| 360 min Winter | 27.759 | 0.189 | 0.0 | 0.2 | 0.2 | 1.7 | O K |
| 480 min Winter | 27.736 | 0.166 | 0.0 | 0.2 | 0.2 | 1.5 | O K |
| 600 min Winter | 27.712 | 0.142 | 0.0 | 0.2 | 0.2 | 1.3 | O K |
| 720 min Winter | 27.691 | 0.121 | 0.0 | 0.2 | 0.2 | 1.1 | O K |
| 960 min Winter | 27.652 | 0.082 | 0.0 | 0.1 | 0.1 | 0.7 | O K |
| 1440 min Winter | 27.595 | 0.025 | 0.0 | 0.1 | 0.1 | 0.2 | O K |
| 2160 min Winter | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 2880 min Winter | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 4320 min Winter | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 5760 min Winter | 27.570 | 0.000 | 0.0 | 0.1 | 0.1 | 0.0 | O K |
| 7200 min Winter | 27.570 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | O K |
| 8640 min Winter | 27.570 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 10080 min Summer | 1.004 | 0.0 | 8.4 | 0 |
| 15 min Winter | 119.302 | 0.0 | 1.5 | 18 |
| 30 min Winter | 79.651 | 0.0 | 2.0 | 32 |
| 60 min Winter | 50.812 | 0.0 | 2.5 | 60 |
| 120 min Winter | 31.379 | 0.0 | 3.1 | 114 |
| 180 min Winter | 23.365 | 0.0 | 3.5 | 144 |
| 240 min Winter | 18.843 | 0.0 | 3.8 | 182 |
| 360 min Winter | 13.786 | 0.0 | 4.1 | 258 |
| 480 min Winter | 11.059 | 0.0 | 4.4 | 330 |
| 600 min Winter | 9.311 | 0.0 | 4.7 | 400 |
| 720 min Winter | 8.086 | 0.0 | 4.8 | 470 |
| 960 min Winter | 6.467 | 0.0 | 5.2 | 596 |
| 1440 min Winter | 4.712 | 0.0 | 5.7 | 822 |
| 2160 min Winter | 3.426 | 0.0 | 6.2 | 0 |
| 2880 min Winter | 2.730 | 0.0 | 6.6 | 0 |
| 4320 min Winter | 1.979 | 0.0 | 7.1 | 0 |
| 5760 min Winter | 1.573 | 0.0 | 7.5 | 0 |
| 7200 min Winter | 1.315 | 0.0 | 7.9 | 0 |
| 8640 min Winter | 1.136 | 0.0 | 8.2 | 0 |

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## Summary of Results for 100 year Return Period (+40%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 10080 min Winter | 27.570 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 10080 min Winter | 1.004 | 0.0 | 8.4 | 0 |

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## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 1.000 |
| Region | England and Wales | Cv (Winter) | 1.000 |
| M5-60 (mm) | 18.000 | Shortest Storm (mins) | 15 |
| Ratio R | 0.366 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +40 |

## Time Area Diagram

Total Area (ha) 0.005

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.005 |

## Time Area Diagram

Total Area (ha) 0.000

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.000 |

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## Model Details

Storage is Online Cover Level (m) 28.050

## Porous Car Park Structure

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 3.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 10.0 |
| Max Percolation (l/s) | 8.3 | Slope (1:X) | 0.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 0 |
| Porosity | 0.30 | Evaporation (mm/day) | 0 |
| Invert Level (m) | 27.570 | Membrane Depth (m) | 0 |

