

Civil and Structural Engineering Group

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Drainage Strategy Report & Flood Risk Statement

The Seam, Barnsley

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1.0 Executive Summary

The proposed development includes the construction of Phase 1 of a wider development scheme. Phase 1 will deliver a new multi-storey car park to the north of the site, an active travel hub (ATH) to the south of the site and surrounding public realm areas. Phase 1 also includes the construction of two plots for future development.

The site is located within Barnsley Town Centre to the west of the Digital Media Centre, County Way, Barnsley. The Digital Media Centre is identified in Barnsley Metropolitan Borough Council's Local Plan as a success major development "to strengthen its base from which further developments can emerge". The proposed development supports the Remaking Barnsley: Strategic Development Framework 2003-2033 and Active Travel in Barnsley 2019-2033 strategy.

The site area is approximately 1.39 hectares. It is brownfield in nature, currently occupied by existing car parking and areas of soft landscaping, which are positively drained to the surrounding sewer network. Existing ground levels are shown to be the highest to the south of the site and tend to fall towards the North.

The site is located in an area of medium vulnerability to pollutants discharged at ground level but not within a groundwater Source Protection Zone (SPZ). The site is underlain by a Secondary A Bedrock Aquifer.

Yorkshire Water sewer records show there to be existing combined and surface water sewers adjacent to the site to the north (along Old Mill Lane) and to the south (along Regent Street/Eldon Street North).

A topographical and utility survey carried out by 1st Horizon Surveying and Engineering Ltd in January 2018 highlights an array of existing private drainage across the site consisting of gullies, pipelines and manholes. This is validated by a CCTV survey carried out by Jet Aire Services in April 2022.

The nearest watercourse/waterbody to the site is the Barnsley Canal (approximately 820m to the east of the site) and the River Dearne (approximately 930m to the east of the site).

The Environment Agency's Flood Map for Planning identified the entirety of the site is located in Flood Zone 1 (low risk of flooding). All other sources of flooding were assessed and regarded as having a low residual risk.

To manage any residual flood risk, ground levels should be profiled to encourage pluvial runoff and overland flows away from the built development and level accesses, towards the nearest drainage point. Floor levels should generally be raised 150mm above surrounding external ground levels to prevent any potential overland flow resulting from pluvial runoff or overland exceedance from entering buildings.

The development is considered to be accessible for emergency access and egress during times of extreme flooding as the known flood plain does not extend into the area proposed for development.

A copy of the Proposed Masterplan can be found within Appendix B.

A Phase I & II Geo-Environmental Assessment was undertaken and in-situ testing shows infiltration rates to be variable (within Made Ground) to very poor. Therefore, infiltration-based SuDS have been discounted at this stage.

Due to the excessive distance of the nearest watercourse/waterbody, it is not possible to discharge to this. Therefore, it is proposed to discharge to the existing public sewers surrounding the site and utilising SuDS features where appropriate and practicable.

In accordance with local policy, brownfield sites should aim to achieve a minimum reduction of 30% on pre-development runoff rates. After consultation with Yorkshire Water, it was agreed in principle that the whole of Phase 1 could discharge to the public sewer on Old Mill Lane at the combined total rate of 133.0 l/s. A copy of the correspondence is included in Appendix F. Excess runoff is to be attenuated on site using a combination of permeable paving, bio-retention areas and an attenuation tank.

Phase 1 is proposed for mix-use containing both residential and commercial developments, as such a lifespan of 100 years is anticipated. The potential climate change allowance for 2070 – 2125 ranges between 25% for the central allowance and 40% for the upper end allowance. As such the design will consider an allowance of 40% climate change on peak rainfall intensity.

The proposed drainage strategy is to be developed in accordance with current best practice and is to be designed not to flood for the critical 1 in 30-year flood event. Flood water generated for up to the critical 1 in 100-year plus climate change storm event is permitted but shall be constrained within the areas on site so as not to cause damage to buildings, essential services or adjoining developments.

It is proposed that foul water flow are to be directed to the public combined sewer in Old Mill Lane. Consultation with Yorkshire Water confirmed that a connection into this sewer was acceptable in principle. Peak foul flow rates have been calculated using the Design and Construction Guidance (DCG) and an estimated total combined peak flow rate of 10.0 l/s has been calculated for the Phase 1 development. Foul water drainage requirements are to be confirmed at detailed design.

The proposed drainage strategy has been modelled in MicroDrainage and the calculations and the outline below ground drainage strategy drawing are included in Appendix G.

The Flood Risk Assessment is considered to be commensurate with the development proposals and in summary, the development can be considered appropriate for Flood Zone 1, in accordance with the NPPF and Local Planning Policy/Core Strategy, and subject to the mitigation measures proposed.

2.0 Introduction

2.1 Appointment and Brief

Building Design Partnership (BDP) have been commissioned by Barnsley Metropolitan Borough Council to carry out a formal site-specific Flood Risk Assessment and Outline Drainage Strategy Report in support of a hybrid planning application, for the proposed development 'The Seam', Barnsley, approximate postcode S70 2JW. A Full Planning Application is to be submitted for the multi-storey carpark, active travel hub and surrounding public realm area and Outline Planning Application for Plot 1 and Plot 2 within the development.

The proposed development includes the construction of two building plots for future development, an active travel hub, a multi-storey car park and surrounding public realm areas. A copy of the Proposed Masterplan can be found in Appendix B.

This Flood Risk Assessment has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying Technical Guidance to assess all forms of flooding including the management of surface water on-site.

2.2 Sources of information

This Report summaries data supplied or provided from the following external sources listed below.

Table 1: Sources of Information used within this Report.

Source of Information	Author	Date
Barnsley Metropolitan Borough Council (BMBC) Strategic Flood Risk Assessment	JBA Consulting	September 2010
Barnsley Metropolitan Borough Council (BMBC) Preliminary Flood Risk Assessment Report and Appendices	BMBC	July 2011
Barnsley Local Plan	BMBC	January 2019
Active Travel in Barnsley 2019-2033 Strategy	BMBC	2019

2.3 Limitations

This report has been prepared for exclusive use by our client Barnsley Metropolitan Borough Council, for the purpose of assisting them in evaluating the potential risk of flooding associated with the site, proposed drainage strategy and in making a Planning Application. Building Design Partnership (BDP) accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of BDP. Any advice, opinions or recommendations within this document should be read and relied upon only in the context of the document as a whole.

BDP has endeavoured to assess all information provided to them during this appraisal. The report summarises from a number of external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.

This report addresses the flood risk posed to and from the proposed development, the extent of which is shown on the Proposed Masterplan contained within Appendix B. This report has been undertaken with the assumption that the site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

3.0 Site Context

3.1 Site Location

The site is located to the north of Barnsley town centre with the Digital Media Centre, County Way immediately to the west. The site is centred on the Ordnance Survey grid reference approximately 434618E, 406746N and approximate postcode is 270 2JW. A site location plan is included in Appendix A.

The Digital Media Centre is identified in Barnsley Metropolitan Borough Council's Local Plan as a success major development "to strengthen its base from which further developments can emerge". The proposed development supports the Remaking Barnsley: Strategic Development Framework 2003-2033 and Active Travel in Barnsley 2019-2033 strategy.

3.2 Site Characterisation/ Land-Use

Key features of the existing site have been summarised below.

Table 2: Key Features of Existing Site

Site Area		1.39 hectares
Site Description and Current Use		The existing site is brownfield in nature, predominantly occupied by existing car parking with pockets of soft landscaping.
Boundaries	North	The site is bound to the north by an existing highway Old Mill Lane (A635).
	East	The site is bound to the east by an existing railway.
	South	Eldon Street surrounds the site to the East/South-East.
	West	Existing carparking is found to the west of the site as well as County Way.
Access	Vehicular	Vehicular access from the north via County Way and from the south via Regent Street/County Way.
	Pedestrian	Pedestrian access from the north via County Way and from the south via Regent Street/County Way.

3.3 Topography

A topographical and utility survey of the site was undertaken by 1st Horizon Surveying and Engineering Ltd in January 2018.

The survey shows existing ground levels are highest to the south of the site with an average level of approximately 97.30m AOD is recorded across this area with the highest level recorded as being 97.784m adjacent to the retaining wall.

Levels fall towards the north of the site. An average level of approximately 95.60m AOD is recorded across the north of the site with lowest level recorded as being 90.861m AOD.

There is a slight fall in levels from west to east across the majority of the site.

In addition, there is an area of vegetated mounded material to the north of the site. The area of the mounded material is approximately 1545m² with maximum level of approximately 100.659m AOD (approximately 5m vertical height of mounded material).

3.4 Geology

A Phase I & II Geo-Environmental Assessment has been undertaken by Arcadis, June 2022. The report references the BGS online GeolIndex website and site-specific Groundsure Insight report and summarises the ground conditions as below.

