

Citylabs 4.0 Ltd.

Citylabs 4.0

FRA and Drainage Strategy

CIV-REP-002

P01 | 4 May 2022

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

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

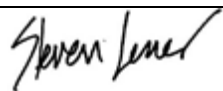
Job number 267661

Ove Arup & Partners Ltd
6th Floor 3 Piccadilly Place
Manchester M1 3BN
United Kingdom
www.arup.com

ARUP

Document verification

ARUP

Job title		Citylabs 4.0		Job number	
				267661	
Document title		FRA and Drainage Strategy		File reference	
Document ref		CIV-REP-002			
Revision	Date	Filename			
Draft 1	4 May 2022	Description	Issue for Work Stage 4		
			Prepared by	Checked by	Approved by
		Name	Alex Leahy	Kathryn Orrell	Steven Lesser
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue Document verification with document ☒					

Contents

	Page
1 Executive Summary	1
2 Introduction	1
2.1 Proposed Development	1
2.2 Consultation to date	1
3 Existing Site	1
3.1 Site Topography	2
3.2 Geology and Hydrogeology	3
3.3 Existing Site Drainage	3
3.4 Critical Drainage Area	4
3.5 Existing Runoff Rates	4
4 Drainage Proposals	5
4.1 General Drainage Proposals	5
4.2 Surface Water Proposals	6
4.3 Climate Change	7
4.4 Discharge Hierarchy	7
4.5 Opportunities for SuDS	8
4.6 Attenuation Proposals	14
4.7 Foul Drainage Proposals	14
5 Flood Risk	16
5.1 Local Development Policies	16
5.2 National Development Policies	16
5.3 Fluvial Flood Risk	16
5.4 Surface Water Flood Risk	17
5.5 River and Sea Flood Risk	17
5.6 Groundwater Flood Risk	18
6 Conclusion	19
6.1 Drainage Strategy	19
6.2 Flood Risk	19

Appendices

Appendix A – United Utilities Asset Map

Appendix B – Drainage Proposals

Appendix C – Correspondence

1 Executive Summary

This document outlines the Flood Risk Assessment (FRA) and Drainage Strategy for the CityLabs 4.0 project and is to be submitted to Manchester City Council to support the planning application. It includes information around the proposed development, site topography, existing drainage, existing run-off rates, drainage proposals, SuDS assessment and flood risk from various sources.

United Utilities have agreed to a 10 l/s run-off leaving the site into their drainage network that runs past the north and south of the site. There is limited opportunity to feature SuDS in the proposal due to constraints associated with the site. These constraints are highlighted in a SuDS Assessment. Additionally, the area has low permeability, so it is not possible to discharge to the ground.

The site sits within Flood Zone 1 and therefore is at a low risk of fluvial flooding. There is also a very low risk of surface water flooding and river and sea flooding.

2 Introduction

Ove Arup and Partners Ltd (Arup) have been commissioned by Bruntwood Science Limited to undertake a flood risk assessment and develop a proposed Drainage Strategy for the proposed CityLabs 4.0 project.

The following report shall be submitted to Manchester City Council (MCC) in support of the outline planning application: 125593/AO/2019.

2.1 Proposed Development

The CityLabs 4.0 project comprises a new-build 7-storey structure which will provide office and lightweight laboratory uses.

To support the new development the external areas around the proposed building will be upgraded to provide a private access road in addition to a combination of new hard and soft landscaping.

2.2 Consultation to date

The drainage strategy has been developed in consultation with Manchester City Council (as Lead Local Flood Authority) and United Utilities (sewerage undertakers).

Key correspondence is included in Appendix C.

3 Existing Site

The City Labs 4.0 site is located on Heathersage Road in the Rusholme area of south Manchester, NGR SJ851958. The site is approximately rectangular with a site area of circa 3290m² (0.329 hectares).

The site is bounded to the north by Hathersage Road, Melrose Apartments to the east and the Winnecott Centre to the west. The eastern part of the site is occupied by a surface car park, and the western part by the Manchester Royal Infirmary diabetes centre building. This building was constructed around 2004 and appears to be a two-storey temporary portacabin type structure.

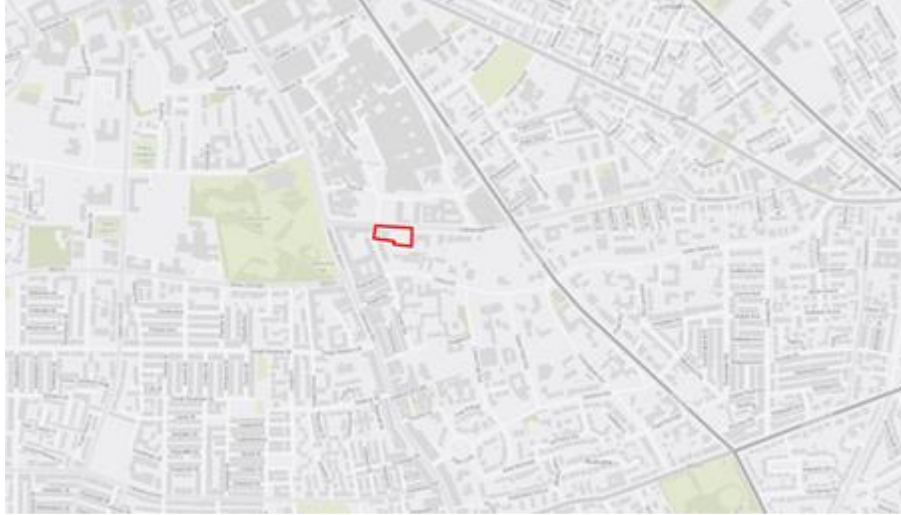


Figure 1: Location plan of Citylabs 4.0 site, shown with a red site boundary

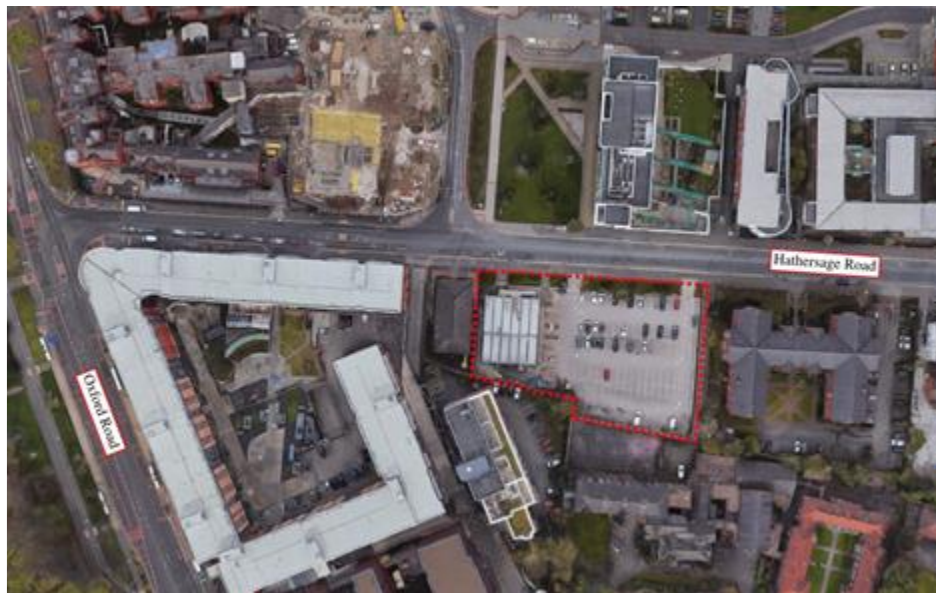


Figure 2: Google Maps view of Citylabs 4.0 site, shown with a red site boundary and adjacent streets labelled

3.1 Site Topography

A topographical survey of the site was undertaken by Survey Operations in August 2019. The survey indicates that the site is relatively flat, with levels ranging from 40.07mAoD to 39.13mAoD, with a slight high point to the north which falls across the site to the south.

3.2 Geology and Hydrogeology

CCG Ground Investigations produced a Ground Investigation report in November 2019. This revealed that the ground conditions across the site are generally as follows:

- Made ground, underlain by
- Superficial Glacial Till, underlain by
- Chester Formation Sandstone

Groundwater monitoring was undertaken across the site which demonstrated groundwater sits approximately 11m below ground level (bgl).

Infiltration tests were also undertaken as part of the investigative works. The infiltration rate determined was 6.18E-05 m/s. This result indicates that the permeability of the existing ground is relatively low and as such there is limited opportunity to discharge surface water to ground.

3.3 Existing Site Drainage

UU existing asset records have been reviewed and these reveal the presence of several combined sewers within the immediate vicinity of the site; see Figure 3 below. Refer to Appendix A for full asset record plan.

In addition to reviewing the UU record information a CCTV survey was undertaken by Survey Operation Utility Survey, ref 19F248/001, August, 2019.

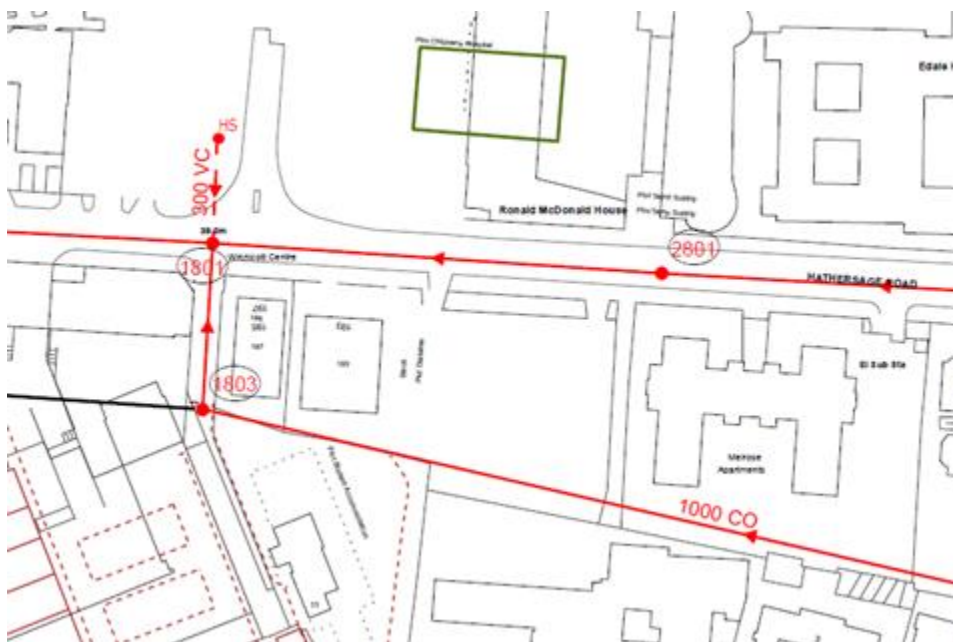


Figure 3: Extract from United Utilities asset record plan showing public sewers in the vicinity of the site

Of particular interest is the combined sewer crossing the south of the site, identified as a 1000mm diameter combined sewer on the UU record plans, which flows from east to west.

The CCTV survey which was undertaken demonstrated that the construction of this sewer is more akin to a brick culvert (1000mmx900mm, WxH) rather than a concrete pipe. Inspection of the CCTV revealed a number of structural defects along the length of the sewer. UU have undertaken their own assessment of the footage and concluded that “none of the defects would require urgent remedial works”.

However, it appears that there is less than 1m cover to this sewer when compared to existing ground levels and the trafficking above is anticipated to increase in the proposed case. As such, the structural defects identified on the survey remain an open risk item and on-going liaison will be required with UU throughout the development of the design to find a suitable coordinated solution.

3.4 Critical Drainage Area

The MCC Strategic Flood Risk Assessment (SFRA) identifies the site as being located within the Central “Conurbation Core” Critical Drainage Area (CDA). This designation has implications on the necessary assessment of the flood risk and sets the parameters which must be followed in relation to the reduction of peak surface water flows offsite and associated attenuation.

3.5 Existing Runoff Rates

3.5.1 Brownfield Runoff Rate

The existing brownfield rates for the site has been calculated using the Wallingford Modified Rational Method and equation. The modified rational equation has been replicated below for clarity:

$Q = 2.78CIA$, where;

Q = flow (l/s);
C = runoff coefficient (l);
I = rainfall (mm/hr); and
A = catchment area (ha).

Table 1 below provides existing discharge rates for the relevant return period storm events during the 15-minute duration storm events:

Table 1: Calculated existing brownfield run-off rates for the development site

Rainfall Event	Rainfall Depth 60-min (mm)	Intensity (mm/hr)	Existing Discharge Rate (l/s) (15-min storm duration)
1 in 1 Year	27.24	27.24	21.9
1 in 30 Year	66.96	66.96	53.7
1 in 100 Year	86.16	86.16	69.1

3.5.2 Greenfield Runoff Rate

Greenfield runoff rates have been calculated for the site in accordance with IoH124 methodology, using the www.uksuds.com greenfield runoff estimation tool.

As greenfield runoff rates are often used to determine the proposed runoff rate for a development, the most conservative values calculated via the IoH124 methodology are provided for the 1 in 1 year, 1 in 30 year and 1 in 100 year in Table 2 below, based on a site area of 0.329ha:

Table 2: Existing Greenfield Run-off Rates (IoH124)

Rainfall Event	Greenfield Runoff Rate (l/s)
1 in 1 Year	1.79
1 in 30 Year	3.5
1 in 100 Year	4.28

3.5.3 Foul Discharge

There are currently a number of temporary portacabins located on the site which together act as the Diabetes Centre for Manchester Royal Infirmary located across the road.

The CCTV survey undertaken by Underground Surveys Ltd demonstrated that there are currently 3no. possible foul connection discharging from these cabins to the combined network. It was not possible to prove these connections during the survey. Due to the limited size of these temporary structure the number of connections would appear to be reasonable.

The existing foul flows discharging from the Diabetes Centre are anticipated to be low due to the scale and nature of the portacabins, although at this stage it has not been possible to estimate the exact flows. None of these connections will be maintained in the permanent case, and therefore should not influence the proposed drainage strategy.

4 Drainage Proposals

4.1 General Drainage Proposals

Two separate piped drainage networks will be provided for the site to drain the surface water and foul drainage respectively. Each network shall have its own dedicated connection point to the public network at separate locations.

The surface water system will discharge into the sewer under Hathersage Road north of the site via the existing connection point to the sewer.

The foul water system will discharge into the private 225mm diameter sewer which runs along the southern border of the site and connects to the 1000mm

public sewer/culvert. Further intrusive works are needed to confirm where the connection to the 1000mm public sewer/culvert is located.

External piped drainage systems will generally be specified in accordance with the Civil Engineering Specification for the Water Industry 7th Edition and designed in accordance with;

- BS EN 752:2008 ‘Drain and Sewer Systems Outside Building’
- Sewers for Adoption 7th Edition
- National Planning Policy (NPPF) Guidance
- Non-statutory Technical Standards for Sustainable Drainage Systems (2015)
- The Building Regulations – Part H

Refer to Appendix B for indicative drainage layout sketch.

4.2 Surface Water Proposals

4.2.1 Local Development Policies

MCC Core Strategy Policy EN – 13 Flood Risk stipulates that all developments within a CDA should follow the guidance in the Level 2 Hybrid SFRA User Guide to determine the relevant peak surface run-off reduction and attenuation requirements.

Level 2 Hybrid SFRA User Guide – Section 3.4.1 Critical Drainage Areas stipulates that brownfield developments within a CDA must aim for a minimum 50% reduction in surface water runoff rates, with an aim of reducing runoff to Greenfield rates up to a 1 in100 storm event, considering climate change.

4.2.2 Proposed Surface Water Runoff Rate

A proposed run-off rate of 10 l/s has been provisionally agreed with UU, confirmed via email 15 March 2022.

Table 3: Proposed surface water run-off rates for the development site

Rainfall Event	Existing Brownfield Runoff Rate (l/s)	Proposed Runoff Rate (l/s)	% Difference
1 in 1 Year	21.9	10	54% reduction
1 in 100 Year	69.1	10	86% reduction
1 in 100 Year + 40% CC	-	10	-

As a minimum 50% reduction in peak runoff rates has been achieved for all design storms, the proposed runoff rate complies with the MCC Core Strategy Policy EN – 13 and the parameters stipulated within the Level 2 Hybrid SFRA User Guide. Additionally, an 86% reduction in the peak run-off for the 1 in 100

Year event demonstrates that an effort has been made to reduce rates towards greenfield rates.