## Orifice Outflow Control

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 27.150

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## Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 121 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 15 min Summer | 9.918 | 0.053 | 0.0 | 1.2 | 1.2 | 9.9 | O K |
| 30 min Summer | 9.933 | 0.068 | 0.0 | 1.3 | 1.3 | 12.7 | O K |
| 60 min Summer | 9.944 | 0.079 | 0.0 | 1.3 | 1.3 | 15.0 | O K |
| 120 min Summer | 9.949 | 0.084 | 0.0 | 1.4 | 1.4 | 15.9 | O K |
| 180 min Summer | 9.949 | 0.084 | 0.0 | 1.4 | 1.4 | 15.8 | O K |
| 240 min Summer | 9.947 | 0.082 | 0.0 | 1.4 | 1.4 | 15.4 | O K |
| 360 min Summer | 9.941 | 0.076 | 0.0 | 1.3 | 1.3 | 14.3 | O K |
| 480 min Summer | 9.936 | 0.071 | 0.0 | 1.3 | 1.3 | 13.4 | O K |
| 600 min Summer | 9.932 | 0.067 | 0.0 | 1.3 | 1.3 | 12.6 | O K |
| 720 min Summer | 9.927 | 0.062 | 0.0 | 1.2 | 1.2 | 11.7 | O K |
| 960 min Summer | 9.919 | 0.054 | 0.0 | 1.2 | 1.2 | 10.2 | O K |
| 1440 min Summer | 9.906 | 0.041 | 0.0 | 1.1 | 1.1 | 7.7 | O K |
| 2160 min Summer | 9.891 | 0.026 | 0.0 | 0.9 | 0.9 | 5.0 | O K |
| 2880 min Summer | 9.881 | 0.016 | 0.0 | 0.8 | 0.8 | 3.1 | O K |
| 4320 min Summer | 9.870 | 0.005 | 0.0 | 0.7 | 0.7 | 0.9 | O K |
| 5760 min Summer | 9.865 | 0.000 | 0.0 | 0.6 | 0.6 | 0.0 | O K |
| 7200 min Summer | 9.865 | 0.000 | 0.0 | 0.5 | 0.5 | 0.0 | O K |
| 8640 min Summer | 9.865 | 0.000 | 0.0 | 0.5 | 0.5 | 0.0 | O K |
| 10080 min Summer | 9.865 | 0.000 | 0.0 | 0.4 | 0.4 | 0.0 | O K |
| 15 min Winter | 9.918 | 0.053 | 0.0 | 1.2 | 1.2 | 9.9 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 118.266 | 0.0 | 10.8 | 18 |
| 30 min Summer | 79.293 | 0.0 | 14.6 | 32 |
| 60 min Summer | 50.812 | 0.0 | 18.7 | 60 |
| 120 min Summer | 31.514 | 0.0 | 23.2 | 102 |
| 180 min Summer | 23.516 | 0.0 | 26.0 | 134 |
| 240 min Summer | 18.989 | 0.0 | 28.0 | 168 |
| 360 min Summer | 13.928 | 0.0 | 30.8 | 238 |
| 480 min Summer | 11.185 | 0.0 | 33.0 | 306 |
| 600 min Summer | 9.428 | 0.0 | 34.8 | 374 |
| 720 min Summer | 8.195 | 0.0 | 36.3 | 440 |
| 960 min Summer | 6.563 | 0.0 | 38.7 | 570 |
| 1440 min Summer | 4.791 | 0.0 | 42.4 | 822 |
| 2160 min Summer | 3.490 | 0.0 | 46.4 | 1188 |
| 2880 min Summer | 2.784 | 0.0 | 49.3 | 1556 |
| 4320 min Summer | 2.021 | 0.0 | 53.7 | 2248 |
| 5760 min Summer | 1.608 | 0.0 | 57.1 | 0 |
| 7200 min Summer | 1.346 | 0.0 | 59.8 | 0 |
| 8640 min Summer | 1.164 | 0.0 | 62.0 | 0 |
| 10080 min Summer | 1.028 | 0.0 | 63.9 | 0 |
| 15 min Winter | 118.266 | 0.0 | 10.8 | 18 |