Table 3: Site Investigation, Arcadis (June 2022)

<i>Unit</i>	<i>Published Information</i>	<i>Borehole Record Information</i>
Superficial Deposits		
Artificial	Made Ground deposits Mainly colliery spoil and infill	Varying thickness of Made Ground (1.0-8.0m bgl) Typically loose to medium dense black, brownish grey and brown clayey ashy subangular to subrounded fine to coarse gravel of mudstone, siltstone, sandstone, brick and coal. The cohesive Made Ground was recorded as soft to firm gravelly clay.
Superficial	None indicated	-
Bedrock		
Bedrock	Pennine Middle Coal Measures (PMCM) Formation Northern half of site underlain by distinct sandstone unit (Kent's Rock) Southern half of site underlain by interbedded grey mudstone, siltstone and pale grey sandstone, commonly with coal seams. Coal seams indicated to outcrop roughly through centre and south of the site and dip to the east at a shallow angle. Additional coal seam indicated to be present at relatively shallow depth beneath the western part of the site, deepening to the east.	Made Ground underlain by solid geology of Pennine Middle Coal Measures. Typically described as weathered to firm slightly gravelly clay near the surface with intact bedrock beneath. In the northern half of the site, Kent's Rock sandstone subcrops beneath the Made Ground. Hydrock 2020 investigation recorded approximately 14-15m of sandstone beneath Made Ground within the centre of the site which overlies 1m thick coal seam with mudstone recorded below. Across the southern site area, interbedded mudstone, siltstone and sandstone are present beneath the Made Ground, overlying Kent's Rock at depth.
Faults	No major regional geological faults are indicated on site or within close proximity to the site on the BGS mapping. However, a South Yorkshire Mining Service (SYMAS) Mineral Report completed for the site in 2017 (Ref; M864/10) and the plans presented in that	

	document suggest a small fault of approximately 2m displacement may cross the site in a roughly north/south orientation.
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In summary, ground conditions across the site were found to comprise Made Ground to a depth between 0.3m and 7.8m bgl, overlying strata of the Pennine Middle Coal Measures. Solid bedrock strata was recorded as very weak to moderately weak thinly laminated mudstone and siltstone, and medium strong sandstone layers.

Groundwater was found to be resting within sandstone of the Pennine Middle Coal Measures at a depth of >9.45m below ground level.

In-situ testing was carried out in the form of soakaway testing which shows variable infiltration rates within Made Ground and very poor infiltration rates in other trial pits. As such, infiltrating SuDS are not considered to be feasible at the site.

3.5 Hydrogeology

A review of DEFRA's Aquifer designation Map indicates that the site is underlain by a Secondary A Aquifer (Bedrock). The ground water vulnerability map also shows that the site is located in an area with a medium vulnerability to a pollutant discharged at ground level. However, the site is not located within a groundwater Source Protection Zones (SPZ).

3.6 Existing Public Sewers

Yorkshire Water sewer records (Appendix E) indicate there are existing combined and surface water sewers running along Regent Street. The surface water sewer from Regent Street continues along the entirety of Eldon Street North flowing in a north-east direction. A combined sewer is shown to run partially along Eldon Street, but the records appear to be incomplete as the sewer does not continue in either direction.

The sewer records also show both combined and surface water sewers running along Old Mill Lane A635 (north of the site).

Consultation with Yorkshire Water confirms that there is a 450 mm & 680 x 780 brick egg public surface water sewer recorded in the northern part of the site and a 300mm public surface water sewer in Regent Street. In addition, there is a 300mm diameter public combined sewer recorded in Old Mill Lane.

3.7 Existing Private Drainage

A topographical and utility survey of the site was undertaken by 1st Horizon Surveying and Engineering Ltd in January 2018 which highlights existing private drainage and services across the site. To validate this information and obtain a better understanding, a CCTV survey was carried out by Jet Aire Services in April 2022.

The CCTV survey shows that the south of the site is drained by the series of gullies connecting to manholes and discharging through the existing retaining wall adjacent to Eldon Street. There appears to be no drainage in a large portion of the centre of the site.

Similarly, towards the north of the site, there is a series of gullies and manholes discharging to the north of the site onto Old Mill Lane A635.

The CCTV report details a large number of runs are collapsed or broken, have displaced joints or no access was possible.

3.8 Watercourses, Land Drainage and other Waterbodies

The Environment Agency Statutory Main River map shows the Deane catchment area runs along to the south of the site with the River Deane approximately 930m east of the site. In addition, the Barnsley Canal is located approximately 820m east of the site.

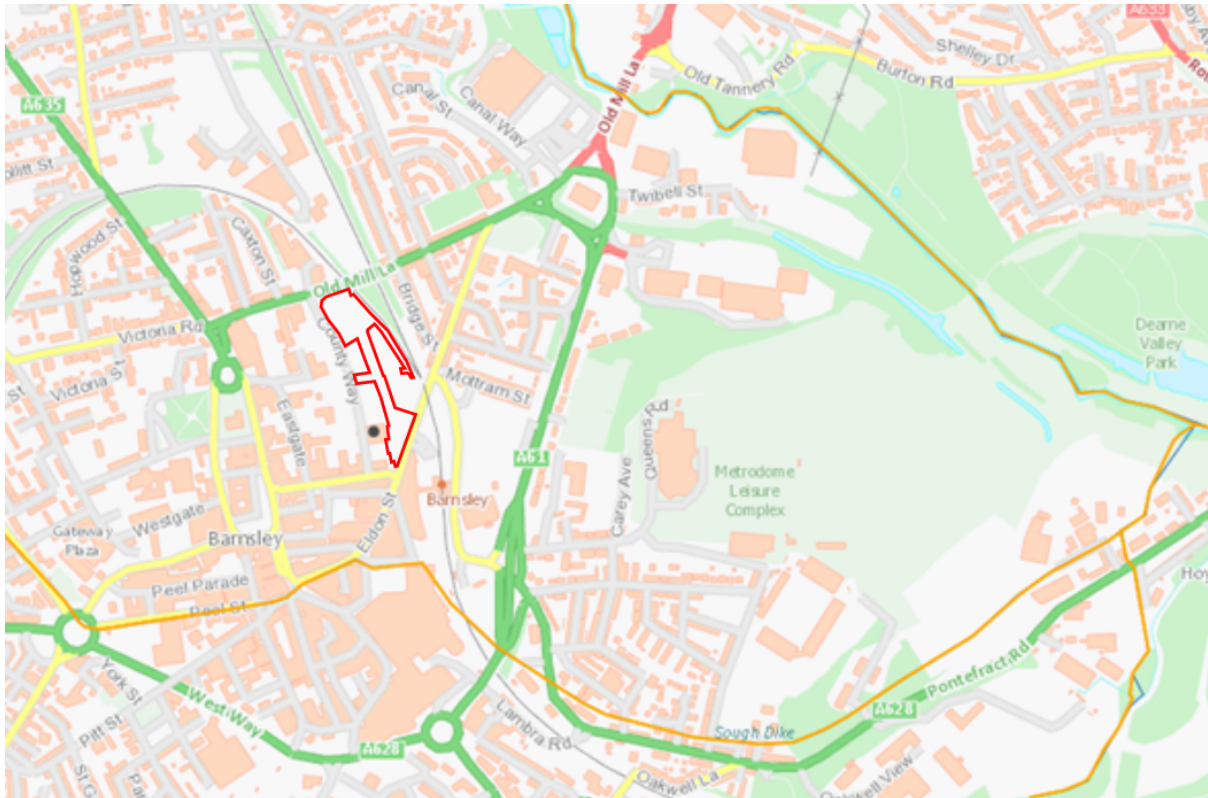


Figure 1 – Environment Agency Statutory Main River Map

Due to the extensive distance from the nearest waterbody and the need to cross third-party land, it is not feasible to discharge into a watercourse/waterbody.

4.0 Policy and Guidance

In carrying out our assessment and preparing this report, regard has been taken of the provisions of the development plan and a range of other material considerations. However, it is the Government's National Planning Policy Framework (NPPF), Local Council's Policies and CIRIA document C624, which provide the most up to date and specific guidance on the Scope of Flood Risk Assessments.

4.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was first published in England in March 2012 and a revised version was published on 20th July 2021. As a result, all previous Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs) were superseded. This included PPS25: Development and Flood Risk, along with its supplement on Development and Coastal Change.

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible should reduce flood risk overall.

Table 2 from the 'Flood Risk and Coastal Change Guidance' (2014) defines the type and nature of different development classifications in the context of their flood risk vulnerability. This should be compared against 'Table 3: Flood Risk Vulnerability and Flood Zone 'compatibility' to determine the risk of flooding to a proposed development.

4.2 Local Plan/Core Strategy

Barnsley Local Plan was adopted in January 2019 and sets out the key elements of the planning framework for the city for future development of Barnsley up to the year 2033. The policies of particular relevance to this Report are Policy CC1 Climate Change, Policy CC3 Flood Risk and Policy CC4 Sustainable Drainage Systems. Extracts from these policies are included in the Appendix E.

4.3 Strategic Flood Risk Assessment (SFRA)

Barnsley Metropolitan Borough Council's (BMBC) Strategic Flood Risk Assessment (SFRA) was produced by JBA Consulting in September 2010. The report assists BMBC in meeting their duties as a Lead Local Flood Authority (LLFA) in managing local flood risk and delivering the requirements of the Flood Risk Regulations (2009).

SFRAs assess the risk associated with all types of flooding and provide the information required to identify the amount of development permitted in an area; how the drainage systems in the area should function and also how the risks in vulnerable areas can be reduced and/or mitigated.

4.4 Preliminary Flood Risk Assessment Report (PFRA)

BMBC's Preliminary Flood Risk Assessment Report was produced in July 2011. The report assists BMBC in meeting their duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations (2009) and meet their duties as a LLFA.