As such the proposed rate of 10 l/s shall be used as the basis of the proposed surface water drainage strategy

4.3 Climate Change

Current NPPF Guidance stipulates that to allow for the predicted impacts of climate change on surface water runoff, increases to peak rainfall intensity should be used

Table 4 is an extract from the updated government guidance in relation to climate change allowances. It is recommended that the ‘upper end’ climate change allowance should be used.

Table 4: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) (Source: Environment Agency Climate Change Guidance)

Applies across all of England	Total potential change anticipated for the ‘2020s’ (2015 to 2039)	Total potential change anticipated for the ‘2050s’ (2040 to 2069)	Total potential change anticipated for the ‘2080s’ (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Under the NPPF an allowance of 40% for the effects of climate change to the year 2115 should be used to achieve the policy requirements for the proposed redevelopment.

Applying a 40% additional allowance will enable surface water from storm events up to and including the 1 in 100-year event plus climate change to be safely stored on-Site without detriment to existing flood risk. As a result, the proposed surface water drainage strategy will serve to improve the resilience of the existing Site to the anticipated changes in rainfall patterns.

4.4 Discharge Hierarchy

Surface water on the site will be managed based on the following hierarchy for disposal as described in Building Regulations Document H and Planning Policy Guidance – Flood Risk and Coastal Change:

- Infiltration into the ground
- Discharge surface water into existing water body
- Discharge to highway or surface water
- Discharge to combined sewer

The hierarchy options are discussed in the following sections with justifications for the options chosen and reasons why others were discounted.

Infiltration into the ground

Consideration was given to the option of infiltration into the ground via soakaways and was discounted for the following reasons:

- Given the mixture of cohesive and granular nature of Made Ground throughout the site, infiltration rates may not be sufficient to support soakaway drainage.
- Glacial Till underlies the Made Ground across the site. Glacial Till encountered in the ground investigations was generally a silty sandy clay. Given the low permeability offered by the Glacial Till, it is likely it will be unable to support infiltration of drainage.
- Even if areas of higher permeability materials were located, given that the site is brownfield, it would not be good environmental practice to allow water to infiltrate through more contaminated materials and potentially transport contamination off site.

Discharge surface water into an existing water body

There are no rivers or streams within close vicinity of the site. Therefore, it is not feasible for surface water to be discharged to a watercourse.

Discharge to surface water sewer

Asset records confirm that there are no dedicated public surface water sewers within the vicinity of the site and therefore this option was discounted.

Discharge to combined sewer

Asset records confirm that a combined sewer runs below Hathersage Road. UU have requested that this sewer receive surface water flows in the proposed case, replicating the current discharge scheme. Please refer to Appendix B for a sketch of the drainage proposals.

4.5 Opportunities for SuDS

Chapter 14 of the NPPF recommends that SuDS should be utilised, where possible, within all new drainage schemes. SuDS generally mimic the natural drainage patterns of the undeveloped Site allowing infiltration into the ground (where feasible) and controlling outflow rates from the development. This reduces the impact and risk of flooding on downstream developments and can provide additional benefits such as pollution control, increased biodiversity and provision of water-based amenity space.

Table 5 below provides a detailed Site-specific assessment of the suitability of a variety of SuDS considered within the proposed surface water drainage strategy.

Table 5: Site specific SuDS Assessment

SuDS Function & Type	Description	Advantages	Disadvantages	Site Suitability/Designer Comments
Blue Roof	A roof specifically intended and designed to store water. This can be via open water surfaces, storage within or beneath porous medium or modular surfaces, within shallow geo-cellular crates or below a raised decking/impermeable surface.	No additional land take making them effective within dense urban Sites and can contribute significantly to overall Site attenuation requirements.	Additional weight and cost to structure (compared to normal roof design). Damage to waterproof membrane can be critical. Does not always provide treatment dependent on system.	Syphonic drainage is proposed for the roof drainage which is not compatible with the use of blue roofs. X
Green/Brown Roof	Multi-layered system that covers the roof of a building with vegetation/landscaping over a drainage layer. Designed to intercept and retain rainfall; reducing the volume of runoff and attenuating peak flows. Typically either defined as intensive or extensive systems depending on the nature of the selected flora.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation. Damage to waterproof membrane can be critical	Syphonic drainage is proposed for the roof drainage which is not compatible with the use of green/brown X Structural building design does not allow for the loading associated with green/brown roofs.
Rainwater Harvesting	The collection of rainwater (usually within underground storage tanks) for later re-use in either buildings (treated), wash down facilities (commercial) or irrigation.	Can provide source control of storm water runoff, reduces demand on mains water.	Use is dependent on demand requirements, contributing surface area, and seasonal rainfall characteristics	Opportunities for rainwater harvesting have been considered in the design but have not been deemed feasible by the design team. X

				This is mainly due to the constrained site, which restricts the available space for both rainwater harvesting equipment (such as tanks and pump sets) and for soft landscaping which might be able to make use of harvested rainwater.
Infiltration Systems/Soakaways	Any system which stores and discharges water directly to the underlying soils. These are typically soakaways, infiltration trenches, infiltration basins or infiltration blankets.	Provides groundwater recharge, ease of construction and can have minimal land take subject to design. Manages surface water at source.	Increased risk of groundwater ingress and pollution. Not suitable for poor draining soils or where infiltrating water may pit structural foundations at risk. Uncertainty over long term performance. Requires comprehensive geotechnical knowledge of underlying soils.	Ground investigation demonstrates that the permeability of the ground is too low to allow for infiltration of surface water. X
Swales	Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Can be incorporated into landscaping proposals, offers good removal of pollutants and reduces runoff rates and volumes. Relatively low cost.	Not suitable for steep areas, and requires significant land take (not suitable for high density urban Sites). Not suitable in areas with roadside parking.	Constrained urban setting means that implementation of swales is not feasible spatially. X
Filter Drains	Filter drains are shallow trenches filled with stone/gravel that accept runoff through sheet flow and provide temporary subsurface storage (typically provided adjacent to	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into Site landscaping and fit well beside roads and car parks.	High clogging potential without effective pre-treatment, limited to small catchments, high cost of replacing filter material.	Constrained urban setting means that implementation of filter drains is not feasible spatially. X

	highways or as interception features). They can drain via infiltration or be lined and positively drained via a perforated collection pipe.			
Bio-retention Systems/Rain Gardens	Shallow planted features, which receive runoff directly from adjacent hardstanding. Typically under drained, surface water will infiltrate to the underlying piped drainage system and in doing so promote storage, plant up-take and filtration.	Easily incorporated into soft landscaping, flexible shape and planting mix and provide good degree of storage (reducing the below ground requirement). High degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.	Requires considered use of water tolerant plant species and landscaping & management. Susceptible to clogging if poorly managed and not suitable for steeply sloping Sites.	The landscaping strategy does not include a provision for planting as it is integrating the site into the surrounding urban city environment. X
Tree Pits	Tree pit systems generally accept sheet runoff from adjacent hardstanding areas in the same manner as bio-retention systems. They can be used in urban settings and provide a range of aesthetic benefits.	Easily incorporated into soft landscaping with high degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.	Limited tree species/size depending on system and requires careful co-ordination with services due to root spread	The landscaping strategy does not include a provision for planting as it is integrating the site into the surrounding urban city environment. X
Permeable Pavements	Pavements that allow rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltrating the ground (unlined) or discharging to the sewerage system (lined).	Provides low-level treatment of highway-derived pollutants (as recognised by the EA) and reduces need for surface drainage (gullies, channels etc). Available in a range of surface types (not just block paving).	Often requires increased construction depth and not suitable for use with Type 1 sub-base. May not be applicable for heavy traffic loadings and irregular maintenance required in certain situations. Not suitable for utility routes.	Due to the constrained nature of the site, utilities are routed below the proposed surfacing surrounding most of the building. As such, permeable paving is not suitable. X

Detention Basins	Detention basins are surface storage basins that provide flow control through attenuation of storm water runoff. They facilitate settling of particulate pollutants. Typically dry, they can also offer multi-functional recreational use.	Can cater for a wide range of rainfall events, easy to maintain, potential for dual land use, can be incorporated in to landscaping proposals and low cost.	Not suitable for steep areas, significant land take and little reduction in runoff volume	The spatial constraints of the site do not allow for the use of detention basins. X
Ponds	Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline.	Good removal capability of urban pollutants, high potential ecological, aesthetic and amenity benefits, can cater for all storm events and good community acceptability.	No reduction in runoff volume; Anaerobic conditions can occur without regular inflow; Significantly land take; No suitable for steep Sites;	The spatial constraints of the site do not allow for the use of ponds. X
Sub-Surface/Geocellular Storage	Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios, can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	As the private road around the site is expected to be trafficked, the site lends itself to the use of sub-surface storage. ✓
Rills/Canals	Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	The spatial constraints of the site do not allow for the use of detention basins. X

Legend

✓ - Suitable for consideration on Site

X - Not suitable for consideration on Site

~ - Further consideration to be carried out during detailed design

4.6 Attenuation Proposals

Based on limiting discharge rates as shown in Table 3 above, it has been estimated through a “Quick Storage Estimate” (using Innovyze MicroDrainage) that to accommodate all storm events up to and including the 1 in 100 year + 40% climate change events, an attenuation volume of circa 210m³ will be required. This calculation assumes that the development will be 90% impermeable.

Table 6: Calculated attenuation volume required to achieve proposed surface water run-off rates

	1 in 100 year +40% CC
Attenuation Storage (m ³)	137 - 210

The Opportunities for SuDS assessment detailed in Section 4.5 above demonstrates that there is limited opportunity for SuDs across the site generally, and very limited opportunities for attenuation more specifically. Predominantly, this is down to the spatially constrained nature of the site both above and below ground.

As such, it is proposed that the attenuation storage volume be provided via a combination of geocellular attenuation tanks and oversized pipework.

4.7 Foul Drainage Proposals

4.7.1 Existing Foul Discharge Rates

Based on the currently available site information, it does not appear that any foul drainage flows are generated from the site.

4.7.2 Proposed Foul Discharge Rates

The peak foul water discharge rate from the proposed development is estimated to be approximately 7.6l/s. This has been calculated using British Flows and Loads 3 (2009) and the WS4 floor areas, and associated uses, provided by the Architect.

UU have confirmed via correspondence that the foul water flow from the proposed development does not require any restriction prior to discharging into the combined public sewer network.

As such, at this stage it is estimated that the peak foul flow rate for the development in the permanent case shall be 7.6l/s.

4.7.3 Proposed Discharge Point

The proposed outfall for the development is a private 225mm diameter private foul sewer running across the south east corner of the site. This connection shall be made by constructing a new manhole onto the existing pipework.

The private sewer itself outfalls to a public 1000mm combined sewer in the south-eastern corner of the site. The positive drainage connection between the private and public sewers has been confirmed via CCTV survey undertaken by Underground Surveys Ltd, December 2019.

The 1000mm combined sewer was also surveyed via CCTV, confirming that the construction is generally consistent with that of a brick culvert. This CCTV survey has been sent to UU for review as part of the design development process and they have confirmed that it is suitable to receive foul flows.

Whilst the presence and condition of the inside of the 1000mm public sewer has been confirmed, the exact line and level of the culvert has not. A package of ground investigations works are scheduled to be undertaken as part of the enabling works for the site to confirm this final information.

This 1000mm combined sewer will act as the ultimate discharge point for the site to the public network.

5 Flood Risk

5.1 Local Development Policies

MCC Core Strategy Policy EN - 13 Flood Risk stipulates that all sites over 0.5ha located within a CDA must have a detailed Flood Risk Assessment (FRA) regardless of what Environment Agency (EA) Flood Zone the site sits.

As outlined above, the City Labs 4 site has a total area of 0.329ha, therefore a detailed FRA is not required. Therefore, the guidance provided with the National Policy Planning Framework (NPPF) shall be followed for the assessment of flood risk.

5.2 National Development Policies

According to the NPPF a site-specific flood risk assessment is required for all sites of 1ha and greater. Furthermore, the EA Flood Maps for Planning the site is located in Flood Zone 1 which designates the site as having a “low probability of flooding from all sources”.

As the site is less than 1ha in area, a flood risk assessment is not formally required. However, for completeness the following sections will briefly summarise the risk of flooding from various sources

5.3 Fluvial Flood Risk

Inspection of the EA Flood Map for Planning reveals that the site sits within Flood Zone 1. This designates the sites as having a “low probability of flooding”; refer to Figure 4 below.

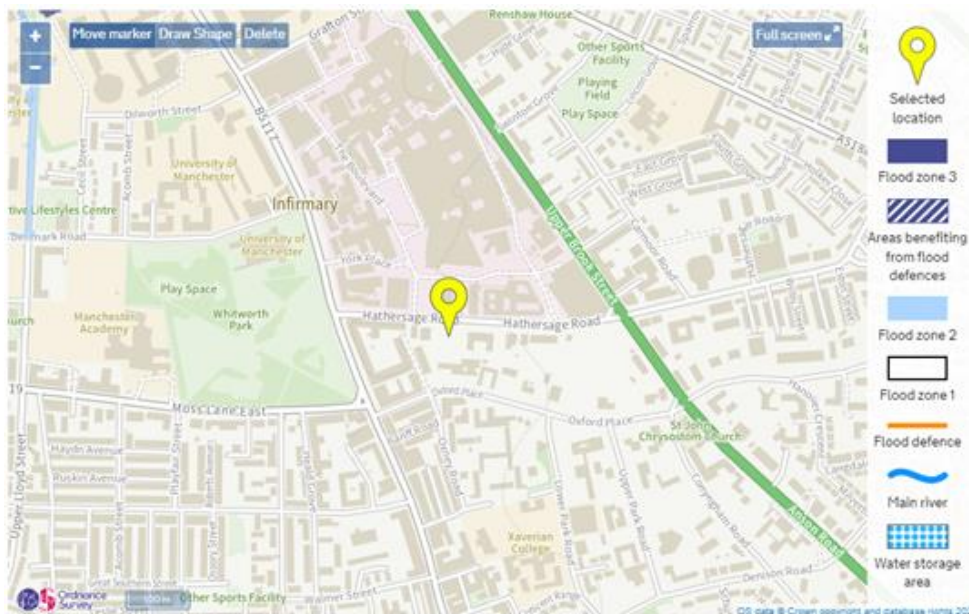


Figure 4: Extract of the EA Flood Map for Planning demonstrating fluvial flood risk for the development site

5.4 Surface Water Flood Risk

The site is classified as being at “very low risk” of surface water flooding which means that the site has less than a 1 in 1000 annual probability of flooding from surface water sources annually; refer to Figure 5 below.

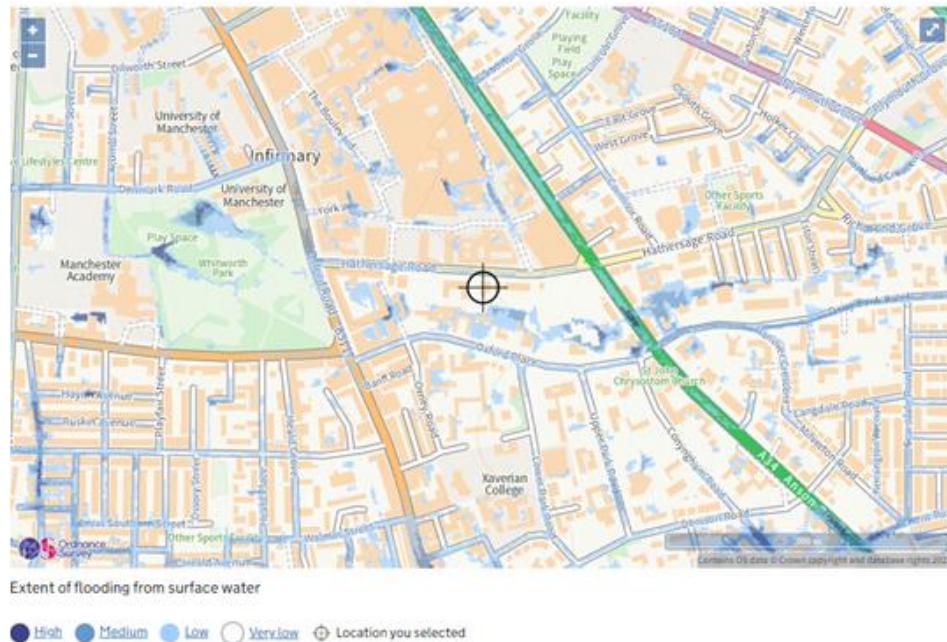


Figure 5: Extract of the EA Surface Water Flooding map demonstrating surface water flood risk for the development site

Hathersage Road directly to the north of the site is designated as being at “low risk” of flooding from surface water sources which means the area has a probability of 1 in 100 to 1 in 1000 of flooding annually.