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## Summary of Results for 100 year Return Period (+40%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 30 min Winter | 9.933 | 0.068 | 0.0 | 1.3 | 1.3 | 12.8 | O K |
| 60 min Winter | 9.945 | 0.080 | 0.0 | 1.4 | 1.4 | 15.1 | O K |
| 120 min Winter | 9.950 | 0.085 | 0.0 | 1.4 | 1.4 | 16.0 | O K |
| 180 min Winter | 9.949 | 0.084 | 0.0 | 1.4 | 1.4 | 15.8 | O K |
| 240 min Winter | 9.946 | 0.081 | 0.0 | 1.4 | 1.4 | 15.3 | O K |
| 360 min Winter | 9.938 | 0.073 | 0.0 | 1.3 | 1.3 | 13.8 | O K |
| 480 min Winter | 9.931 | 0.066 | 0.0 | 1.3 | 1.3 | 12.4 | O K |
| 600 min Winter | 9.924 | 0.059 | 0.0 | 1.2 | 1.2 | 11.2 | O K |
| 720 min Winter | 9.918 | 0.053 | 0.0 | 1.2 | 1.2 | 10.1 | O K |
| 960 min Winter | 9.908 | 0.043 | 0.0 | 1.1 | 1.1 | 8.0 | O K |
| 1440 min Winter | 9.891 | 0.026 | 0.0 | 0.9 | 0.9 | 5.0 | O K |
| 2160 min Winter | 9.876 | 0.011 | 0.0 | 0.8 | 0.8 | 2.1 | O K |
| 2880 min Winter | 9.867 | 0.002 | 0.0 | 0.7 | 0.7 | 0.4 | O K |
| 4320 min Winter | 9.865 | 0.000 | 0.0 | 0.5 | 0.5 | 0.0 | O K |
| 5760 min Winter | 9.865 | 0.000 | 0.0 | 0.4 | 0.4 | 0.0 | O K |
| 7200 min Winter | 9.865 | 0.000 | 0.0 | 0.3 | 0.3 | 0.0 | O K |
| 8640 min Winter | 9.865 | 0.000 | 0.0 | 0.3 | 0.3 | 0.0 | O K |
| 10080 min Winter | 9.865 | 0.000 | 0.0 | 0.3 | 0.3 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 30 min Winter | 79.293 | 0.0 | 14.6 | 32 |
| 60 min Winter | 50.812 | 0.0 | 18.7 | 60 |
| 120 min Winter | 31.514 | 0.0 | 23.2 | 112 |
| 180 min Winter | 23.516 | 0.0 | 26.0 | 140 |
| 240 min Winter | 18.989 | 0.0 | 28.0 | 178 |
| 360 min Winter | 13.928 | 0.0 | 30.9 | 254 |
| 480 min Winter | 11.185 | 0.0 | 33.0 | 328 |
| 600 min Winter | 9.428 | 0.0 | 34.8 | 398 |
| 720 min Winter | 8.195 | 0.0 | 36.3 | 466 |
| 960 min Winter | 6.563 | 0.0 | 38.8 | 598 |
| 1440 min Winter | 4.791 | 0.0 | 42.5 | 852 |
| 2160 min Winter | 3.490 | 0.0 | 46.4 | 1212 |
| 2880 min Winter | 2.784 | 0.0 | 49.4 | 1528 |
| 4320 min Winter | 2.021 | 0.0 | 53.8 | 0 |
| 5760 min Winter | 1.608 | 0.0 | 57.1 | 0 |
| 7200 min Winter | 1.346 | 0.0 | 59.8 | 0 |
| 8640 min Winter | 1.164 | 0.0 | 62.0 | 0 |
| 10080 min Winter | 1.028 | 0.0 | 63.9 | 0 |

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## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 1.000 |
| Region | England and Wales | Cv (Winter) | 1.000 |
| M5-60 (mm) | 18.000 | Shortest Storm (mins) | 15 |
| Ratio R | 0.357 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +40 |

## Time Area Diagram

Total Area (ha) 0.037

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.037 |

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## Model Details

Storage is Online Cover Level (m) 10.000

## Cellular Storage Structure

Invert Level (m) 9.865 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.80
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 236.0 | 0.0 | 0.086 | 0.0 | 0.0 |
| 0.085 | 236.0 | 0.0 | | | |