The PFRA aims at providing a high-level overview of flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. Information from flooding incidences was collated and analysed. Based on the evidence that was collated for the Barnsley area, none of the past flooding events were considered to have had 'significant harmful consequences' as defined in the Regulations.

4.5 Active Travel in Barnsley Strategy 2019-2033

BMBC's Active Travel Strategy aims to make active an attractive and realistic choice for short journeys to enable and encourage people to walk and cycle as part of their daily lives. These aims will be delivered by integrating active travel into the planning process, maintaining and expanding active travel routes and supporting active travel in the community.

The Active Travel Strategy is aligned to the BMBC Corporate Plan and Public Health Strategy. As part of the proposals, an Active Travel Hub and surrounding public realm is included in the proposed development.

5.0 Sources of Flood Risk

5.1 Fluvial Flood Risk

The Environment Agency Flood Zone Map indicates that the proposed development lies wholly within Flood Zone 1 (low risk).

These Flood Zones are defined as follows:

- Flood Zone 1: Land assessed as having less than 1 in 1000 annual probability of flooding from rivers (<0.1%).
- Flood Zone 2: Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of flooding from rivers (1%-0.1%).
- Flood Zone 3: Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%)

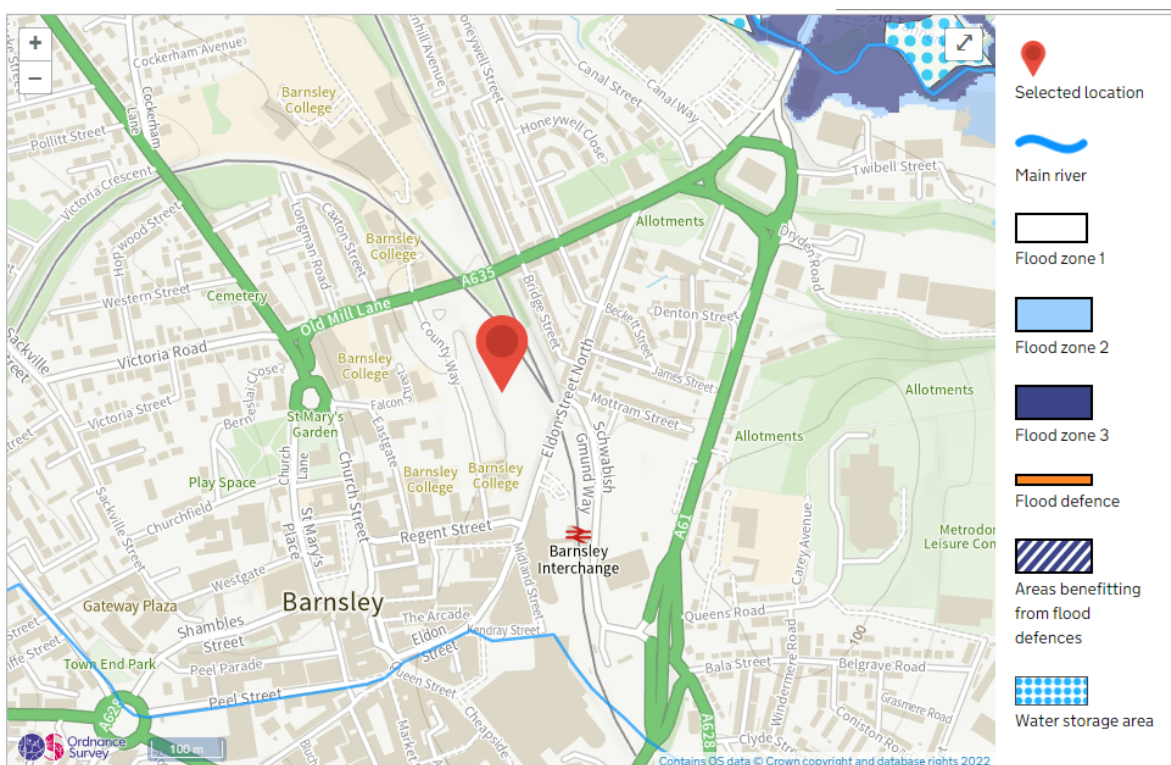


Figure 1 – Environment Agency Flood Map for Planning – Flooding from rivers and sea. © Environment Agency copyright and / or database rights 2021. All rights reserved. © Crown Copyright and database right 2021. Ordnance Survey licence number 100024198

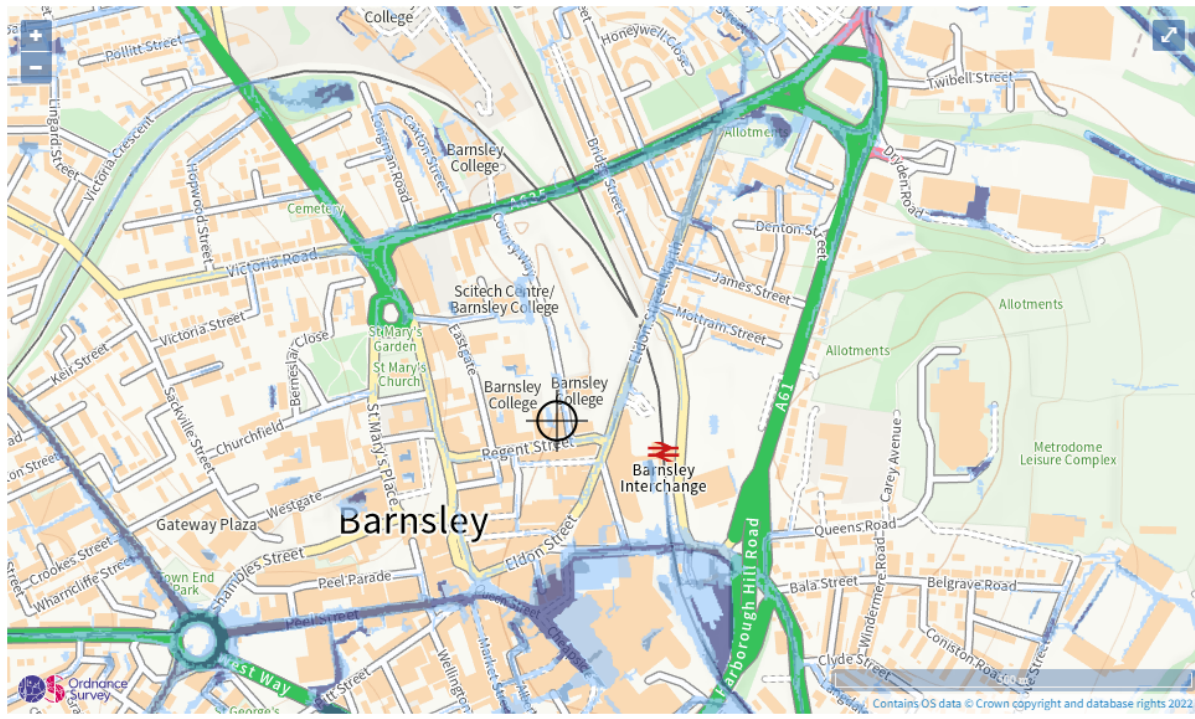
According to the ArcGIS map, there appears to be no historical flood events occurring on the proposed site. This is validated by the SFRA Map 2 Historical Flood Events map which indicates that no historical flood events have occurred on site. This is to be confirmed by the Environment Agency / LLFA / Yorkshire Water.

5.2 Pluvial Flood Risk

Pluvial flooding is defined as flooding resulting from rainfall-generated overland flow before runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events but can also occur with low intensity rainfall or melting snow where ground is saturated, frozen, developed or otherwise has low permeability resulting in overland flow and ponding in depressions in the topography. Large catchment areas are particularly prone to this type of flooding.

The majority of the site is shown to be at a very low risk from surface water flooding. There are small areas on site highlighted as low risk which will likely be due to depressions in the existing ground levels.

The surrounding highways including County Way and Eldon Street North show low risk of flooding from rainfall-generated overland flows.



Extent of flooding from surface water

● High ● Medium ● Low ○ Very Low ⊕ Location you selected

Figure 2 – Environment Agency Flood Map for Planning – Extent of flooding from surface water
(Source: <https://flood-warning-information.service.gov.uk>)

5.3 Sewer Flood Risk

Sewer flooding occurs when the capacity of the local drainage system is exceeded either as a result of intense rainfall, blockages or high water levels in watercourses preventing sewers from discharging properly.

The SFRA does not detail whether the site has been specifically affected by sewer flooding however, it states that Yorkshire Water (YW) have provided data on internal and external flooding from their databases and in the YW managed and maintained systems the incidences of external sewer flooding are not widespread or particularly frequent.

Correspondence with YW advises that “there appear are no incident of hydraulic failure on our sewer network within the vicinity of your site” and have not highlighted any sewer flooding on site.

5.4 Groundwater Flood Risk

In general terms groundwater flooding can occur from three main sources, raised water tables, seepage and percolation, and groundwater recovery or rebound. According to the Phase I & II Geo-Environmental Assessment, the ground water level is low however, further consultation with the EA and LLFA has been undertaken to confirm the groundwater flood risk.

The SFRA states that “likely candidates for groundwater flooding in the Barnsley MBC area are: Kingstone area of Barnsley, Kingwell area of Worsbrough; Millhouses area of Hoyland; and Upperwood area of Darfield.” The site does not lie in any of these areas.

Further consultation with the EA and LLFA has been undertaken to confirm the risk of groundwater flooding on site.