To ensure that the risk of flooding along Hathersage Road is not increased due to the development of the site, external levels will be set to contain all surface water flows on the site itself and nothing is discharged to the highway.

5.5 River and Sea Flood Risk

The site is classified as being at “very low risk” of River and Sea flooding which means that the site has less than a 1 in 1000 annual probability of flooding from surface water sources annually; refer to Figure 6 below.

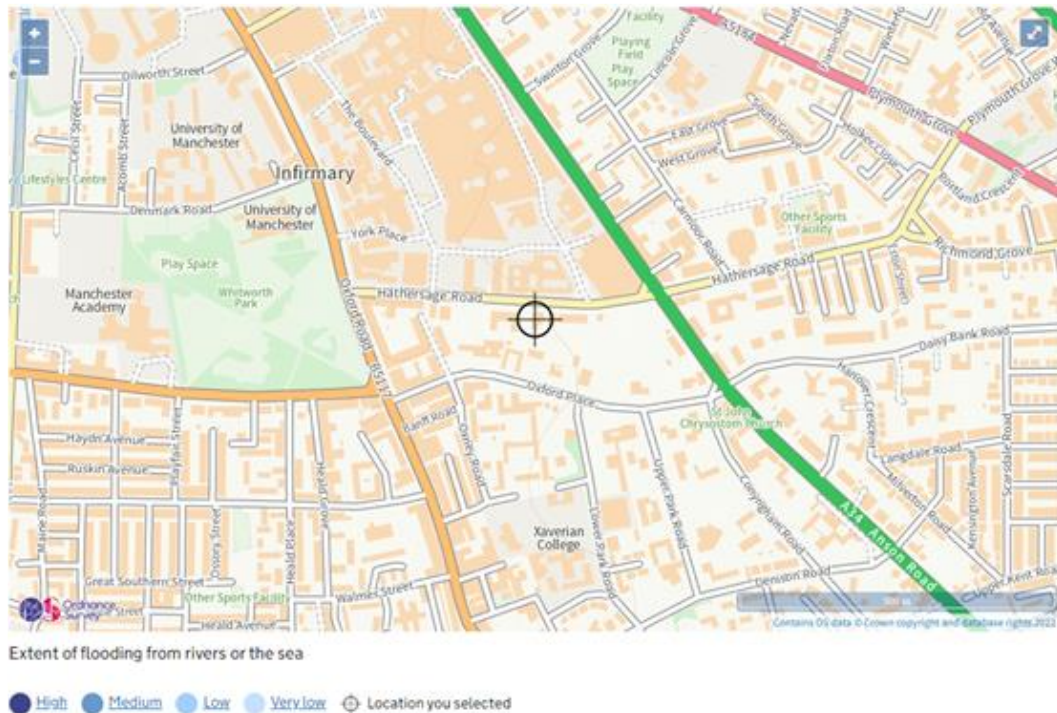


Figure 6: Extract of EA Rivers and Sea Flood Map demonstrating flood risk from rivers and sea for the development site

5.6 Groundwater Flood Risk

The Level 2 Hybrid SFRA denotes the site area as not being in an area at risk of ground water flooding. Therefore, the site is considered to be at low risk of flooding from groundwater.

6 Conclusion

6.1 Drainage Strategy

- The UU drainage network around the site consists of several combined sewers.
- UU confirmed on 15th March 2022, that the proposed surface water run-off rate of 10 l/s is acceptable.
- The following surface water run-off reductions will occur as a result of the run-off rate being limited to 10 l/s:
 - A reduction of 54% for a 1 in 1 year event
 - A reduction of 86% for a 1 in 100-year event.
- The SuDS Assessment indicates that many features are not possible due to constraints on the site. Below ground storage solutions such as oversized pipes, tank systems and modular geocellular systems are suitable for this site.
- Infiltration tests undertaken indicate that permeability of the existing ground is low, therefore there is limited opportunity to discharge surface water to ground. However, discharging to the ground would not be environmentally good practice as the site is brownfield.
- The surface water from the site will discharge to the sewer underneath Hathersage Road, north of the site.
- UU confirmed on 20th November 2019, that the foul discharge rate for the development may discharge at an unrestricted rate. Based on the current calculations, this is anticipated to be 7.6 l/s.
- The foul water system will discharge into the private 225mm sewer which runs along the southern border of the site and connects to the 1000mm public sewer/culvert.

6.2 Flood Risk

- The site sits within Flood Zone 1 and it therefore has a low probability of fluvial flooding.
- The site is classified as “very low risk” in regard to surface water flooding and river and sea flooding.
- In line with NPPF and MCC Policy a site-specific risk assessment for the site is not required.

6 Conclusion

6.1 Drainage Strategy

- The UU drainage network around the site consists of several combined sewers.
- UU confirmed on 15th March 2022, that the proposed surface water run-off rate of 10 l/s is acceptable.
- The following surface water run-off reductions will occur as a result of the run-off rate being limited to 10 l/s:
 - A reduction of 54% for a 1 in 1 year event
 - A reduction of 86% for a 1 in 100-year event.
- The SuDS Assessment indicates that many features are not possible due to constraints on the site. Below ground storage solutions such as oversized pipes, tank systems and modular geocellular systems are suitable for this site.
- Infiltration tests undertaken indicate that permeability of the existing ground is low, therefore there is limited opportunity to discharge surface water to ground. However, discharging to the ground would not be environmentally good practice as the site is brownfield.
- The surface water from the site will discharge to the sewer underneath Hathersage Road, north of the site.
- UU confirmed on 20th November 2019, that the foul discharge rate for the development may discharge at an unrestricted rate. Based on the current calculations, this is anticipated to be 7.6 l/s.
- The foul water system will discharge into the private 225mm sewer which runs along the southern border of the site and connects to the 1000mm public sewer/culvert.

6.2 Flood Risk

- The site sits within Flood Zone 1 and it therefore has a low probability of fluvial flooding.
- The site is classified as “very low risk” in regard to surface water flooding and river and sea flooding.
- In line with NPPF and MCC Policy a site-specific risk assessment for the site is not required.

Appendices

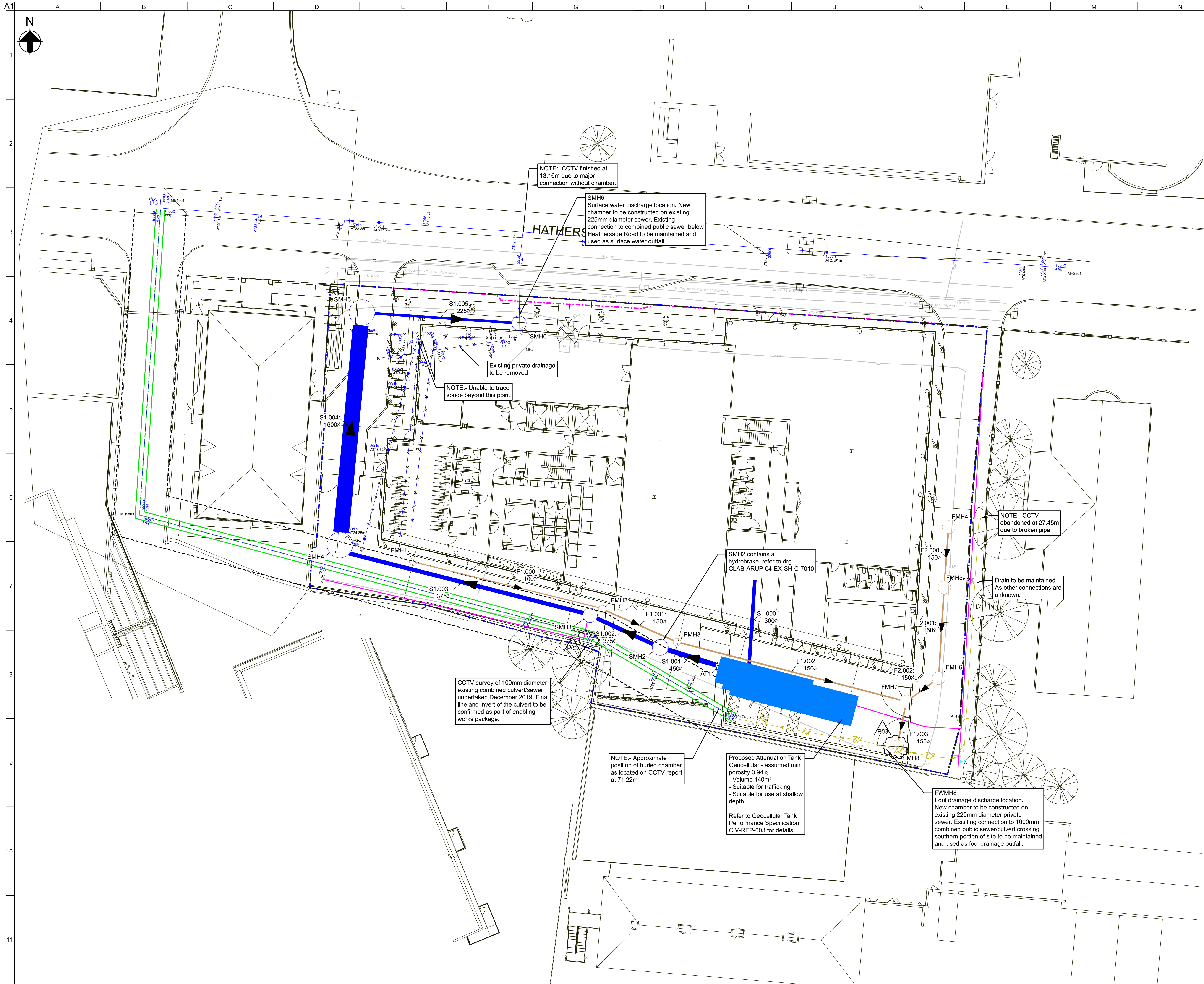
FRA and Drainage Strategy

Contents

Appendix A - United Utilities Asset Map	1
Appendix B – Drainage Proposals	2
Appendix C – Correspondence	3

Appendix A - United Utilities Asset Map

Appendix B – Drainage Proposals



- Notes
1. All dimensions are in mm, all levels in mAOD, unless specified otherwise.
 2. Document Status: This drawing has been prepared for Stage 4 and is issued for information only. As such the drawing is intended to provide an overview of the design intent rather than a definitive design. The drawing is subject to further design development, revision or replacement as detailed design progresses.
 3. Although every effort has been taken to check survey/site information used on this drawing, Arup is not responsible for its accuracy.
 4. This layout is based on the following drawings:
 - WIP Landscape Masterplan Layout, supplied by Layer Architects on 11th February 2020; drawing number '184-LYR-XX-ZZ-DWG-L-1001 - GENERAL ARRANGEMENT rev6' dated 20/01/20
 - Utility Survey by Survey Operations on Aug 2019; drawing number 19F248/001.
 5. Approximate Site Boundary is taken from Sheppard Robson Location Plan, supplied 12th February 2020; drawing reference '6312-SRA-XX-XX-DR-A-00001 rev06' dated 01/11/19.
 6. For Adoptable Highways Design, refer to Curtins S278 General Arrangement drawing; drawing ref '074034-CUR-00-XX-DR-D-75100 revP01'.
 7. For Kerb layouts refer to layer drawing 184-LYR-XX-ZZ-DWG-L-2002 Dated 28/02/20. Details provided on drawing CLAB-ARUP-04-EX-DR-C-7004 P02.
 8. Refer to manhole schedule CLAB-ARUP-04-EX-SH-C-7010 for details on invert levels and pipe connections.
 9. Refer to the following documents for more information:
 - CIV-REP-002 - Drainage Strategy and FRA
 - CIV-REP-003 - Geocellular Performance Specification
 - CIV-SPEC-001 - Infrastructure Works Specification

- Key
- Approximate Site Boundary
 - Approximate Adopted Highway Boundary
 - Existing United Utilities Culvert
 - Proposed Surface Water Drain
 - Proposed Surface Water Manhole
 - Proposed Foul Water Sewer
 - Proposed Foul Water Manhole
 - Proposed channel drain with connection ACO multidrain or similar approved
 - Existing private drains to be removed
 - Existing private drains to be maintained

P03	04/05/22	RR	AL	KO
Issue for Work Stage 4				
P02	29/05/20	LG	SJ	SIL
Design Stage 4				
P01	04/03/20	APS	AAS	SIL
Preliminary Work Stage 3				
Rev	Date	By	Chkd	Appd

ARUP

Three Piccadilly Place, Manchester, M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879