## Complex Outflow Control

### Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

### Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

### Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

### Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

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Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

### Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

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Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

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Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

Orifice

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.835

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# ACO Blue Roof Calculator Version 1.0.0.36

**Project Title**

DSM Deansgate

**Design Number**

**Notes / Reference**

Roof

| | |
|---|---|
| Design Storm Event | 1:100 |
| Climate Change % | 40% |
| Location | Manchester |
| Roof Area m² | 371.0 |
| Additional Contributing Areas (m²) | |
| **Total Catchment Area (m²)** | **371.0** |
| Net Roof Area (m²) | 236.0 |
| Permitted Outflow (l/s) | 1.484 |
| Blue or Blue/Green Roof | Blue / Green |
| If B/G, Green Roof Type | Extensive |
| a. Permanent reservoir above or in storage void | None |
| b. Required Reservoir Depth (mm) | |

| | |
|---|---|
| Required Net Storm Storage Volume (m³) | 13.26 |
| Total Net Volume Required (m³) | 13.26 |
| Void Ratio | 0.90 |
| Selected depth of storage tank (mm) | 85 |

R: 0.36 l/s

M5-60: 18.00 mm/h

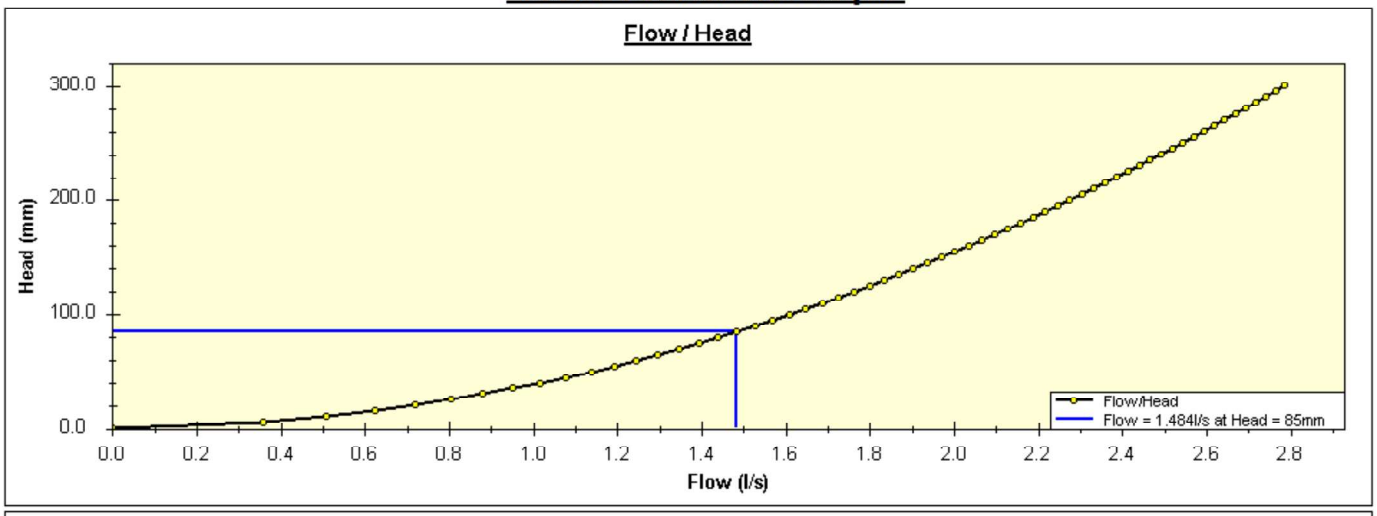
| DURATION (mins) | INTENSITY (mm/h) | REQUIRED STORAGE VOLUME (m³) |
|---|---|---|
| 5 mins | 173.21 | 4.91 |
| 10 mins | 135.33 | 7.48 |
| 15 mins | 119.04 | 9.71 |
| 30 mins | 76.34 | 11.49 |
| 1 hour | 50.15 | 13.26 |
| 2 hours | 31.29 | 12.53 |
| 4 hours | 18.46 | 6.03 |
| 6 hours | 13.77 | 0.00 |
| 10 hours | 9.36 | 0.00 |
| 24 hours | 4.77 | 0.00 |
| 48 hours | 2.67 | 0.00 |