5.5 Flooding from Other Sources/Infrastructure Failure

Non-natural or artificial sources of flooding that can occur as a result of structural, hydraulic or geotechnical failure of infrastructure that retains, transmits or controls the flow of water; such as reservoirs, lakes and canals etc.

The site is shown not to be at risk from reservoir flooding.

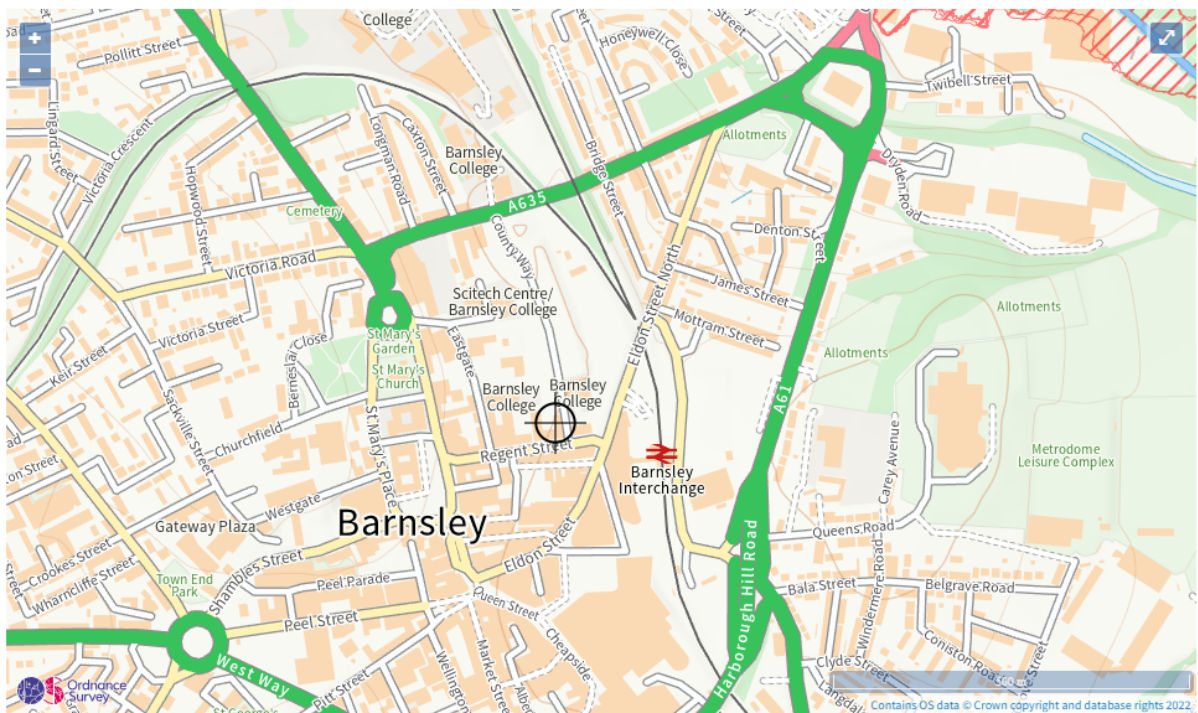


Figure 4 – Environment Agency Flood Map for Planning – Extent of flooding from reservoirs
 (Source: <https://flood-warning-information.service.gov.uk>)

Furthermore, in reference to the DEFRA’s ‘Reservoir Safety’ Document “*England has an excellent reservoir safety record, and there have been no dam breaches resulting in the loss of life since reservoir safety legislation was first introduced in 1930.*”

5.6 Summary of Flood Risk

Taking into consideration the evidence collated and the implementation of the recommended mitigation measures, the flood risk proposed to the development can be summarised as indicated in the table below.

Table 4: Summary of Mitigated Sources of Flood Risk

Source	Mitigated Risk
Fluvial	Low
Coastal – Sea	N/A
Coastal – Estuarine	N/A
Pluvial Flooding	Very Low
Sewer - SWS, FWS, CS, CSO	Low
Groundwater	Low
Other Sources	Low

The proposed development includes residential buildings, non-residential buildings, car parking and surrounding public realm and therefore it is considered as more vulnerable within Table 3: Flood Risk Vulnerability and flood zone 'compatibility' in the Technical Guidance for the NPPF. This type of development would be wholly appropriate for Flood Zone 1.

Table 5: Extract from Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (Technical Guidance for NPPF, gov.co.uk)

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	X	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	X	X	X	✓

Key:

✓ Development is appropriate

X Development should not be permitted

5.7 Mitigation Measures

In order to reduce the impact of any potential fluvial or pluvial flooding at the site, ground levels should be profiled to direct any overland flows away from the built development and level accesses, towards the nearest drainage point.

6.0 Surface Water Management Strategy

6.1 Existing Site Drainage Regime

The site is currently developed and is therefore classified as brownfield development. The CCTV Survey undertaken by Jet Aire in April 2022, confirmed the site to be positively drained, with the majority of Phase 1 discharging to the North to the 680 x 780mm surface water sewer in Old Mill Lane via two separate outfall locations. The remaining area within the south of the site was shown to discharge to the east through the existing retaining wall via two large external backdrops into the public surface water sewer on Eldon Street.

A sketch of the existing catchment areas is included in the Appendix C.

6.2 Pre-development Surface water Runoff

Using the two-pipe method in MicroDrainage, the existing discharge rate to each outfall location is tabulated below.

Table 6: Pre-development Runoff Rates

Return Period	Outfall to Old Mill Lane (1.33Ha)	Outfall to Eldon Street (0.74Ha)
1	154.2 l/s	92.0 l/s
30	406.6 l/s	227.1 l/s
100	522.0 l/s	293.0 l/s

However, based on the existing diameter and gradient of the outfall pipes these rates were considered to exceed the existing capacity and were therefore reduced accordingly to the following rates as agreed with Yorkshire Water.

- Maximum existing discharge rate to public sewer Old Mill Lane – 98.0 l/s
- Maximum existing discharge rate to public sewer Eldon Street – 92.0 l/s

6.3 Post-development Surface water Runoff

In accordance with local policy, brownfield sites should aim to achieve a minimum reduction of 30% on pre-development runoff rates. The table below shows the proposed restricted rates to be used within the Drainage Strategy.

Table 7: Post-development Runoff Rates

Outfall Location	Existing Runoff rate (l/s)	Proposed Rate with 30% Reduction (l/s)
Old Mill Lane	98.0	68.6
Eldon Street	92.0	64.4
Total	190.0	133.0

However, due to ongoing maintenance issues resulting from the large backdrops through the eastern retaining wall onto Eldon Street, it was recommended by Barnsley Council to remove this connection.

After consultation with Yorkshire Water, it was agreed in principle that the whole of Phase 1 could discharge to the public sewer on Old Mill Lane at the combined total rate of 133.0 l/s with suitable upgrades made to the outfall location. A copy of the correspondence is included in Appendix F.

In May 2022, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. The allowances are now calculated by management catchment with the upper end allowances being assessed for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).

The site lies within the Don and Rother Management Catchment and the associated peak rainfall allowances are shown tabulated below.

Table 8: Don and Rother Management Catchment Peak Rainfall allowances

Epoch	3.3% annual exceedance rainfall event		1% annual exceedance rainfall event	
	Central Allowance	Upper Allowance	Central Allowance	Upper Allowance
2050s	20%	35%	20%	40%
2070s	25%	35%	25%	40%

* 2050s for development with a lifetime up to 2060
2070s for development with a lifetime between 2061 and 2125

Phase 1 is proposed for mix-use containing both residential and commercial developments, as such a lifespan of 100 years is anticipated. The potential climate change allowance for 2070 – 2125 ranges between 25% for the central allowance and 40% for the upper end allowance. As such the design will consider an allowance of 40% climate change on peak rainfall intensity

6.4 Methods of Surface Water Management

In accordance with Building Regulations and the NPPF Drainage Hierarchy the management and discharge of surface water from a development should be applied in the order of priority as listed.

- 1) Disposal to ground via infiltration, and where this is not practicable;
- 2) Disposal to a watercourse, and where this is not practicable;
- 3) Disposal to a surface water sewer or highway drain, and where this is not practicable;
- 4) Disposal to a combined sewer.

Note: No surface water will be allowed to connect to a foul sewer.

The feasibility of each disposal method has been assessed and summarised in the table below.

Table 9: Review of Drainage Hierarchy

Method	Comments	Feasible
Infiltration	Four trial pits for infiltration testing were undertaken across the site. Two pits showed localised areas with sufficient infiltration rates, however these were underlain by clay and are assumed to be pockets of voids associated with made ground. The remaining two pits were unsuccessful with no movement in water over the test period. All the trial pits showed clay at relatively shallow depths (1 to 1.5mbgl) across the site therefore infiltrating SuDS were considered not to be feasible and discounted.	N
Watercourse	No watercourses in close proximity to the site.	N

Surface Water Sewer	Public surface water sewers located to the north and east of the site. Existing connections from the site have been confirmed via a CCTV Survey.	Y
Combined Water Sewer	Public combined sewer located to the north and east of the site.	Y

Based on the underlying ground conditions and the location of the site, the most appropriate method for the discharge of surface water runoff is to the public surface water sewer in Old Mill Lane.