Client

bruntwood

Project Title

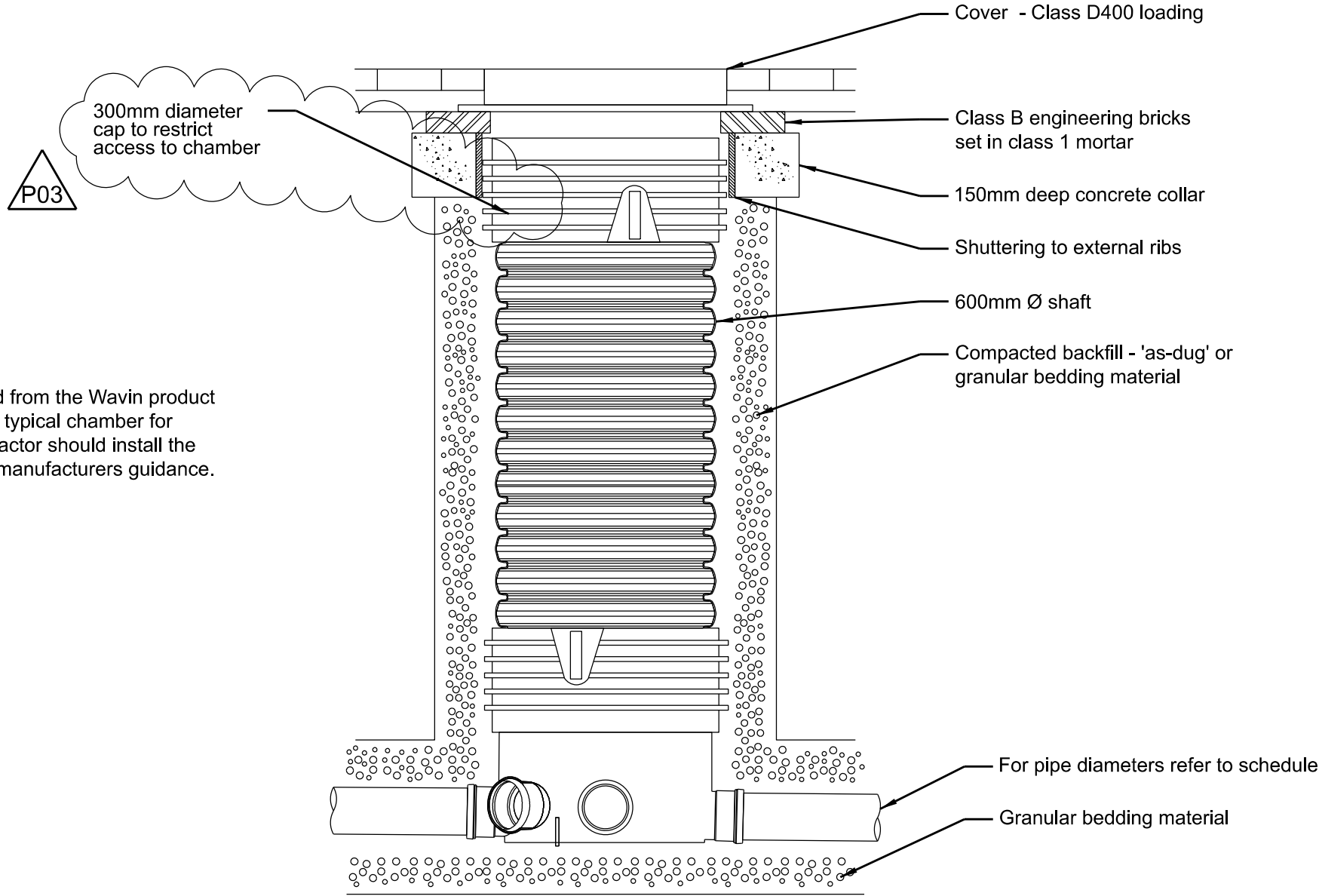
Citylabs 4.0

Drawing Title

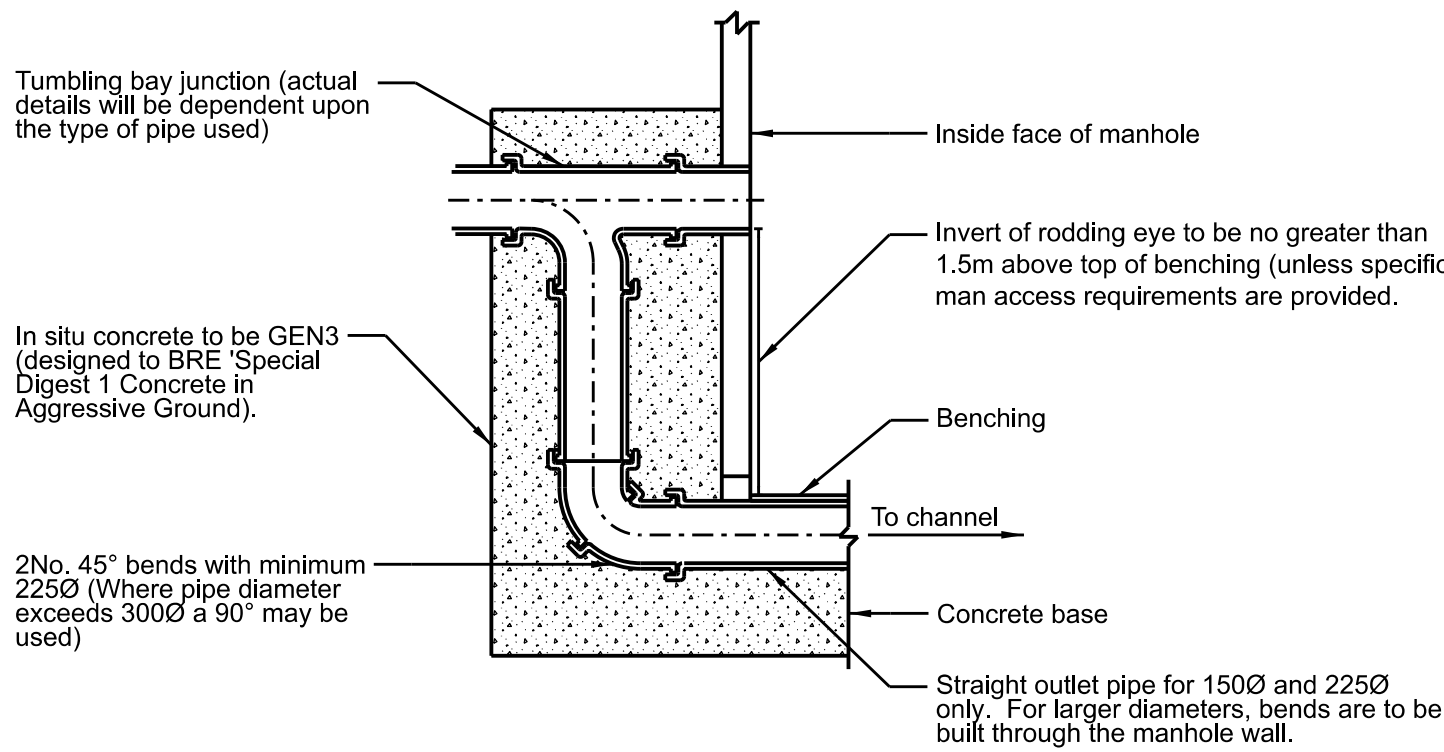
External Works
Drainage - General Arrangement

Scale at A1	1:200
Role	Civil - Drainage
Suitability	S3 - Fit for Review and Comment
Arup Job No	267661-00
Name	CLAB-ARUP-04-EX-DR-C-2006
Rev	P03

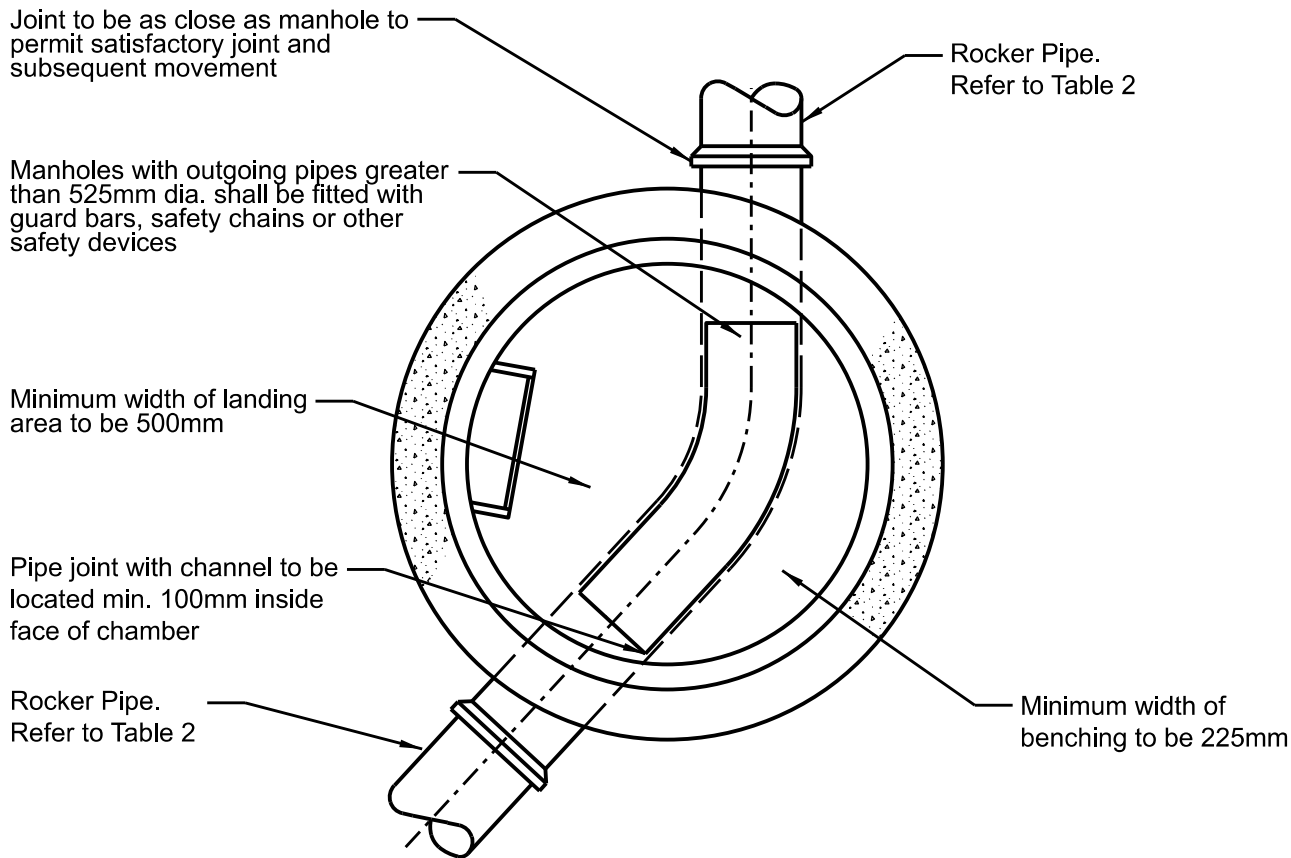
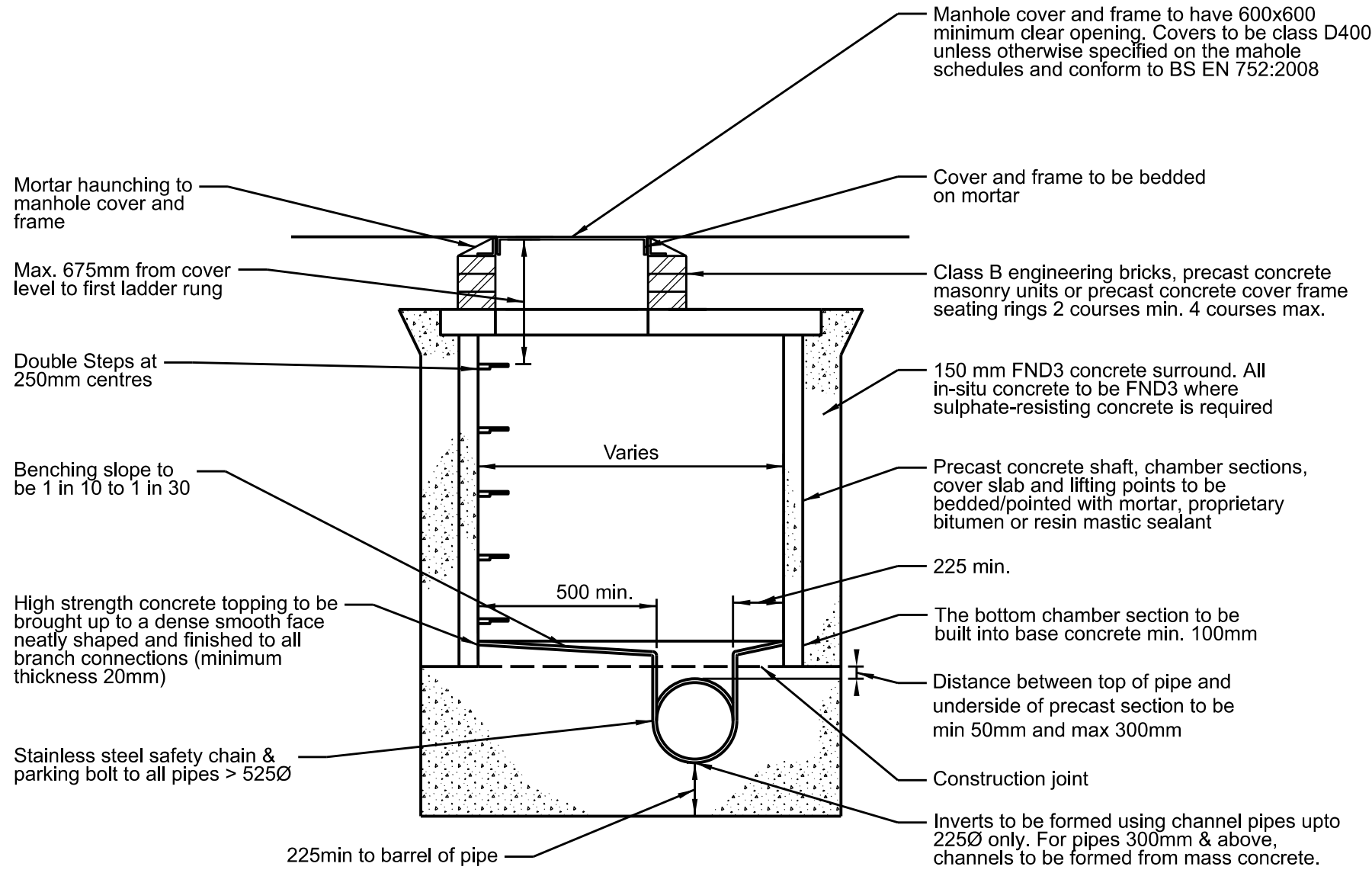
This detail has been reproduced from the Wavin product technical guide to illustrate their typical chamber for non-adoptable areas. The contractor should install the product in accordance with the manufacturers guidance.



Type C - Typical Narrow Storm/Foul Water Inspection Non-person Entry Chamber - Used for Jetting Only
Depth from Cover Level to Soffit 0.9m to 1.5m



Typical Vertical Backdrop
N.T.S.



Type B - Typical Precast Manhole Detail
Maximum Depth from Cover Level to Soffit of Pipe 3.0m
N.T.S.

Nominal diameter (mm)	Maximum effective length (m)
150-600	0.6
601-750	1.00
over 750	1.25

Table 2: Rocker pipe lengths

P03

Notes

1. All dimensions are in mm, all levels in mAOD, unless specified otherwise.
2. Document Status: This drawing has been prepared for Stage 4 and is issued for information only. As such the drawing is intended to provide an overview of the design intent rather than a definitive design. The drawing is subject to further design development, revision or replacement as detailed design progresses.

P03	04/05/22	RR	AL	KO
Issue for Work Stage 4				
P02	29/05/20	LG	AS	SL
Work Stage 4 Issue for Tender				
P01	04/03/20	DW	AS	SL
Preliminary Work Stage 3				
Rev	Date	By	Chkd	Appd

ARUP

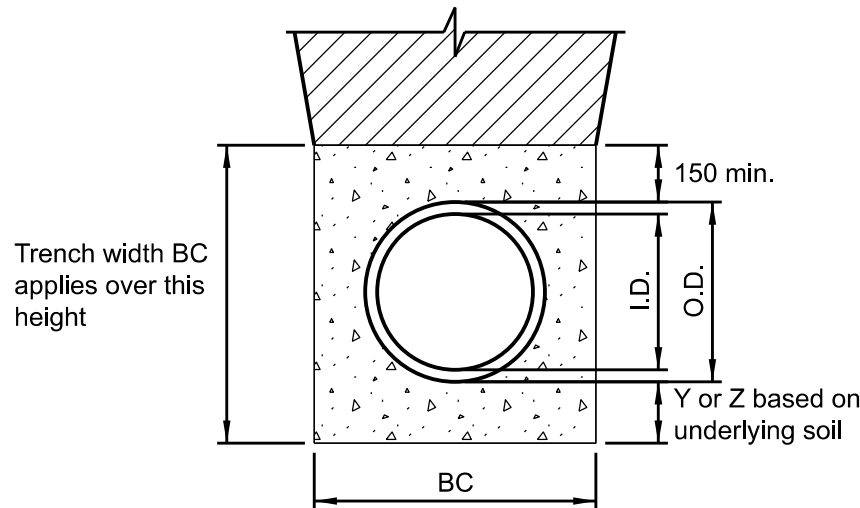
Three Piccadilly Place, Manchester, M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879