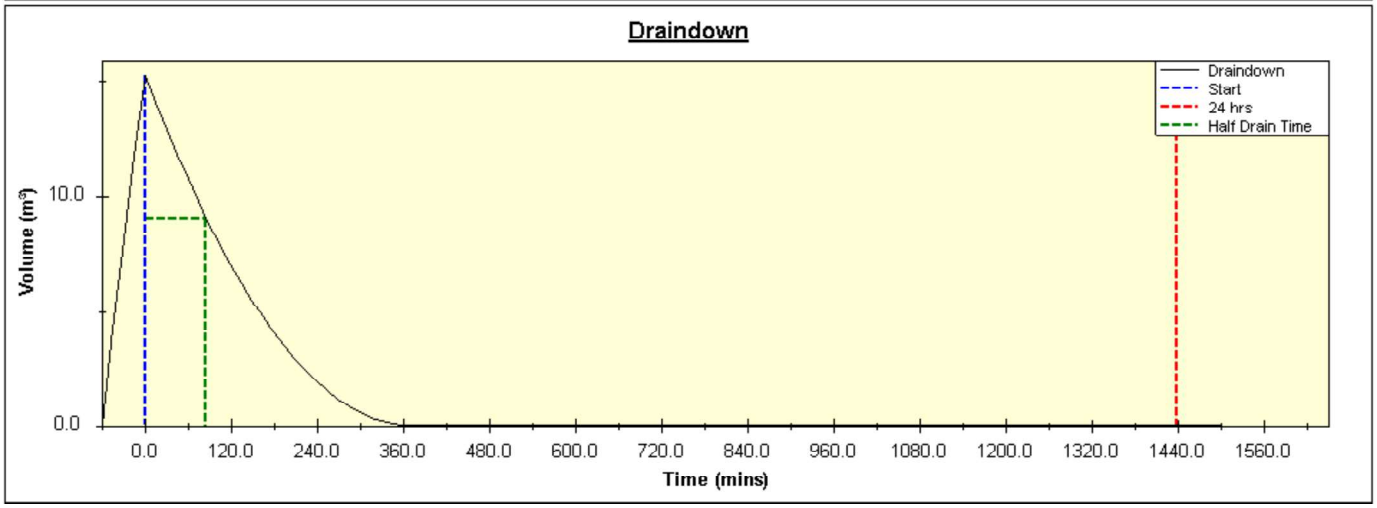
**Structural Load Calculations**

| Item | kN/m² |
|---|---|
| Weight of Product (Tank / Cell) | 0.111 |
| Weight of Product (Tray) | 0.000 |
| Geotextile | 0.004 |
| Weight of Permanent Storage | 0.000 |
| Weight of Stormwater Storage | 0.750 |