6.5 Sustainable urban Drainage Systems (SuDS)

The general principle of the surface water drainage strategy for the development site is to collect runoff from buildings and hardstanding areas and attenuate at source, with a controlled discharge to the surrounding network.

The CIRIA SuDS Manual encourages the use of the 'SuDS management train' concept to manage runoff. The hierarchy of techniques to be used is:

1. Prevention – Prevention of runoff by good site design and reduction of impermeable areas.
2. Source Control – Dealing with water where and when it falls (e.g., infiltration techniques).
3. Site Control – Management of water in the local area (e.g., swales, detention basins).
4. Regional Control – Management of runoff from sites (e.g., balancing ponds, wetlands).

Varied SuDS methods have been summarised in the table below to assess and establish which are most feasible for the site.

Table 10: Assessment of SuDS

Suds Method	Comments	Feasible
Green & Blue Roof	Vegetated or hardstanding roof designed to store water, which can be used for irrigation, cooling water or non-potable use within the building. Flat roofs associated with apartment buildings and the Active Travel Hub could be designed with this feature if structural capacity, extra loadings and waterproofing are taken into consideration within the design.	Yes
Basins and Ponds	Basins and ponds increase biodiversity and amenity of the area, provide attenuation and improve water quality. These could be designed as part of the proposed green spaces if they are of sufficient size.	Yes
Filter Strips, Swales and Raingardens	Filter Strip, swales and raingardens can be used within private or public areas to reduce and treat runoff. There are several green spaces within the public realm where potential raingardens/bio-retention areas could be utilised.	Yes
Permeable Paving	Permeable paving provides at source treatment and surface water storage within underlying sub grade. This can be applied to proposed public or private highways, footways and car parking areas.	Yes
Infiltration SuDS	Based on the underlying geology and infiltration results, infiltration is not considered to be feasible at the site and has been discounted.	No
Tanked/Geocellular attenuation systems	Below-ground attenuation systems that can be designed for use under trafficked or landscaped areas. Tank systems can provide high storage capacity but do not provide runoff treatment or improve amenity and biodiversity.	Yes

The type of land use is considered to be the primary influencing factor in the quality of urban surface water runoff. The indicative pollution hazard indices for the land uses associated with the proposed

development have been extracted from Table 26. 2 of the SuDS Manual and have been tabulated below.

Table 11: Extract from Table 26.2 Pollution hazard indices for different land use classifications (CIRIA SuDS Manual C753)

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g., schools/offices) i.e., <300 traffic movements/day	Low	0.5	0.4	0.4
Total	Low	1.0	0.8	0.5

In order to provide adequate treatment to the site, the proposed SuDS components should have a total pollution mitigation index greater than or equal to the pollution hazard index of the land use. The surface water drainage strategy proposes to use permeable paving, green roofs and bio-retention areas within the design. The mitigation indices for these SuDS feature, tabulated below, are shown to be greater than the pollution indices from the proposed land use and are therefore considered appropriate to mitigate potential pollutants from the site.

Table 12: Extract of Table 26.3 Indicative SuDS Mitigation Indices for Discharge to Surface Water (CIRIA SuDS Manual Table C753)

Types of SuDS Components	Mitigation Indices		
	Total suspended solids (TSS)	Metals	Hydrocarbons
Bio-retention system	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Green Roof	0.8-0.9	0.7-0.9	0.9
Total	2.3-2.4	2.1-2.3	2.4

Further design of the SUDs features will be undertaken at the detailed design stage in conjunction with the design of the piped drainage systems.

6.6 Outline Surface Water Drainage Strategy

The proposed drainage strategy is to be developed in accordance with current best practice and is to be designed not to flood for the critical 1 in 30-year flood event. Flood water generated for up to the

critical 1 in 100 year plus climate change storm event is permitted but shall be constrained within the areas on site so as not to cause damage to buildings, essential services or adjoining developments.

Surface water runoff from the whole of the Phase 1 proposed development is to be directed to the public surface water sewer in Old Mill Lane at a restricted rate of 133 l/s as agreed with Yorkshire Water. Excess runoff is to be attenuated on site using appropriate SuDS features.

For the public realm, the Drainage Strategy proposes to use a combination of permeable paving and bio-retention areas in the south of the site to provide attenuation up to the 1 in 100 year plus climate change event. Runoff is to be temporarily stored within the coarse graded aggregate subbase prior to discharge into the main drainage network. Due to constraints within the northern region of the site associated with limited space, topography, utilities infrastructure and Network Rail access requirements, runoff from the remainder of the site is proposed to be attenuated within an underground tank, prior to discharge into the public surface water sewer on Old Mill Lane.

For Plot 1 an allowance of 5 l/s into the main drainage infrastructure has been included as part of the overall Phase 1 drainage strategy. As such, flows from this area will need to be restricted and additional attenuation will need to be included within the Plot 1 redline boundary. Using the Quick Storage Estimate tool on MicroDrainage the total volume of attenuation required is 170m³. This can be accommodated within a single underground tank or as combination of SuDS features, such as a blue roof or detention basin.

Taking into consideration the restricted space for Plot 2, the public realm drainage strategy has accounted for 70% impermeable area of the proposed redline boundary for Plot 2, with the assumption that 30% will be utilised for permeable areas such as gardens etc. If future development of Plot 2 increases the impermeable area beyond the 70% assumption, then the inclusion of additional attenuation will need to be provided within the Plot 2 boundary. This could be in the form of blue roofs or permeable paving.

The proposed drainage strategy has been modelled in MicroDrainage and the calculations and drainage strategy drawing are included in Appendix G.

7.0 Foul Water Drainage Strategy

The existing site is wholly utilised as a car park and therefore no foul flows are currently generated from the site. As a result, no foul water infrastructure is present within the site, with the exception of a small private sewer in the southwest, which currently serves the adjacent property.

Taking into consideration the existing topography and the location of the proposed buildings within the site, it is proposed that foul water flows are directed to the public combined sewer in Old Mill Lane. Consultation with Yorkshire Water confirmed that a connection into this sewer was acceptable in principle.

The peak foul water flow rate from the proposed development has been based on the following parameters:

- Café within Active Travel Hub (ATH);
- 1 toilet area within Multi-storey Car park (MSCP);
- 80 apartments with commercial use on ground floor level for Plot 1; and
- 36 apartments and 20 townhouses for Plot 2.

Using the peak design flow rates within the Design and Construction Guidance (DCG) the estimated flow rate has been calculated as follows:

Residential - 136 dwellings at 0.05 l/s per dwelling = **6.8 l/s**

Commercial units based on an assumed floor area of 0.14Ha at 0.6 l/s/ha = **0.1 l/s**

For the ATH and MSCP the flow rate has been estimated based on the assumed appliances to be installed as part of the café and toilet facilities.

Total Discharge Units calculated to be 19.1. Based on a frequency factor of 0.7, the peak flow rate is estimated to be **3.1 l/s**.

For the Phase 1 development the total combined estimated peak flow rate is considered to be **10.0 l/s**.

The foul water system will be designed and constructed in accordance with the current Building Regulations, BS EN:752 drainage and sewer systems outside buildings, the local authority building control specifications and requirements, Design and Construction Guidance (DCG) and the Civil Engineering Specification for the Water Industry 7th Edition.

The proposed drainage strategy plan is enclosed in Appendix

8.0 Drainage Summary

8.1 Gravity Drainage System

Following review of the existing sewer records and available topographical information, it is anticipated that gravity connections to the existing surrounding surface water and combined public sewer networks will be achievable, subject to further detailed drainage investigation works.

8.2 Adoption and Maintenance

It is anticipated that the new drainage network will be partly offered for adoption to Yorkshire Water with the remainder of the network to be owned/maintained by Barnsley Council either privately or through the Highways adoption process.