Client
bruntwood

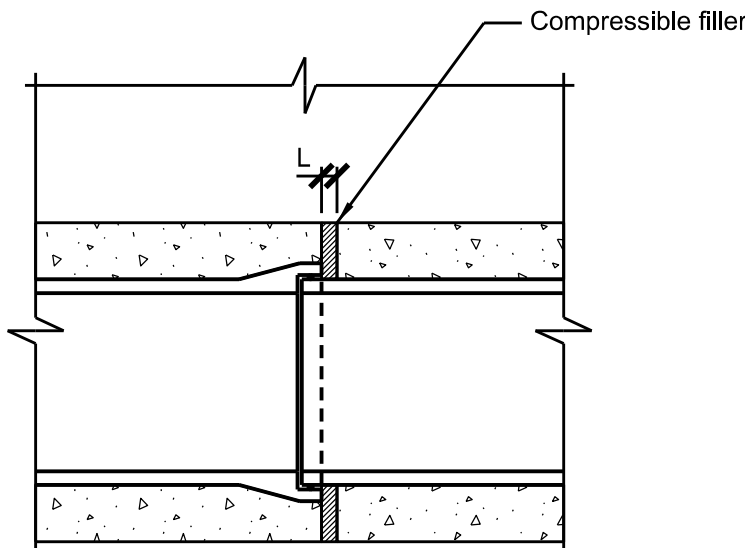
Project Title
Citylabs 4.0

Drawing Title
**External Works
Drainage Typical Details
Sheet 1 of 3**

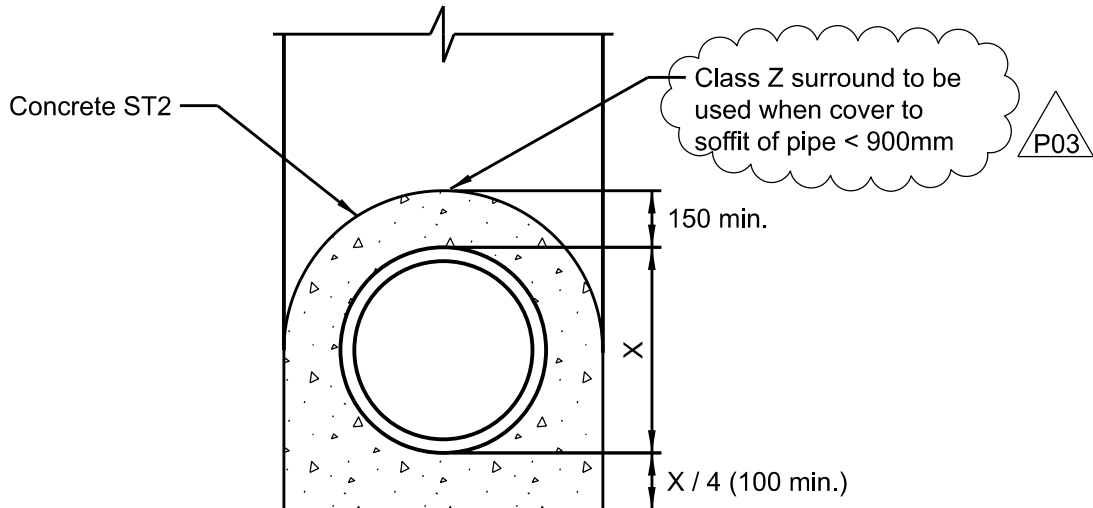
Scale at A1	N.T.S.
Role	Civil - Drainage
Suitability	S3 - Fit for Review and Comment
Arup Job No	267661-00
Name	CLAB-ARUP-04-EX-DR-C-7007
Rev	P03



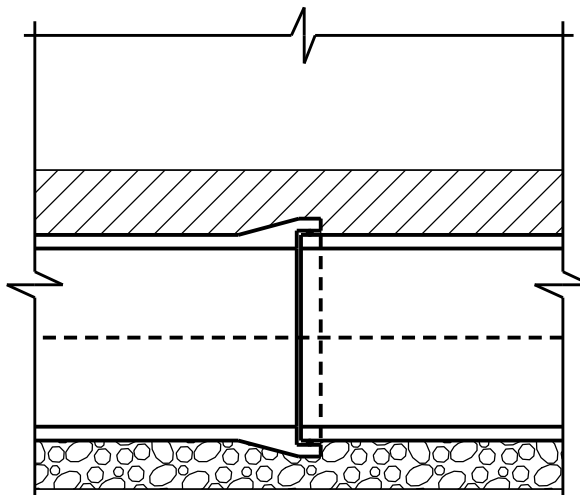
Typical Trench Section



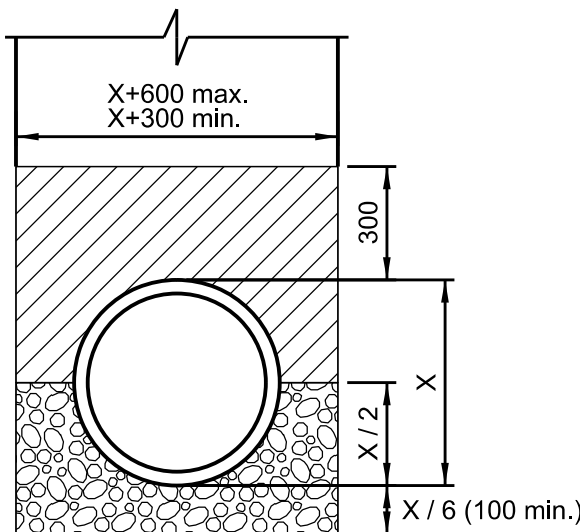
Concrete Bed and Surround
Class Z Spigot and Socket Pipes



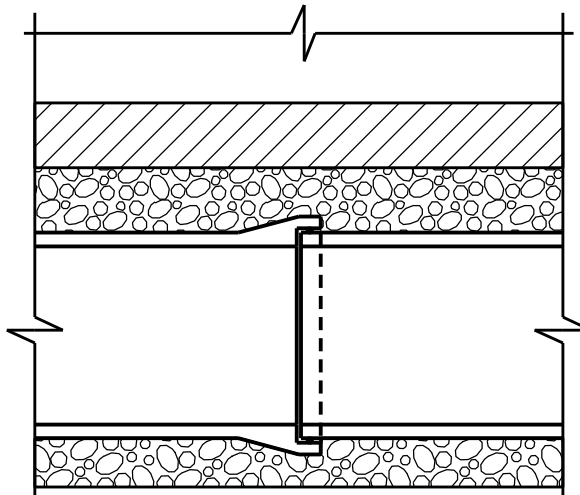
Concrete Bed and Surround
Class Z



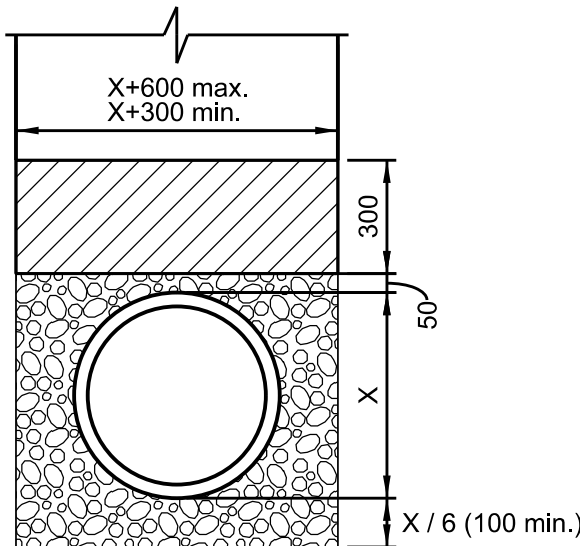
Granular Bed
Class B Spigot and Socket Pipes



Granular Bed
Class B Bedding Factor 1.9



Granular Bed and Surround
Class S Spigot and Socket Pipes



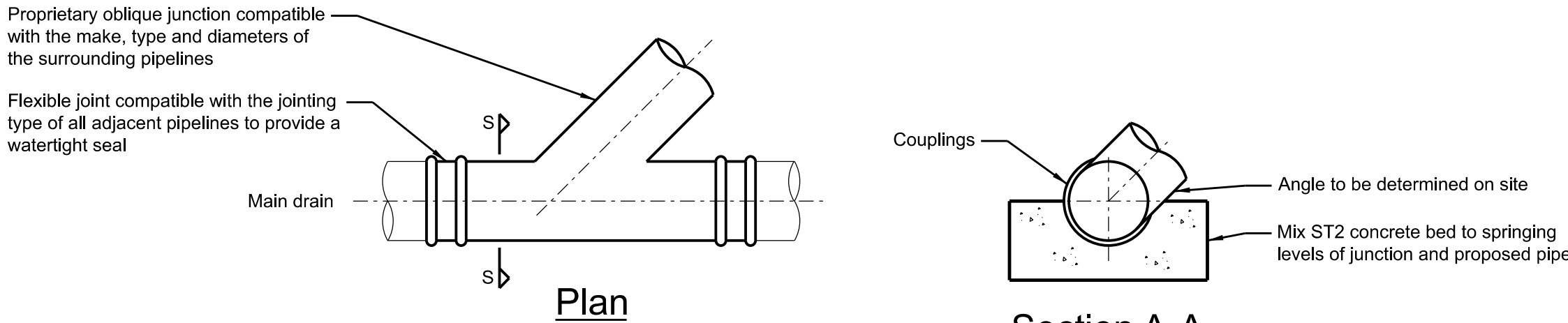
Granular Bed and Surround
Class S Bedding Factor 2.2

Pipe dia. (mm)	Aggregate size.	
	Graded (mm)	Single sized (mm)
100	-	10
150	14 - 5	10 or 14
225 - 300	14 - 5 or 20 - 5	10,14 or 20
375 - 525	14 - 5 or 20 - 5	10,14 or 20
Exceeding 525	14 - 5 or 20 - 5 or 40 - 5	10,14,20 or 40

Table A
Granular Pipe Bedding Material Type 'S'

Pipe dia.(mm)	Width BC		Y		Z
	Max.	Min.	Y1 (Uniform soil)	Y2 (Rock) *	Min.
100	550	450	100	200	100
150	600	490	100	200	100
225	700	580	150	200	100
300	750	680	150	200	100
375	1050	950	150	200	100
450	1150	1030	150	200	150
525	1200	1120	150	200	150
600	1350	1240	150	200	150
675	1450	1330	150	200	225
750	1500	1400	150	200	225
825	1600	1490	150	225	225
900	2100	1900	150	225	225
975	2150	1950	175	250	300
1050	2250	2050	175	275	300
1200	2500	2250	200	300	300
OVER 1200	O.D. + 1000	O.D. + 800	I.D./6	I.D./4	400

Table B
Trench Widths and Other Dimensions



Pipe Connection Detail

- Notes
1. All dimensions are in mm, all levels in mAOD, unless specified otherwise.
 2. Document Status: This drawing has been prepared for Stage 4 and is issued for information only. As such the drawing is intended to provide an overview of the design intent rather than a definitive design. The drawing is subject to further design development, revision or replacement as detailed design progresses.

P03	04/05/22	RR	AL	KO
Issue for Work Stage 4				
P02	29/05/20	LG	AS	SL
Work Stage 4 Issue for Tender				
P01	04/03/20	DW	AS	SL
Preliminary Work Stage 3				
Rev	Date	By	Chkd	Appd

ARUP

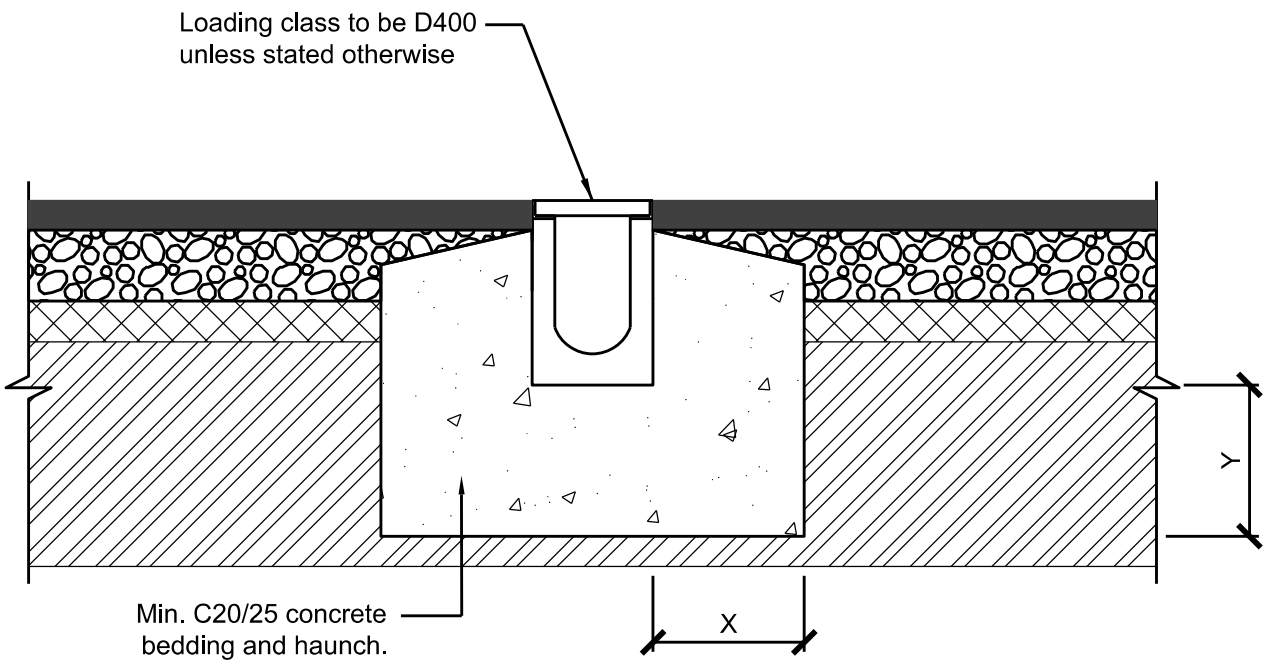
Three Piccadilly Place, Manchester, M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879