Half Draindown time: 86 mins

## Level & Draindown Graphs



# *APPENDIX I*

## *FOUL WATER DRAINAGE CALCULATIONS*

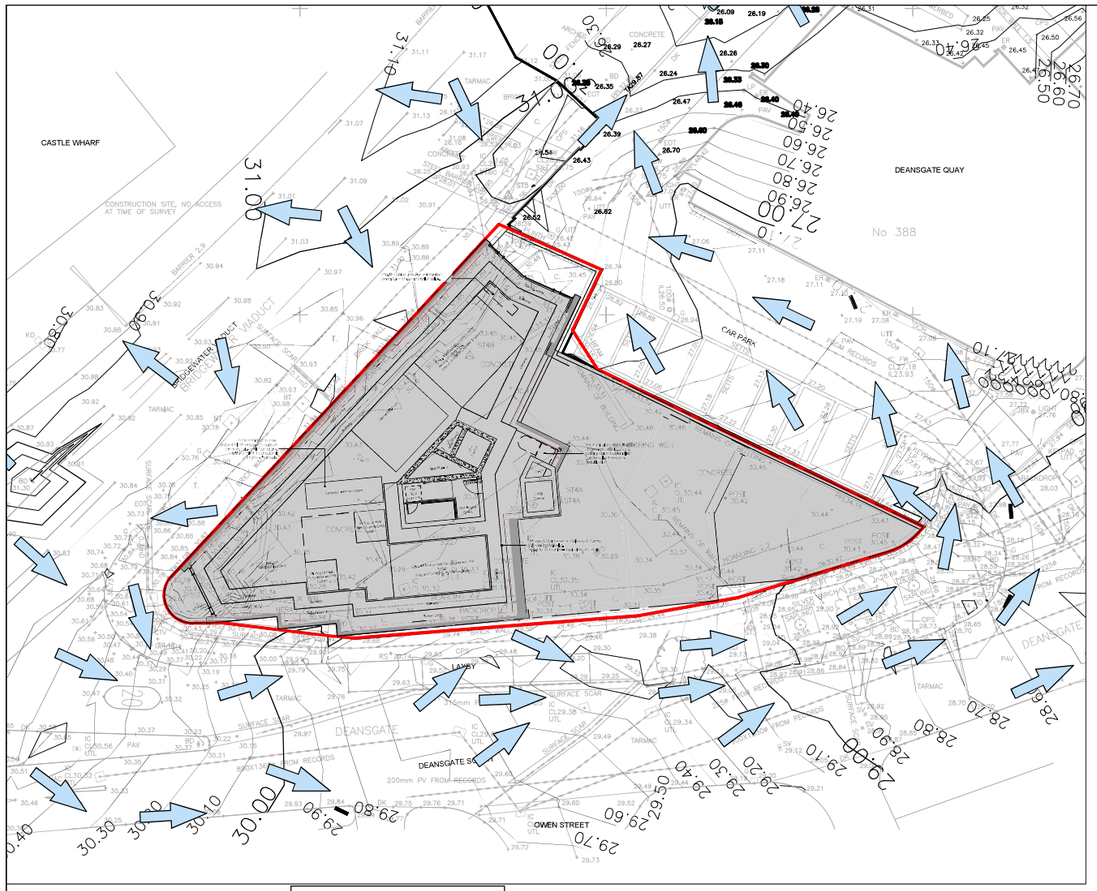
**20047 Deansgate, Manchester**

Foul Water Drainage - Flow Estimate. 21st June 2023.