8.3 Performance Criteria

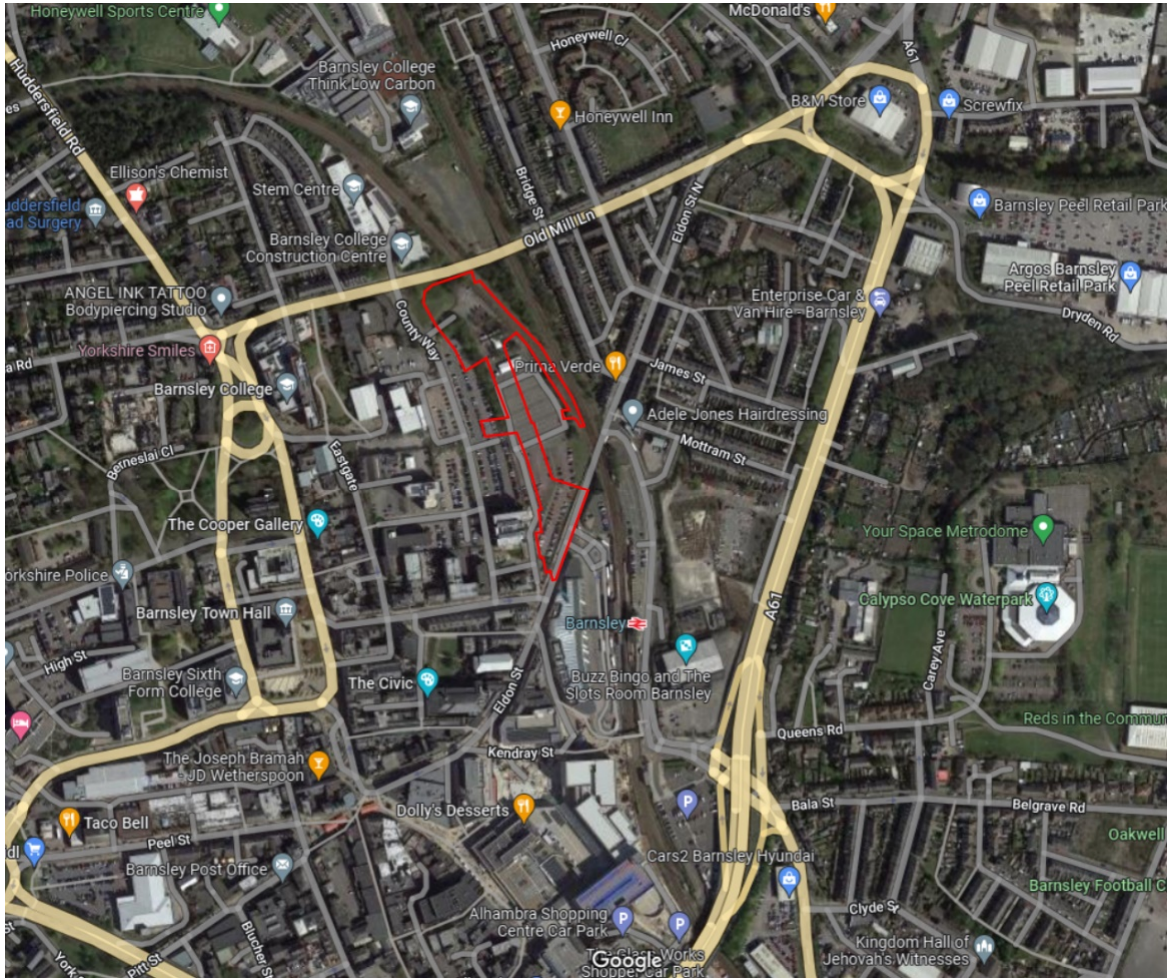
The foul and surface water drainage systems serving the site will be designed and installed in accordance with the following standards and best practice guidance.

- Approved Document H - Drainage and waste disposal;
- BS EN 752:2008 - Drain and sewer systems outside buildings;
- Design and Construction Guidance (DCG);
- PPG 3 - Use and design of oil separators in surface water drainage systems;

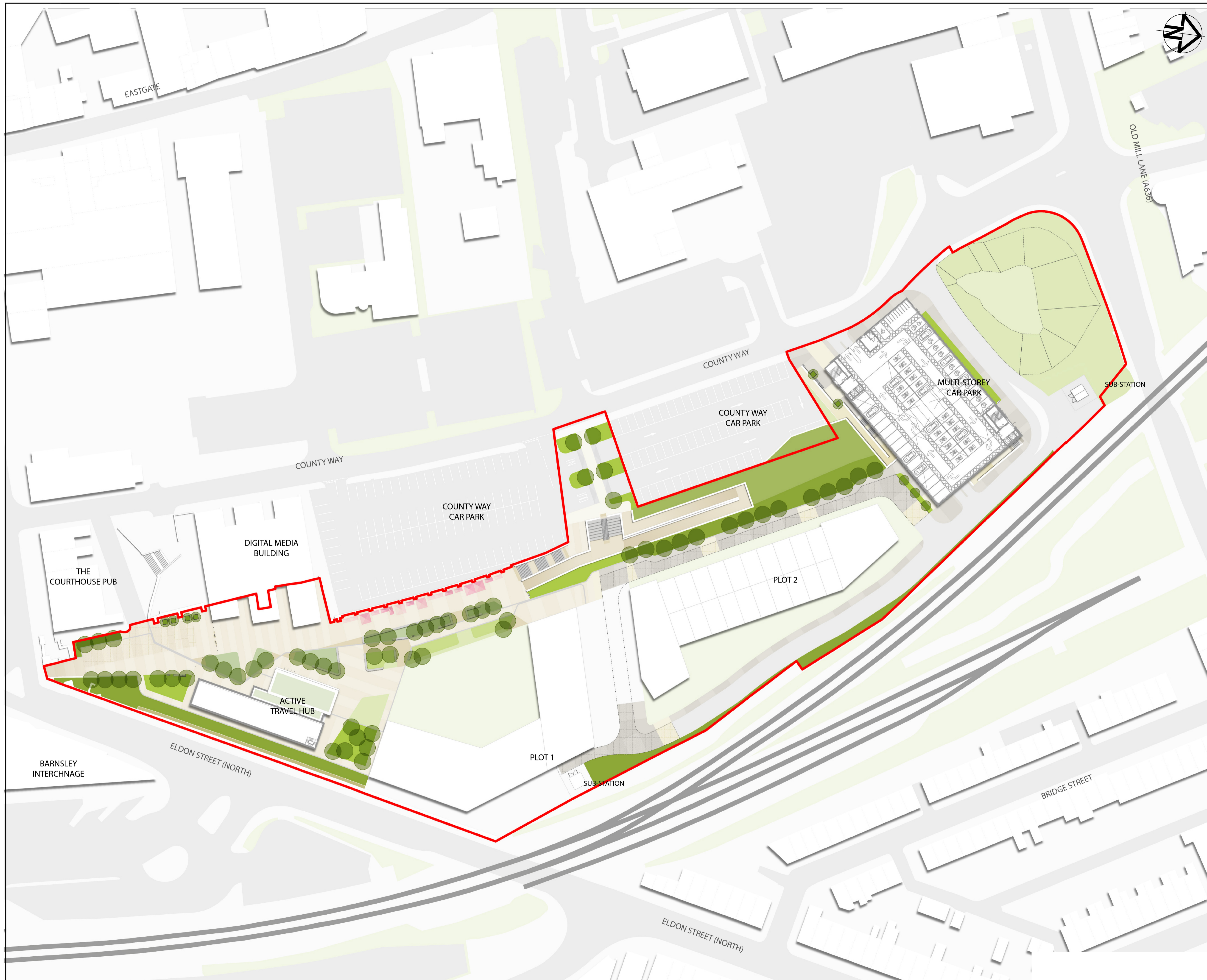
National Planning Policy Framework (NPPF) and Planning Policy Statement 25 (PPS25).

Appendix A

Site Location Plan



Appendix B
Proposed Masterplan



- LEGEND:**
- Paving: Yorkstone
 - Paving: Yorkstone (suitable for vehicular Use)
 - Paving: Kellen
 - Paving: Kellen (suitable for vehicular Use)
 - Paving: Asphalt
 - Feature Paving: Yorkstone and Kellen (to complete plant bed shapes, distinguish are
 - Feature Paving: Kellen (for connectivity between spaces, wayfinding)
 - Seated Wall
 - Planting: Mown Grass
 - Planting: Wildflower
 - Planting: Ornamental
 - Planting: Screen
 - Planting: SuDS/Raingardens
 - Planting: Tree
 - Indicative Market Stalls
 - Phase 1 Boundary

Rev	Date	Description	Prod.	Chk.	Rev.	App.
P01.3	07/07/22	Issued for planning approval	LJ	AS	AT	--
P01.2	06/07/22	Issued for planning approval	LJ	AS	AT	--
P01.1	01/07/22	Draft issued for planning approval	LJ	AS	AT	--

BARNSELY
Metropolitan Borough Council

Project: **THE SEAM**

Site:	Client:
The Seam Barnsley	Barnsley Metropolitan Borough Council Barnsley Council, PO Box 634, Barnsley S70 9GG www.barnsley.gov.uk

ARCADIS

Registered office: 80 Fenchurch Street, London EC3M 4BY
Coordinating office: 80 Fenchurch Street, London EC3M 4BY
Tel: 44 (0)20 7812 2000

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**PUBLIC REALM DESIGN
PHASE 1
ILLUSTRATIVE MASTERPLAN**

Designed: L. Johnstone	Signed:	Date: 07/07/22
Produced: L. Johnstone	Signed:	Date: 07/07/22
Checked: A. Sumfeth-Stevens	Signed:	Date: 07/07/22
Reviewed: A. Tully	Signed:	Date: 07/07/22
Approved: ---	Signed:	Date: ---