Client
bruntwood

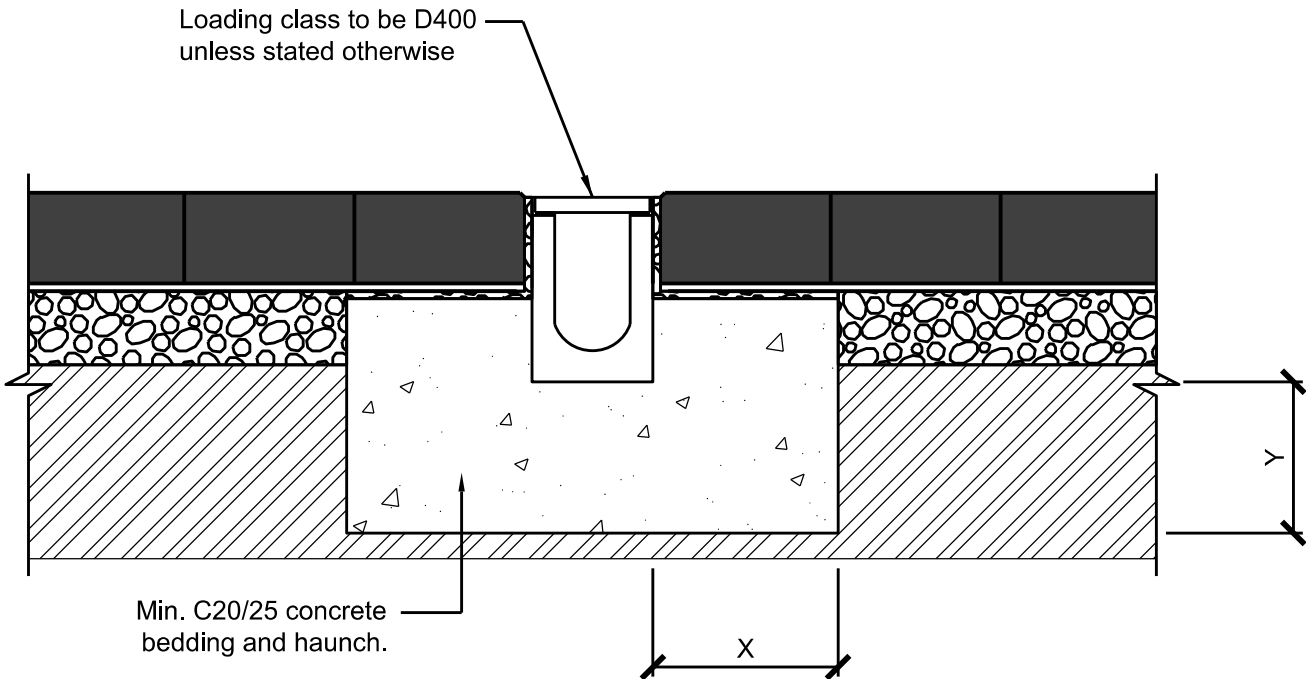
Project Title
Citylabs 4.0

Drawing Title
**External Works
Drainage Typical Details
Sheet 2 of 3**

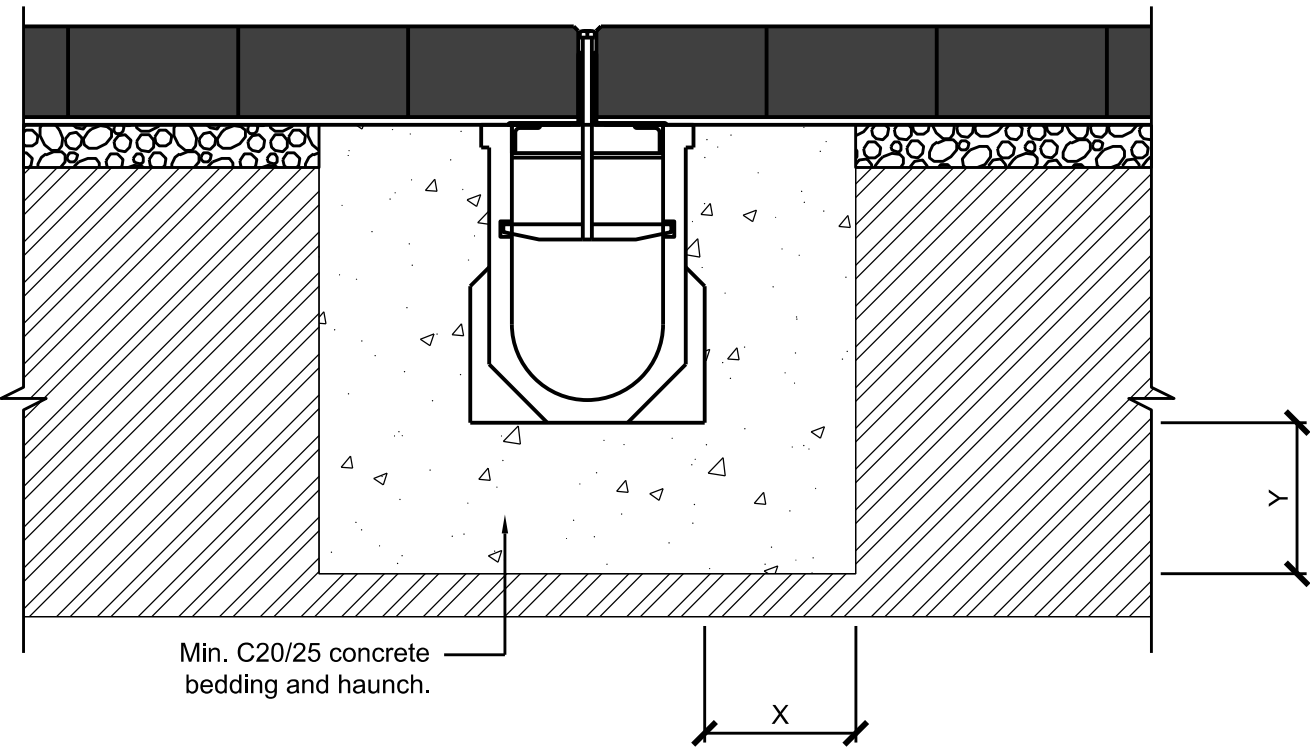
Scale at A1	N.T.S
Role	Civil - Drainage
Suitability	S3 - Fit for internal review and comment
Arup Job No	Rev
267661-00	P03
Name	
CLAB-ARUP-04-EX-DR-C-7008	



Linear Channel in Asphalt

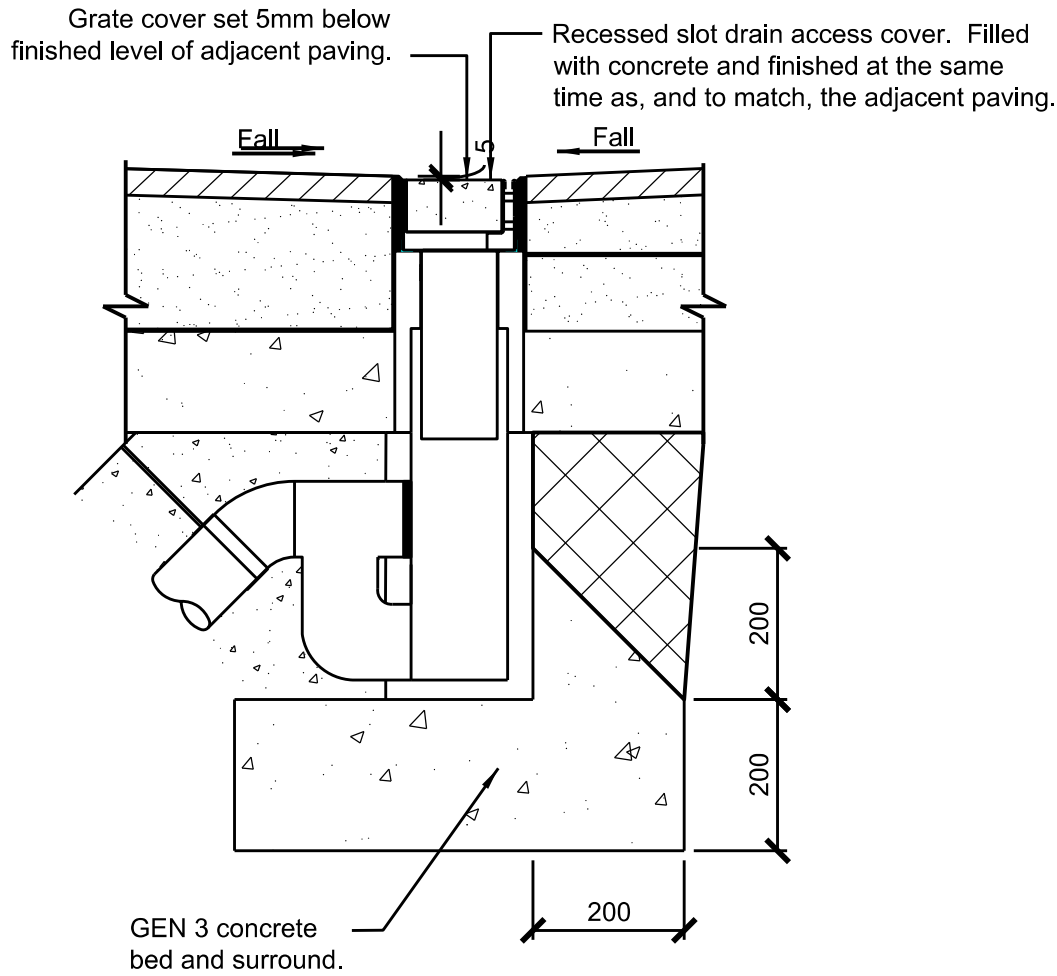


Linear Channel in Paved area



Slot Channel in Block Paved area

Minimum Dimensions of Concrete Surround (mm)				
	A 15	B125	C250	D400
X	100	150	150	200
Y	100	150	150	200



Typical Sump Outlet (D400)

- Notes**
1. All dimensions are in mm, all levels in mAOD, unless specified otherwise.
 2. Document Status: This drawing has been prepared for Stage 4 and is issued for information only. As such the drawing is intended to provide an overview of the design intent rather than a definitive design. The drawing is subject to further design development, revision or replacement as detailed design progresses.

P03	04/05/22	RR	AL	SO
Issue for Work Stage 4				
P02	29/05/20	LG	AAS	SIL
Preliminary Work Stage 4				
P01	04/03/20	DW	AAS	SIL
Preliminary Work Stage 3				
Rev	Date	By	Chkd	Appd

ARUP

Three Piccadilly Place, Manchester, M1 3BN
Tel+44(0)161 228 2331 Fax+44(0)161 228 6879

Client
bruntwood

Project Title
Citylabs 4.0

Drawing Title
**External Works
Drainage Typical Details
Sheet 3 of 3**

Scale at A1	1:10
Role	Civil - Drainage
Suitability	S3 - Fit for Review and Comment
Arup Job No	Rev
267661-00	P03
Name	
CLAB-ARUP-04-EX-DR-C-7009	

FOUL WATER MANHOLE SCHEDULE							
Structure Name	Cover Level	Depth	MH DIA	Cover Type	Clear Opening	Connected Pipes	COMMENTS
FMH1	39.639	1.324	475Ø	D400	300x300	F1.000 Inv. 38.315	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH2	39.571	1.426	475Ø	D400	300x300	F1.000 Inv. 38.145 F1.001 Inv. 38.145	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH3	39.700	1.653	475Ø	D400	300x300	F1.001 Inv. 38.047 F1.002 Inv. 38.047	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH4	39.606	1.416	1050Ø	D400	600x600	F2.000 Inv. 38.190	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH5	39.452	1.352	1050Ø	D400	600x600	F2.000 Inv. 38.100 F2.001 Inv. 38.100	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH6	39.430	1.661	1050Ø	D400	600x600	F2.001 Inv. 37.850 F2.002 Inv. 37.768	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH7	39.542	1.827	1050Ø	D400	600x600	F1.002 Inv. 37.715 F2.002 Inv. 37.715 F1.003 Inv. 37.715	All external foul drainage chambers to have double sealed covers to mitigate risk of foul smells.
FMH8	39.257	1.587	1050Ø	D400	600x600	F1.003 Inv. 37.670	Foul water manphole to connect to existing 225mm private drain.

P02

FOUL WATER PIPE SCHEDULE					
Pipe Name	Size (mm)	Plan Length (m)	Slope	Start Invert Level	End Invert Level
F1.000	100	22.301	0.76%	38.315	38.145
F1.001	150	9.470	1.04%	38.145	38.047
F1.002	150	27.486	1.21%	38.047	37.715
F1.003	150	5.327	0.84%	37.715	37.670
F2.000	150	7.013	1.28%	38.190	38.100
F2.001	150	10.534	2.37%	38.100	37.850
F2.002	150	3.795	1.41%	37.768	37.715

SURFACE WATER MANHOLE SCHEDULE							
Structure Name	Cover Level	Depth	MH DIA	Cover Type	Clear Opening	Connected Pipes	COMMENTS
SMH1	39.200	1.850	475Ø	D400	300x300	S1.001 Inv. 37.350	Proposed Attenuation Tank min cover 0.85m.
SMH2	39.643	2.323	1350Ø	D400	600x600	S1.001 Inv. 37.320 S1.002 Inv. 37.320	Hydrobrake reference no: CTL-SHE-0127-1000-2294-1000 (or similar approved). Restriction to 10l/s.
SMH3	39.580	2.300	1200Ø	D400	600x600	S1.002 Inv. 37.280 S1.003 Inv. 37.280	
SMH4	39.733	2.633	2400Ø	D400	600x600	S1.003 Inv. 37.100 S1.004 Inv. 37.100	
SMH5	39.403	2.423	2400Ø	D400	600x600	S1.004 Inv. 36.980 S1.005 Inv. 36.980	Orifice plate to be installed on downstream end of 1600 dia pipe S1.004
SMH6	39.600	2.700	1200Ø	D400	600x600	S1.005 Inv. 36.900	Surface water manhole hole to connect to existing private combined drain.

P02

P02

SURFACE WATER PIPE SCHEDULE					
Pipe Name	Size (mm)	Plan Length (m)	Slope	Start Invert Level	End Invert Level
S1.000	300	9.763	5.63%	38.600	38.050
S1.001	450	7.154	0.42%	37.350	37.320
S1.002	375	8.944	0.45%	37.320	37.280
S1.003	375	28.973	0.62%	37.280	37.100
S1.004	1600	27.078	0.44%	37.100	36.980
S1.005	225	18.260	0.44%	36.980	36.900

- Notes:
- All dimensions are in mm, all levels in mAOD, unless specified otherwise.
 - This schedule has been prepared for Stage 4 and is issued for informaton only. As such the schedules are intended to provide an overview of the design rather than a difinitive design. The drainage network is subject to further design development, revision or replacement as detailed design progresses.
 - This schedule should be read in conjunction with: CLAB-ARUP-04-EX-DR-C-2006.

P02	04 /05/22	RR	AL	KO
-----	-----------	----	----	----

Issue for Work Stage 4

P01	29 /05/20	SAJ	AAS	SIL
-----	-----------	-----	-----	-----

Work Stage 4 Issue for Tender

Rev	Date	By	Chkd	Appd
-----	------	----	------	------

ARUP

9th Floor, 3 St Paul's Place,
Norfolk Street, Sheffield S1 2JE
Tel +44 (0)114 2728247 Fax +44 (0)114 2759553
www.arup.com

Client

bruntwood

Project Title

Citylabs 4.0

Drawing Title

Manhole and Pipe Schedule

Scale at A1

NTS

Role

Civil - External Works

Suitability

S3 - Fit for internal review and comment

Arup Job No

267661-00

Name

CLAB-ARUP-04-EX-SH-C-7010

Rev
P02

Appendix C – Correspondence

Alex Leahy

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 15 March 2022 10:41
To: Alex Lloyd
Cc: Wastewater Developer Services; Sam Styles; Rebecca Rotheram
Subject: FW: Repeat PDE 4200029239 CityLabs 4.0 Hathersage Road Manchester
Attachments: Standard Conditions for Works Adjacent to Pipelines issued July 2015.pdf

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

Good morning Alex,
Thanks for your email. And thanks for that attached email.

I tried to call you this afternoon, but no one answered, so I have sent this email.

- Our current record does not show the culvert watercourse, and after reviewing all the previous correspondence, I understand it was classified as a 1000mm combined sewer, I have discussed this with our network team, who have looked into the history of this and noticed that old maps also show this to be a combined sewer.

It would therefore appear that whilst this may have originally been a culverted watercourse, it has historically been re-classified to a sewer (and diverted into the public combined sewer network).

Also, the LLFA has been agreed to classify it as a 1000mm combined sewer.

- On the other hand, the acceptable total surface water discharge rate will be **10 l/s** due to the limited storage capacity on site.
- Regarding the mitigation measures to protect the 1000mm sewer during the construction (5m easement for the pipe centre line), the attached document containing all the relevant information needed to avoid any conflict.