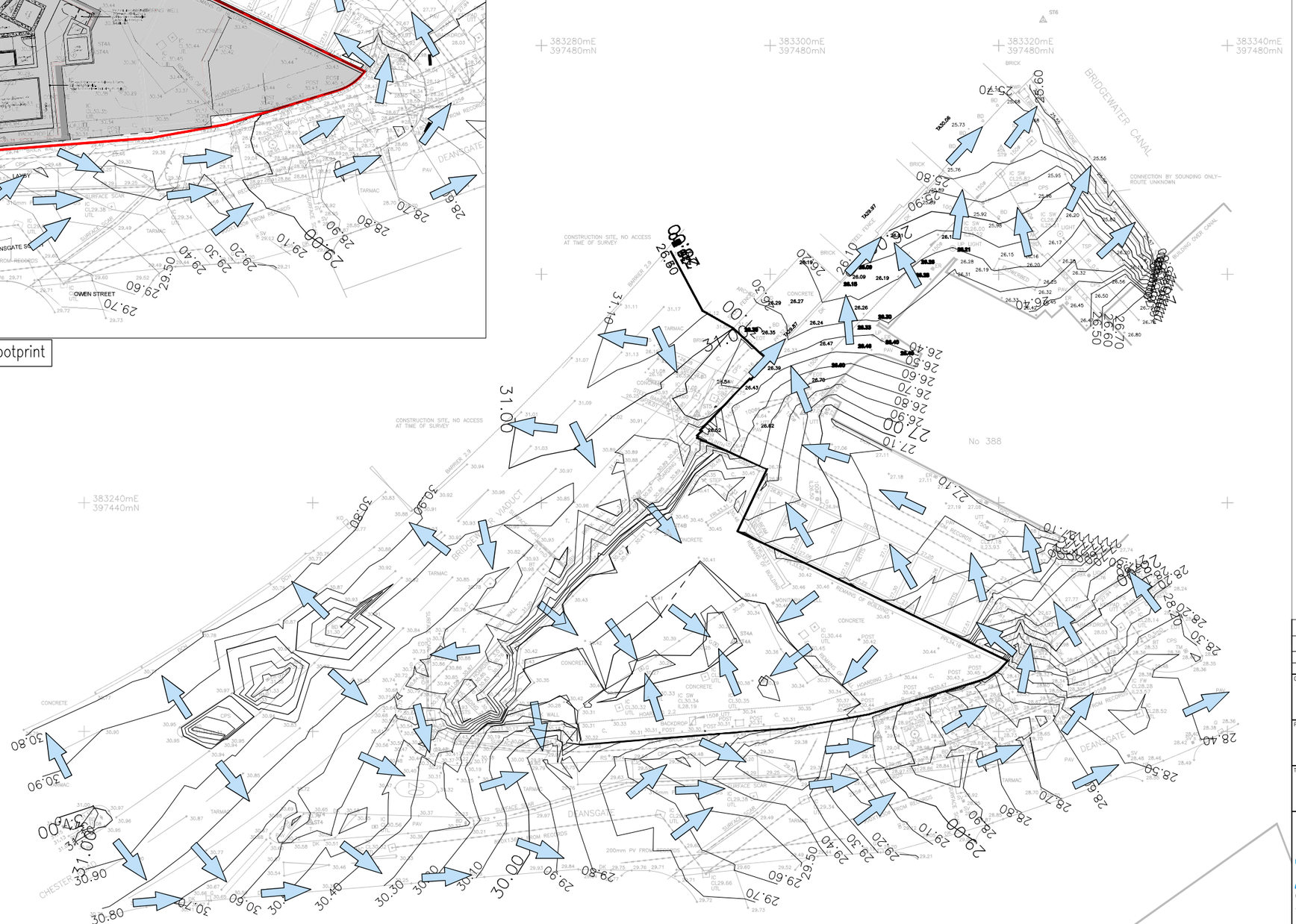
| **Proposed peak discharge rate based on occupancy (Flows and Loads 4)** | |
|---|---|
| **Residential** | |
| Student Beds | 509 |
| Flow per person per day (L/d) | 120 |
| Flow per day (L/d) | 61080 |
| Volume per day (m3) | 61.08 |
| Flow per second (L/s) | 0.71 |
| Peaking Factor | 6 |
| Peak Flow per second (L/s) | 4.24 |

# *APPENDIX J*

## *EXCEEDANCE FLOW*




New Building Footprint




## NOTES

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS RELATE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
6. THIS DRAWING IS COPYRIGHT © PROPERTY OF SHEAR DESIGN LIMITED.

Arrow indicates direction of overland flow in the event of an exceedance flood event

| REV | DATE | DESCRIPTION | BY | CHK |
|---|---|---|---|---|
| B | 22.06.23 | UPDATED TO SUIT ARCHITECT'S CURRENT ROOF LAYOUT. | TU | TU |
| A | 13.09.22 | DRAWING PRESENTATION ADJUSTED. | TU | TU |

AMENDMENTS

CLIENT: FUSION MANCHESTER DEVCO LTD

PROJECT: STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

TITLE: DRAINAGE
EXCEEDANCE FLOW ROUTES

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| DRAWN: | CHECKED: | DATE: | SCALE: |
|---|---|---|---|
| TU | DK | JULY 2022 | 1:200 @ A1 |

| SHEAR DESIGN REF: | DRAWING NUMBER: | REVISION: |
|---|---|---|
| 20047 | 20047-127 | B |

STATUS: A