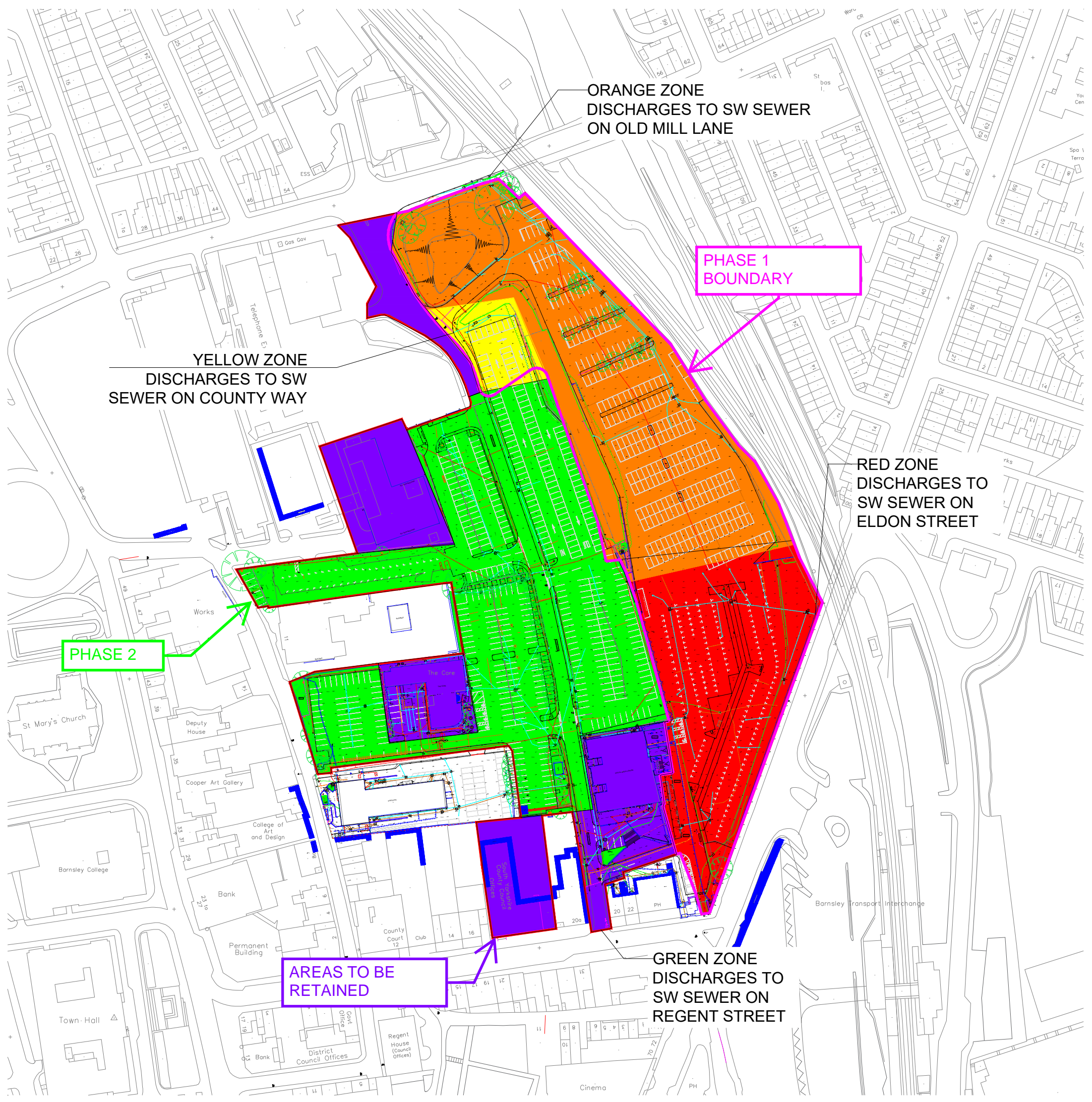
Design Stage: Detailed Design

Original Size: A1	Grid: OS	Datum: AOD
Suitability Code: S2	Scale: 1:500	Project Number: 10052406

FOR PLANNING

Drawing Number: 10052406 - ARC - ELS - XX - DR - LA - 00001	Revision: P01.3
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Appendix C
Existing Catchment Area Sketch



ORANGE ZONE
DISCHARGES TO SW SEWER
ON OLD MILL LANE

PHASE 1
BOUNDARY

YELLOW ZONE
DISCHARGES TO SW
SEWER ON COUNTY WAY

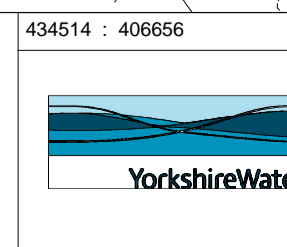
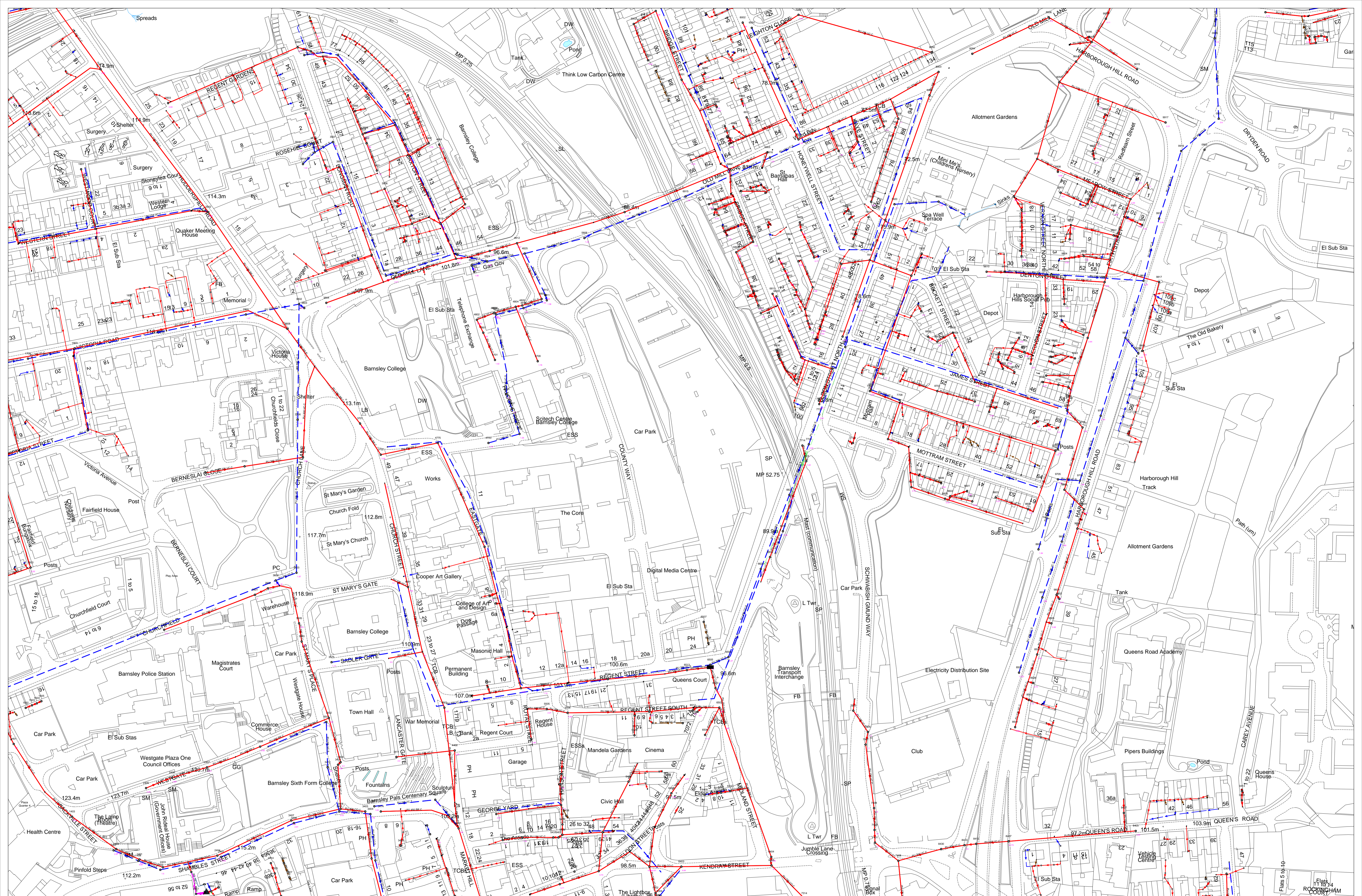
RED ZONE
DISCHARGES TO
SW SEWER ON
ELDON STREET

PHASE 2

AREAS TO BE
RETAINED

GREEN ZONE
DISCHARGES TO
SW SEWER ON
REGENT STREET

Appendix D
Yorkshire Water Sewer Records



434514 : 406656
 Map Name : SE3406SW
 Yorkshire Water,
 PO Box 500,
 Halifax Road,
 Bradford BD6 2LZ
 Contact Name :
 YorMap Advisor C ROBERTS
 Contact Tel : 87 2582

Title
 Notes
 (C) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HM Government © Crown Copyright and Database 2014. All rights reserved. Ordnance Survey Licence number 100022452

Partial Key
 Foul Sewer = F
 Combined Sewer = C
 Surface Water Sewer = SW
 Trade Sewer = TD
 Partially Separate = PS
 Date Req : 25/09/2020, 13:19:02
 Date Gen : 25/09/2020, 13:42:44
 Source : Sewer Network Enquiry

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
 Flats 1 to 14
 ROCKINGHAM

Appendix E
Extracts from Policies

19 . Climate Change

The Challenge

Considering central government's belief that climate change is the greatest long term challenge facing the world today, and a main challenge to delivery of sustainable development

Helping to tackle and adapt to climate change through the delivery of new housing, employment and infrastructure

Addressing flood risk

Increasing and encouraging the production of renewable energy in the borough whilst protecting the countryside and amenity

Policy Solutions

Climate change cuts across many aspects of the Local Plan and many of the policies in this document seek to prepare for and adapt to climate change

The planning system can help meet the targets for the reduction of emissions of greenhouse gases by:

Supporting the building of zero-carbon homes and business premises that are low energy and produce lower carbon emissions.

Locating development to reduce the need to travel and making walking and cycling essential components of new development that are accessible and attractive.

Supporting integrated development.

- 19.1** The NPPF recognises the key role planning has in meeting the challenge of climate change and states that Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change. This policy sets out how the Council will attempt to address the climate change issues will be addressed through the Local Plan.