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

Kind regards,



United Utilities
Water for the North West

Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
Customer Services
Email: Mohammed.Aljafarawi@uuplc.co.uk
M: 07950474499
unitedutilities.com

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

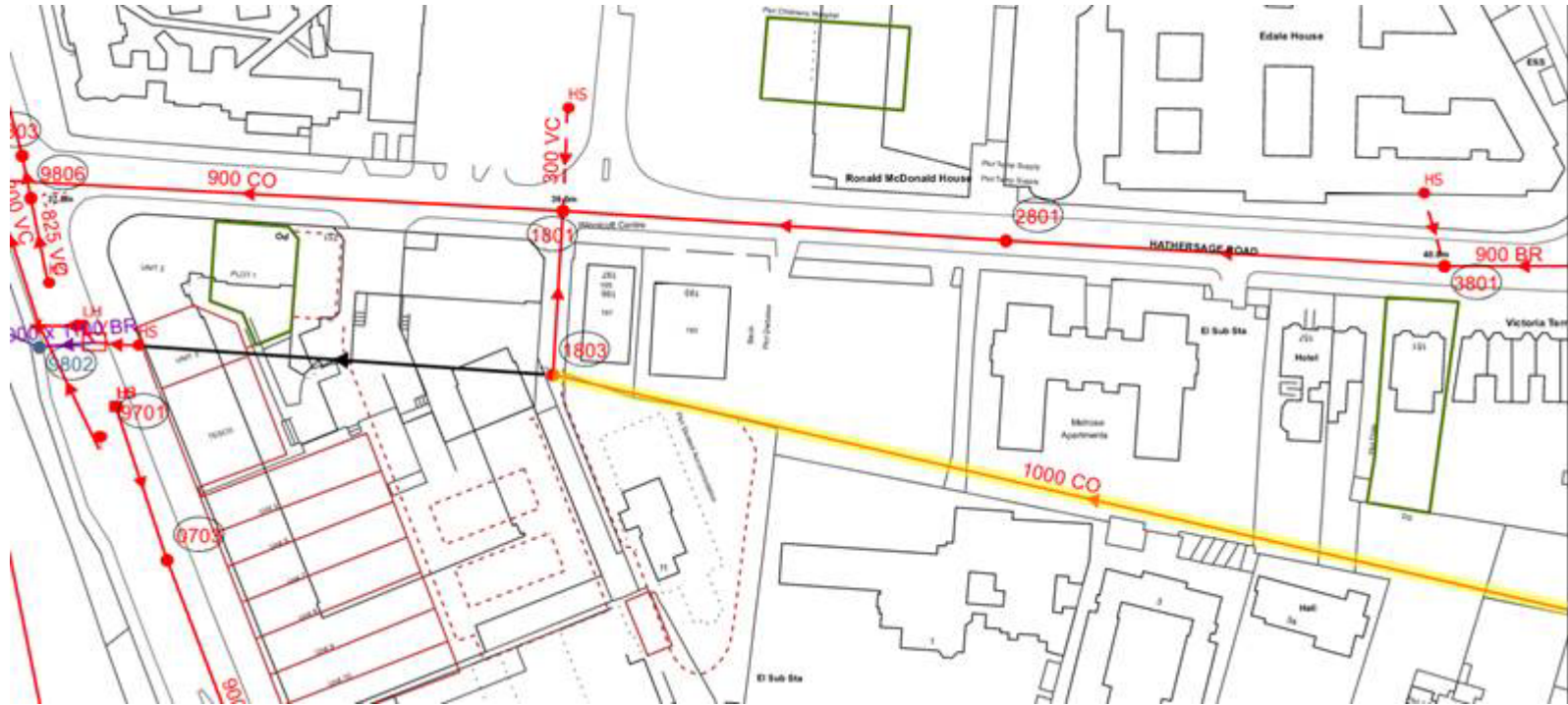
From: Alex Lloyd [<mailto:Alex.Lloyd@arup.com>]
Sent: 14 March 2022 10:19
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Rebecca Rotheram <Rebecca.Rotheram@arup.com>; Sam Styles <Sam.Styles@arup.com>
Subject: RE: PDE 4200029239 CityLabs 4.0 Hathersage Road Manchester

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

Hi Mohammed,

Thank you for your response. I'd like to confirm a few points to inform our design:

- The correspondence attached from UU states that you view the culvert that crosses the site to be a combined sewer. Your response below states that you now view it to be a culverted watercourse that is **not** owned by United Utilities is this correct?
- United Utilities stated that they had contacted the LLFA directly. Please could you provide an update on their response?
- Is this 1000mm Culvert no longer shown as a Combined Sewer on your records?



Many Thanks,

Alex Lloyd (née Sims)

She/her/hers

Senior Civil Engineer

M.Eng C.Eng MICE

Arup

6th Floor, 3 Piccadilly Place

Manchester, M1 3BN, United Kingdom

d +44 113 237 8269

m +44 75 57 871 016

arup.com

Follow us

[LinkedIn](#) [Twitter](#) [Instagram](#) [YouTube](#) [Facebook](#)

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

Sent: 01 March 2022 16:08

To: Alex Lloyd <Alex.Lloyd@arup.com>

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

Subject: FW: PDE 4200029239 CityLabs 4.0 Hathersage Road Manchester

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

Good afternoon Alex,
Thanks for your email. Below you will find the answers for your questions:

1. Is the discharge restriction of 10L/S still acceptable to UU. We have amended the design to take the entire discharge to Hathersage Road with a Hydrobrake chamber to provide the restriction. First of all, I would say that you were misinformed previously by a colleague. We would expect all surface water to drain to the culverted watercourse rather than to the 900mm CWS Within Hathersage Road. The discharge rate must be agreed with the LLFA.

If you had to connect to the public combined sewer for any reason, we will expect the surface water runoff to be restricted to a maximum pass forward flow of 5l/s.

2. In order to take the whole discharge to Hathersage Road we will need to construct the new drainage within the 3m easement of the existing culvert. Please see the attached drainage design. Is this acceptable? If you were to connect the public sewer, It is acceptable to lay down your drainage system (small diameters) within the 3m easement.

3. The current culvert sits beneath a car park and is trafficked. We will be resurfacing above the culvert. I've attached the correspondence with the system engineering team that indicates that they were happy that the culvert was structurally stable. I've attached the external works proposals. With regards to construction traffic, would access across the culvert during construction be acceptable? If we were to propose protection measures do you have any detailed requirements that have to be met?
The culverted watercourse that crosses the site is not a United Utilities asset. The landowner who I assume is your client is the riparian owner and is responsible for the operation and maintenance of the watercourse.

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

Kind regards,



United Utilities
Water for the North West

Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
Customer Services
Email: Mohammed.Aljafarawi@uuplc.co.uk
M: 07950474499
unitedutilities.com

If you have received a great service today why not tell us?

Visit: unitedutilities.com/wow

Did you know we now have a live chat facility available to you Mon to Friday 8 -5pm. You just click on the orange live chat box on our webpage and one of our advisors will be ready to chat to you and help you with your enquiry <https://www.unitedutilities.com/builders-developers/> or you can email us at developerserviceswater@uuplc.co.uk

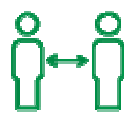
Coronavirus | Prevent the spread



Wash your hands



Disinfect common surfaces



Practise social distancing



FEVER + COUGH

Stay home if you have symptoms

[Click for our message to customers](#)

From: Alex Lloyd [<mailto:Alex.Lloyd@arup.com>]

Sent: 21 February 2022 09:55

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

Subject: RE: CityLabs 4.0, Hathersage Road, Manchester M13 0JE - 4200029239

Hello,
Following previous correspondence on this project 4200029239- City Labs 4.0. We are looking to re-start design and I would like to clarify a few points:

1. Is the discharge restriction of 10L/S still acceptable to UU. We have amended the design to take the entire discharge to Hathersage Road with a Hydrobrake chamber to provide the restriction.
2. In order to take the whole discharge to Hathersage Road we will need to construct the new drainage within the 3m easement of the existing culvert. Please see the attached drainage design. Is this acceptable?
3. The current culvert sits beneath a car park and is trafficked. We will be resurfacing above the culvert. I've attached the correspondence with the system engineering team that indicates that they were happy that the culvert was structurally stable. I've attached the external works proposals. With regards to construction traffic, would access across the culvert during construction be acceptable? If we were to propose protection measures do you have any detailed requirements that have to be met?

Kind Regards,

Alex Lloyd (née Sims)
She/her/hers
Senior Civil Engineer
M.Eng C.Eng MICE

Arup
6th Floor, 3 Piccadilly Place
Manchester, M1 3BN, United Kingdom
d +44 113 237 8269
m +44 75 57 871 016
arup.com

Follow us
[LinkedIn](#) [Twitter](#) [Instagram](#) [YouTube](#) [Facebook](#)

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 01 April 2020 14:52
To: Alexandra Sims <alexandra.sims@arup.com>
Subject: [External] RE: CityLabs 4.0, Hathersage Road, Manchester M13 0JE - 4200029239

Hi again Alex,

I have just realised my previous email did not include information on construction restrictions in relation to the large public sewer.

A minimum clearance of 3m (either side from the centreline of the pipe) must be achieved, though due to the diameter of the sewer we request this clearance is increased to 5m either side if possible.

Kind regards,

Tom



United Utilities
Water for the North West

Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
unitedutilities.com

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

From: Wastewater Developer Services
Sent: 31 March 2020 12:47
To: 'alexandra.sims@arup.com' <alexandra.sims@arup.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: CityLabs 4.0, Hathersage Road, Manchester M13 0JE - 4200029239

Good Afternoon Alex,

Many thanks for the detailed email and apologies for the delayed response.

I would have no objections to an overall surface water discharge rate of 10 l/s for this development.

Please could you confirm why the entire surface water drainage cannot be connected via a singular connection to Hathersage Road? I only ask as a 50mm orifice size on the flow control may be prone to blockages – if all the drainage was routed to this singular connection then the orifice size could be increased.

Regarding the condition of the culvert, thank you for providing the survey report. I will forward this on to our network team and inform you with anything I hear back.

Kind regards,

Tom



Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
unitedutilities.com

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

From: Alexandra Sims [<mailto:alexandra.sims@arup.com>]
Sent: 19 March 2020 09:58
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Stacey Johnson <Stacey.Johnson@arup.com>
Subject: FW: CityLabs 4.0, Hathersage Road, Manchester M13 0JE - 4200029239

Hello,
I am contacting you with regards to the pre-development enquiry for City Labs 4. Reference 4200029239.

Since my colleague last contacted you we have undertaken some CCTV of the existing drainage and sewerage on site. Please find copies of this via the following link:
https://arup-my.sharepoint.com/:f/p/alexandra_sims/EIVavx8Fb1tPrI7ZMAe-S1QBGOxDu6JrGntf-aEAVBJWQ?e=oQ91DG

The CCTV in the additional survey folder within this provides information on the 1000mm dia sewer. The survey has identified the location of the sewer on the site. It has also provided a depth to invert of 1.9m for the 1000mm diameter brick sewer.

Discharge

We have been working through a drainage design for the site based on discharging to the brick sewer as the roof drainage discharges to this location. The design has been based on the following constraints:

- Total area to be drained 0.35Ha
- 3m easement either side of the culvert
- 1.9m depth to invert
- Connecting at $\frac{3}{4}$ of the culvert depth
- Minimum 0.5m cover to the tank
- Remove risk of flooding to the site in a 1 in 100yr +40% CC- only a small amount can be managed on site due to lack of space around the building
- No infiltration is possible on this site due to contamination therefore, traditional SuDs features are not possible
- Lack of space and depth to sewers means that tanked SUDS features are not advisable
- 1m space required between the building and tank for utilities and pile caps

Using the available area and depth we achieved a total discharge of 20L/s without flooding in a 1 in 100yr +40% CC. We therefore, looked to see what area we could take to the existing connection to the UU sewer in Hathersage road:

- Using a minimum orifice value of 50mm we have been able to restrict the flow to the sewer in Hathersage road to 4L/s.
- Using the reduced area of 0.27Ha we have achieved a reduced flow of 6L/s to the Culvert.

This gives a total discharge of the site of 10L/S. We realise that this doesn't meet the 6L/S requested however, based on the significant constraints on the site please can you confirm whether you would consider this to be acceptable.

Existing Culvert

We would also like to discuss the existing culvert on site. There are two issues that the CCTV has identified:

- Based on the invert level the culvert may only have 0.6m cover over it
- There are 3 locations where it has been classified as Condition 4- refer to the 'CCTV DRAINAGE INSPECTION REPORT' within the additional survey folder

In light of the above please can you provide some advice on the restrictions for construction and procedures for remediation works to the culvert.

Kind Regards,

Alex Sims

Senior Civil Engineer | Infrastructure, Transport and Cities

M.Eng C.Eng MICE

Arup

6th Floor, 3 Piccadilly Place, Manchester, M1 3BN, United Kingdom

d: +44 113 237 8269 m: +44 75 57 871 016

www.arup.com

Connect with Arup on [LinkedIn](#)

Follow [@ArupUKMEA](#)

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

Sent: 12 December 2019 09:18

To: Gemma McCaig <Gemma.McCaig@arup.com>

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

Subject: [External] FW: CityLabs 4.0, Hathersage Road, Manchester M13 0JE - 4200029239

Good Morning Gemma,

Discharge Rates:

The 6 l/s was calculated using the modified rational method, with a rainfall intensity of 50 mm/hr (as this was likely what the existing drainage arrangement will have been designed for) and an area of 0.085ha (the roof area plus a little contingency). The reason why the whole site area has not been used is because from the topographical survey it appears the car park is not positively connected to the public sewer network, and should therefore not be used in calculating the existing discharge rate.

1000mm combined sewer vs culverted watercourse:

Thank you for passing on the response from the LLFA. Our network team have confirmed that we will still view this as a combined sewer – old maps appear to show it was historically re-classified to a sewer and should therefore remain as such. I have contacted the LLFA directly to state our point of view, and will update you if anything changes.

Hope this helps,

Kind regards,

Tom



Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
T: 01925 679 308
unitedutilities.com

If you have received a great service today why not tell us?

Visit: unitedutilities.com/wow

From: Gemma McCaig [<mailto:Gemma.McCaig@arup.com>]

Sent: 05 December 2019 09:56

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

Subject: FAO Tom Bethell - CityLabs 4.0 Predevelopment Enquiry 4200029239

Hi Tom

I have reviewed the response to the predevelopment enquiry and have noticed that the allowable rate of discharge form the site has been set at 6l/s. Please can you tell me whether this rate has been set due to lack of capacity in the network or an aspiration to restrict to as close to greenfield runoff as possible.

Kind regards
Gemma

From: Gemma McCaig

Sent: 04 December 2019 13:58

To: 'WasteWaterDeveloperServices@uuplc.co.uk' <WasteWaterDeveloperServices@uuplc.co.uk>

Subject: CityLabs 4.0 Predevelopment Enquiry 4200029239 [Filed 04 Dec 2019 13:58]

Hi Tom

Further to our conversation on Monday (2nd December), I contacted Manchester City Council and asked them for any historical information they had for the culverted watercourse that supposedly runs through the proposed development site. Their response, included below, includes a screenshot showing the alignment of the “watercourse”.

I have compared this alignment with the sewer records for the area and believe they are both showing the same thing however, I would appreciate it if you could offer any information which would help to clarify this.

Kind regards
Gemma

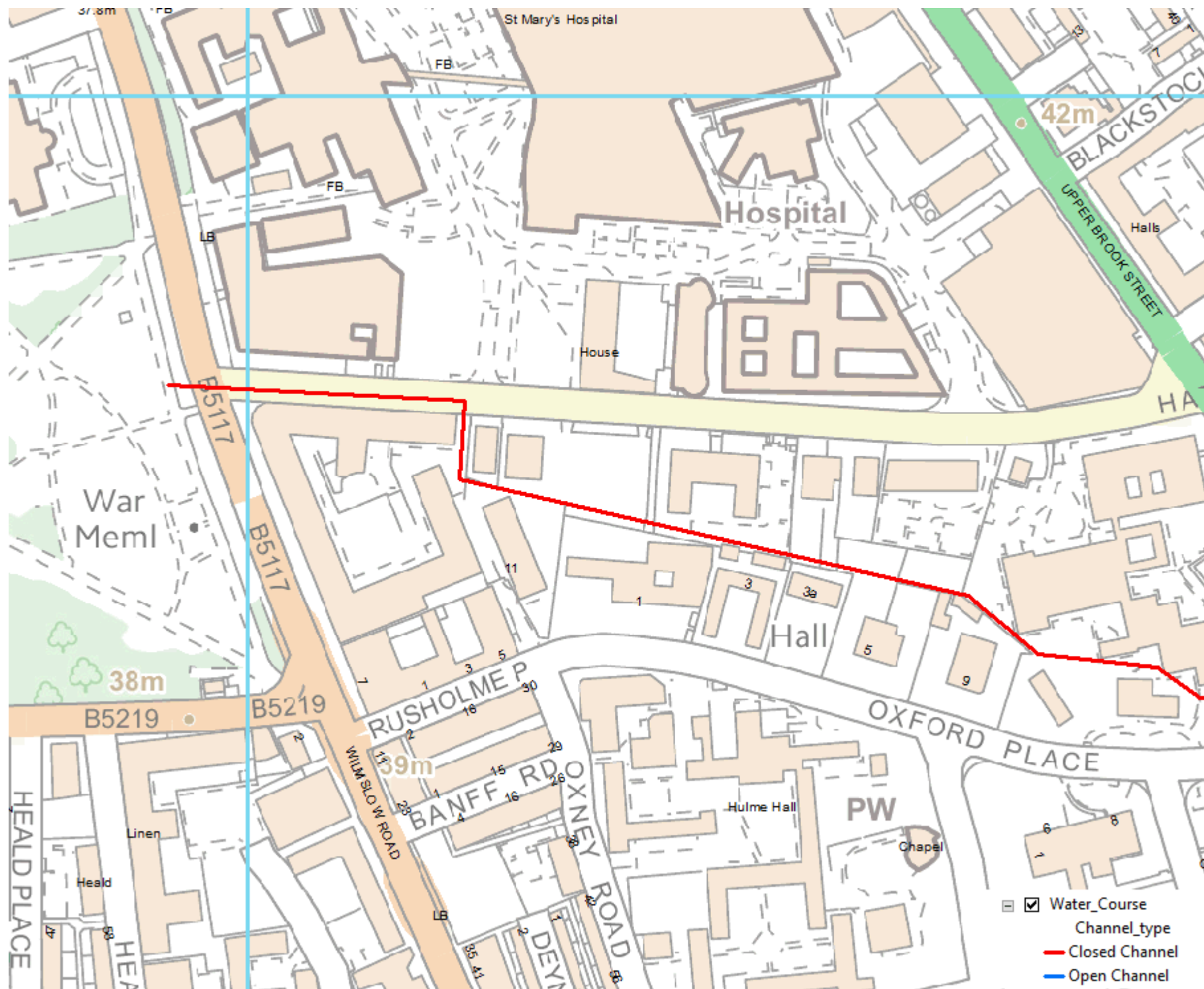
From: z.todorovic@manchester.gov.uk <z.todorovic@manchester.gov.uk> **On Behalf Of** floodriskmanagement@manchester.gov.uk
Sent: 04 December 2019 13:01
To: Gemma McCaig <Gemma.McCaig@arup.com>
Cc: floodriskmanagement@manchester.gov.uk
Subject: [External] Re: CityLabs 4.0 - Query regarding feedback from EIA Scoping Opinion Request

Hi Gemma

Our record show a culverted watercourse at Hathersage Road as per the screenshot attached. Unfortunately we do not have further information on the exact alignment and condition of that culvert but it might assist you in ascertaining the exact location of manholes in that location.

Kind regards

Zorica Todorovic



Flood Risk Management
 Highways Service, Growth and Neighbourhoods Directorate
 Manchester City Council
 Tel: 0161 219 6295
 Email: floodriskmanagement@manchester.gov.uk
 Web: <http://www.manchester.gov.uk/>

POSTAL ADDRESS: Manchester City Council, Public Realm, The Neighbourhood Service, PO Box 532, Town Hall, Manchester M60 2LA

From: Gemma McCaig <Gemma.McCaig@arup.com>
 To: "floodriskmanagement@manchester.gov.uk" <floodriskmanagement@manchester.gov.uk>,
 Date: 02/12/2019 15:34
 Subject: CityLabs 4.0 - Query regarding feedback from EIA Scoping Opinion Request

Hi

I have been forwarded a copy of the response from the EIA Scoping Option Request for a City Labs 4.0 which states that Rush Brook (a culverted watercourse) runs along the proposed development site. United Utilities records also indicate that a 1000mm diameter combined sewer crosses through the site from east to west, before turning north and connecting into the combined sewer in Hathersage Road (see attached). Please can you tell me whether you have any historical records/ as built information for Rush Brook Culvert to enable me to compare the alignments and try to establish to locations of these assets.

Kind regards

Gemma McCaig
Engineer | Infrastructure
BEng (Hons) EngTech MICE

Arup
6th Floor 3 Piccadilly Place Manchester M1 3BN United Kingdom
t: +44 161 228 2331
www.arup.com

Electronic mail messages entering and leaving Arup business systems are scanned for viruses and acceptability of content.

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error please notify the system manager. The full text of the Council's email disclaimer is available at www.manchester.gov.uk/emaildisclaimer.

Your personal data is very important to us. Please refer to our privacy notice at www.manchester.gov.uk/privacy for further information.

This footnote also confirms that this email message has been swept for the presence of computer viruses.

EMGateway3.uuplc.co.uk made the following annotations

The information contained in this e-mail is intended only for the individual to whom it is addressed. It may contain legally privileged or confidential information or otherwise be exempt from disclosure. If you have received this Message in error or there are any problems, please notify the sender immediately and delete the message from your computer. You must not use, disclose, copy or alter this message for any unauthorised purpose. Neither United Utilities Group PLC nor any of its subsidiaries will be liable for any direct, special, indirect or consequential damages as a result of any virus being passed on, or arising from the alteration of the contents of this message by a third party.

United Utilities Group PLC, Haweswater House, Lingley Mere
Business Park, Lingley Green Avenue, Great Sankey,
Warrington, WA5 3LP
Registered in England and Wales. Registered No 6559020

www.unitedutilities.com

Electronic mail messages entering and leaving Arup business systems are scanned for viruses and acceptability of content.



NOTE: SURVEY LEVELS
REQUIRED TO
DETERMINE WORKS TO
FALLS AND RETAINING
ELEMENTS.
PROPOSED LEVELS IN
THIS AREA WILL
REQUIRE VERIFICATION
POST SURVEY.

NOTE: Finished floor
level circa 200mm lower
than finished ground
level.

Key:
Exceedance Flow Route

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.75
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.360	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.236	4.00	39.200	1	0.600
2	0.034	4.00	39.200	475	1.850
3			39.643	1350	2.323
4	0.078	2.00	39.580	1200	2.300
5			39.733	2400	2.633
6			39.403	2400	2.423
6_OUT			39.600	1200	2.700

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	9.763	0.600	38.600	38.050	0.550	17.8	300	4.04	50.0
1.001	2	3	8.184	0.600	37.350	37.320	0.030	272.8	450	4.15	50.0
1.002	3	4	8.389	0.600	37.320	37.280	0.040	209.7	375	4.27	50.0
1.003	4	5	27.974	0.600	37.280	37.100	0.180	155.4	375	4.59	50.0
1.004	5	6	27.220	0.600	37.100	36.980	0.120	226.8	1600	4.74	50.0
1.005	6	6_OUT	18.260	0.600	36.980	36.900	0.080	228.3	225	5.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.749	265.0	32.0	0.300	0.850	0.236	0.0	70	2.563
1.001	1.226	194.9	36.6	1.400	1.873	0.270	0.0	131	0.949
1.002	1.247	137.7	36.6	1.948	1.925	0.270	0.0	131	1.060
1.003	1.451	160.2	47.2	1.925	2.258	0.348	0.0	139	1.267
1.004	2.958	5947.5	47.2	1.033	0.823	0.348	0.0	98	0.934
1.005	0.861	34.2	47.2	2.198	2.475	0.348	0.0	225	0.877

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	9.763	17.8	300	Circular	39.200	38.600	0.300	39.200	38.050	0.850
1.001	8.184	272.8	450	Circular	39.200	37.350	1.400	39.643	37.320	1.873
1.002	8.389	209.7	375	Circular	39.643	37.320	1.948	39.580	37.280	1.925
1.003	27.974	155.4	375	Circular	39.580	37.280	1.925	39.733	37.100	2.258
1.004	27.220	226.8	1600	Circular	39.733	37.100	1.033	39.403	36.980	0.823
1.005	18.260	228.3	225	Circular	39.403	36.980	2.198	39.600	36.900	2.475

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1	Manhole	Adoptable	2	475	Manhole	Adoptable
1.001	2	475	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	2400	Manhole	Adoptable
1.004	5	2400	Manhole	Adoptable	6	2400	Manhole	Adoptable
1.005	6	2400	Manhole	Adoptable	6_OUT	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	39.200	0.600	1				
				0	1.000	38.600	300
2	39.200	1.850	475		1	1.000	38.050
				0	1.001	37.350	450
3	39.643	2.323	1350		1	1.001	37.320
				0	1.002	37.320	375
4	39.580	2.300	1200		1	1.002	37.280
				0	1.003	37.280	375
5	39.733	2.633	2400		1	1.003	37.100
				0	1.004	37.100	1600
6	39.403	2.423	2400		1	1.004	36.980
				0	1.005	36.980	225
6_OUT	39.600	2.700	1200		1	1.005	36.900
							225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.000	Drain Down Time (mins)	240
Ratio-R	0.360	Additional Storage (m ³ /ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
8	0	0	0
30	0	0	0
100	0	0	40

Node 6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	36.980	Product Number	CTL-SHE-0132-1000-1950-1000
Design Depth (m)	1.950	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	10.0	Min Node Diameter (mm)	1500

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.94	Time to half empty (mins)	140

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	61.8	0.0	1.350	61.8	0.0	1.351	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	38.687	0.087	40.6	0.6840	0.0000	OK
30 minute summer	2	19	37.489	0.139	40.5	8.1701	0.0000	OK
30 minute summer	3	19	37.456	0.136	31.5	0.1941	0.0000	OK
60 minute summer	4	43	37.433	0.153	32.3	0.2766	0.0000	OK
60 minute summer	5	43	37.437	0.337	32.3	1.5262	0.0000	OK
60 minute summer	6	43	37.429	0.449	30.3	2.0299	0.0000	SURCHARGED
15 minute summer	6_OUT	1	36.900	0.000	9.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	40.6	2.566	0.153	0.1545	
30 minute summer	2	1.001	3	31.5	0.786	0.161	0.3352	
30 minute summer	3	1.002	4	31.7	0.972	0.230	0.2865	
60 minute summer	4	1.003	5	32.3	1.151	0.202	2.0519	
60 minute summer	5	1.004	6	30.3	0.338	0.005	10.4319	
60 minute summer	6	Hydro-Brake®	6_OUT	9.9				39.4

Results for 8 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	38.725	0.125	75.0	0.9810	0.0000	OK
60 minute summer	2	49	37.633	0.283	54.0	16.5772	0.0000	OK
60 minute summer	3	48	37.634	0.314	45.5	0.4497	0.0000	OK
60 minute summer	4	48	37.635	0.355	57.9	0.6420	0.0000	OK
60 minute summer	5	47	37.632	0.532	55.7	2.4089	0.0000	OK
60 minute summer	6	48	37.632	0.652	39.5	2.9500	0.0000	SURCHARGED
15 minute summer	6_OUT	1	36.900	0.000	10.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	75.1	2.970	0.283	0.2470	
60 minute summer	2	1.001	3	45.5	0.814	0.233	0.9124	
60 minute summer	3	1.002	4	43.1	0.952	0.313	0.8668	
60 minute summer	4	1.003	5	55.7	1.051	0.348	3.0534	
60 minute summer	5	1.004	6	39.5	0.385	0.007	18.3435	
60 minute summer	6	Hydro-Brake®	6_OUT	10.0				71.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	38.749	0.149	99.3	1.1714	0.0000	OK
60 minute winter	2	58	37.825	0.475	51.4	27.8697	0.0000	SURCHARGED
60 minute winter	3	59	37.827	0.507	37.7	0.7256	0.0000	SURCHARGED
60 minute winter	4	58	37.825	0.545	50.8	0.9857	0.0000	SURCHARGED
60 minute winter	5	59	37.824	0.724	47.1	3.2770	0.0000	OK
60 minute winter	6	59	37.824	0.844	37.0	3.8199	0.0000	SURCHARGED
15 minute summer	6_OUT	1	36.900	0.000	10.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	99.4	3.156	0.375	0.3076	
60 minute winter	2	1.001	3	37.7	0.782	0.193	1.2967	
60 minute winter	3	1.002	4	36.4	0.910	0.264	0.9253	
60 minute winter	4	1.003	5	47.1	1.055	0.294	3.0855	
60 minute winter	5	1.004	6	37.0	0.431	0.006	26.5888	
60 minute winter	6	Hydro-Brake®	6_OUT	10.0				96.0

Results for 100 year +40% Q Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	38.830	0.230	179.4	1.8099	0.0000	OK
120 minute winter	2	116	38.718	1.368	59.3	79.1987	0.0000	SURCHARGED
120 minute winter	3	116	38.719	1.399	25.2	2.0020	0.0000	SURCHARGED
120 minute winter	4	116	38.718	1.438	41.4	2.6005	0.0000	SURCHARGED
120 minute winter	5	116	38.717	1.617	40.1	7.3137	0.0000	SURCHARGED
120 minute winter	6	116	38.716	1.736	30.4	7.8517	0.0000	SURCHARGED
15 minute summer	6_OUT	1	36.900	0.000	10.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	179.6	3.509	0.678	0.4972	
120 minute winter	2	1.001	3	25.2	0.699	0.129	1.2967	
120 minute winter	3	1.002	4	24.3	0.796	0.176	0.9253	
120 minute winter	4	1.003	5	40.1	0.997	0.250	3.0855	
120 minute winter	5	1.004	6	30.4	0.411	0.005	54.5199	
120 minute winter	6	Hydro-Brake®	6_OUT	10.0				189.3

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.70
Flow per dwelling per day (l/day)	2880	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Units	Cover Level (m)	Manhole Type	Depth (m)
1	24.0	39.639	Adoptable	1.324
2	21.0	39.571	Adoptable	1.426
3		39.700	Adoptable	1.653
4	175.2	39.606	Adoptable	1.416
5	10.3	39.450	Adoptable	1.400
6		39.430	Adoptable	1.650
7		39.540	Adoptable	1.825
7_OUT		39.140	Adoptable	1.470

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	1	2	22.605	1.500	38.315	38.145	0.170	133.0	150
1.001	2	3	9.470	1.500	38.145	38.047	0.098	96.6	150
1.002	3	7	27.486	1.500	38.047	37.715	0.332	82.8	150
2.000	4	5	7.013	1.500	38.190	38.050	0.140	50.1	150
2.001	5	6	10.534	1.500	38.050	37.780	0.270	39.0	150
2.002	6	7	3.795	1.500	37.780	37.715	0.065	58.4	150
1.003	7	7_OUT	5.324	1.500	37.715	37.670	0.045	118.3	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.415	0.759	13.4	2.4	1.174	1.276	0.000	0	24.0	0.0	44	0.576
1.001	0.509	0.891	15.7	3.4	1.276	1.503	0.000	0	45.0	0.0	47	0.707
1.002	0.535	0.963	17.0	3.4	1.503	1.675	0.000	0	45.0	0.0	45	0.748
2.000	0.791	1.239	21.9	6.6	1.266	1.250	0.000	0	175.2	0.0	57	1.084
2.001	0.867	1.405	24.8	6.8	1.250	1.500	0.000	0	185.5	0.0	54	1.195
2.002	0.756	1.148	20.3	6.8	1.500	1.675	0.000	0	185.5	0.0	60	1.035
1.003	0.606	0.805	14.2	7.6	1.675	1.320	0.000	0	230.5	0.0	78	0.819

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	22.605	133.0	150	Circular	39.639	38.315	1.174	39.571	38.145	1.276
1.001	9.470	96.6	150	Circular	39.571	38.145	1.276	39.700	38.047	1.503
1.002	27.486	82.8	150	Circular	39.700	38.047	1.503	39.540	37.715	1.675
2.000	7.013	50.1	150	Circular	39.606	38.190	1.266	39.450	38.050	1.250
2.001	10.534	39.0	150	Circular	39.450	38.050	1.250	39.430	37.780	1.500
2.002	3.795	58.4	150	Circular	39.430	37.780	1.500	39.540	37.715	1.675
1.003	5.324	118.3	150	Circular	39.540	37.715	1.675	39.140	37.670	1.320

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Adoptable	2	450	Manhole	Adoptable
1.001	2	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.002	3	450	Manhole	Adoptable	7	1200	Manhole	Adoptable
2.000	4	1050	Manhole	Adoptable	5	1050	Manhole	Adoptable
2.001	5	1050	Manhole	Adoptable	6	1050	Manhole	Adoptable
2.002	6	1050	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.003	7	1200	Manhole	Adoptable	7_OUT	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	39.639	1.324	450				
				0	1.000	38.315	150
2	39.571	1.426	450		1	1.000	38.145
				0	1.001	38.145	150
3	39.700	1.653	450		1	1.001	38.047
				0	1.002	38.047	150
4	39.606	1.416	1050				
				0	2.000	38.190	150
5	39.450	1.400	1050		1	2.000	38.050
				0	2.001	38.050	150
6	39.430	1.650	1050		1	2.001	37.780
				0	2.002	37.780	150
7	39.540	1.825	1200		1	2.002	37.715
				2	1.002	37.715	150
				0	1.003	37.715	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
7_OUT	39.140	1.470	1200	1	1.003	37.670	150
							