Policy CC1 Climate Change

We will seek to reduce the causes of and adapt to the future impacts of climate change by:

Giving preference to development of previously developed land in sustainable locations;

Promoting the reduction of greenhouse gas emissions through sustainable design and construction techniques;

Locating and designing development to reduce the risk of flooding;

Promoting the use of Sustainable Drainage Systems (SuDS);

Promoting and supporting the delivery of renewable and low carbon energy; and

Promoting investment in Green Infrastructure to promote and encourage biodiversity gain.

- 19.2** The following policies in this section, CC2 to RE1 provide the detailed policy framework for the implementation of interventions/ initiatives identified in this policy.

Policy CC2 Sustainable Design and Construction

Development will be expected to minimise resource and energy consumption through the inclusion of sustainable design and construction features, where this is technically feasible and viable.

All non-residential development will be expected, to achieve a minimum standard of BREEAM 'Very Good' (or any future national equivalent). This should be supported by preliminary assessments at planning application stage.

- 19.3** Development proposals will be expected to consider energy efficiency and sustainable design from the outset and will be required to include details of their sustainability within their Design and Access Statement.
- 19.4** For housing development energy efficiency is regulated by Building Regulations. We will encourage energy efficiency that exceeds those minimum standards set out in national standards and take that into account where proposed in support of a planning application.
- 19.5** We will use the BREEAM (British Research Establishment Assessment Method) to measure the environmental performance of all non domestic buildings. As well as energy use and the emissions generated BREEAM deals with water use, materials and waste management, land use and ecology, pollution, health and well-being and transport.
- 19.6** We will encourage and plan for sustainable decentralised zero or low carbon energy generation, such as biomass-fuelled district heating or combined heat and power (CHP) schemes. Where a heat network is not available or viable, a contribution ensuring connection

19 . Climate Change

to a future district heating scheme is required on suitable developments. Developments not connected and unsuitable for future connection to a heat network will rely on energy generated from renewables, like solar panels, photovoltaics and heat pumps.

Flood Risk

Policy CC3 Flood Risk

The extent and impact of flooding will be reduced by:

Not permitting new development where it would be at an unacceptable risk of flooding from any sources of flooding, or would give rise to flooding elsewhere;

Ensuring that in the Functional Floodplain (Flood Zone 3b), only water compatible development or essential infrastructure (subject to the flood risk exception test) will be allowed. In either case it must be demonstrated that there would not be a harmful effect on the ability of this land to store floodwater;

Requiring developers with proposals in Flood Zones 2 and 3 to provide evidence of the sequential test and exception test where appropriate;

Requiring site-specific Flood Risk Assessments (FRAs) for proposals over 1 hectare in Flood Zone 1 and all proposals in Flood Zones 2 and 3;

Expecting proposals over 1000 m² floor space or 0.4 hectares in Flood Zone 1 to demonstrate how the proposal will make a positive contribution to reducing or managing flood risk; and

Expecting all development proposals on brownfield sites to reduce surface water run-off by at least 30% and development on greenfield sites to maintain or reduce existing run-off rates requiring development proposals to use Sustainable Drainage Systems (SuDS) in accordance with policy CC4; and

Using flood resilient design in areas of high flood risk.

- 19.7** It is predicted that the incidence of flooding will increase as a consequence of climate change. In Barnsley the rivers Dearne and Dove and the low lying areas in the east of the borough are particularly at risk from flooding. However, recent flood events caused by surface water and sewer flooding have demonstrated that areas which have not suffered from flooding in the past can still be at risk. It is therefore important that all new development is located and designed to reduce the risk of flooding to the development itself and settlements downstream, and provides resilience to protect against increased risk of flooding in the future.
- 19.8** In accordance with the NPPF the Council will discourage inappropriate development in areas at risk of flooding. This means there will be a general presumption against development within areas of high or medium flood risk unless there are no reasonably available sites in areas of lower flood risk and, in cases where it is appropriate for the exception test to be applied, the benefits of the development outweigh the risks from flooding.

- 19.9** The NPPF and the accompanying Planning Practice Guidance categorises areas at risk from fluvial (river) flooding as:
- Flood Zone 1 Low Probability (less than 1 in 1000 year probability of flooding)
 - Flood Zone 2 Medium Probability (1 in 1000 year probability of flooding)
 - Flood Zone 3a High Probability (1 in 100 year probability of flooding)
 - Flood Zone 3b The Functional Floodplain (land where water has to flow or be stored in times of flood).
- 19.10** The Environment Agency (EA) defines and produces maps which show the Flood Zones. These maps are informed by previous flood events and are updated regularly and can be viewed on the EA website.
- 19.11** Flood Zone 3b (The Functional Floodplain) comprises land where water has to flow or be stored in times of flood and forms a vital part of flood control. The boundary of Flood Zone 3b was agreed by the Council and the EA during the production of the Barnsley Strategic Flood Risk Assessment (SFRA) and is shown on the Policies Map. Development will not be allowed in Flood Zone 3b unless it can be shown that there would be no harmful effect on the ability of this land to store floodwater.
- 19.12** Developers will need to take into account the SFRA and give particular consideration to the surface water flood maps and the emerging Local Flood Risk Management Strategy.
- 19.13** The Council's Level 1 Strategic Flood Risk Assessment (SFRA) indicates that the majority of areas where growth will be located are within Flood Zone 1.
- 19.14** Development which would increase the risk of flooding by increasing the rate or volume of surface water must be the subject of measures that will reduce the risk of flooding. In cases where development would increase the risk of flooding by increasing surface water, developers will have to take action to reduce flooding so the development can go ahead, for example, by creating balancing ponds and other facilities for holding water.
- 19.15** We will consider the need to produce Surface Water Management Plans in partnership with stakeholders to reduce the threat of surface water flooding.

19 . Climate Change

Policy CC4 Sustainable Drainage Systems (SuDS)

All major development⁽¹²⁾ will be expected to use Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it can be demonstrated that all types of SuDS are inappropriate.

The Council will also promote the use of SuDS on minor development.

To enable the Council to determine the suitability of a proposed SuDS scheme:

Outline Planning applications must be supported by a conceptual drainage plan and SuDS design statement; and

Detailed Planning applications must be supported by a detailed drainage plan and SuDS design statement, which should contain information on how the SuDS will operate, be managed and maintained for the lifetime of the development.

- 19.16** Sustainable Drainage Systems (SuDS) control surface water run-off as close to its origin as possible. The Flood and Water Management Act 2010 maintains that there is always a SuDS solution. As such priority will be given to incorporating SuDS into development, unless it can be demonstrated that SuDS are not appropriate.
- 19.17** SuDS are a non-traditional environmentally friendly way of dealing with surface water. SuDS rely on gravity to drain surface water from hard surfaces into drainage systems or into the ground. Where surface water would have traditionally drained into a combined foul and surface water sewer, the use of SuDS prevents relatively clean surface water from passing unnecessarily through the waste-water treatment process. Run-off water is collected and stored so that natural cleansing (sedimentation, filtration and biodegradation) happens before it is released into watercourses. SuDS control surface water run-off as close to its origin as possible, before it enters a watercourse. This involves moving away from traditional piped drainage systems to those that are similar to natural drainage processes.
- 19.18** The SuDS approach is particularly valuable in urban areas where high density development and impermeable surfaces mean surface run-off can easily cause flooding, either directly or indirectly through sewer flooding. SuDS has several environmental and social benefits:
- Prevents pollutants from entering the drainage system;
 - Protects or enhances water quality and decreases demand for treated water (recycling);
 - Conserves energy and reduces carbon dioxide emissions;
 - Reduces sewer discharge and flooding;

¹² as defined in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2015 and subsequent updates

Provides a habitat for wildlife; and

Contributes to the greening of the urban environment.

- 19.19** This policy applies to all elements of the design of developments, including roads and footways. Including SuDS in the overall site and layout, and as part of the wider Green Infrastructure provision where appropriate, should be considered early in the planning and design stage, in consultation with the Environment Agency, the Planning Authority and the Highway Authority.
- 19.20** Developers must show that SuDS will work and will be maintained in the long term. Developers may be required to contribute towards the maintenance of SuDS, possibly through the establishment of a management company where appropriate.
- 19.21** Infiltration type SuDS may not be appropriate in all cases due to ground conditions. Where this is the case alternative (non infiltration) SuDs must be considered. Infiltration SuDS may not be appropriate on land that is affected by contamination, as they can mobilise contaminants in the ground and pollute groundwater. Developers must show that infiltration SuDS will not pose a risk to the quality of underlying groundwater.
- 19.22** All SuDS should be designed in accordance with the CIRIA C697 SuDS Manual or equivalent local guidance.
- 19.23** The Council is working with the Environment Agency to investigate the potential to deliver new flood storage areas. The most significant example of this is the Dearne Valley Green Heart Nature Improvement Area. Schemes are also proposed to commence in 2016 at Wombwell and Little Houghton to formalise areas that are known to flood and increase their capacity and biodiversity potential. We will support these schemes provided they do not affect the openness of the Green Belt.

Water

Policy CC5 Water Resource Management

To conserve and enhance the Boroughs water resources proposals will be supported which:

- a. Do not result in the deterioration of water courses and which conserve and enhance:
 - i. The natural geomorphology of water courses;
 - ii. Water quality; and
 - iii. The ecological value of the water environment, including watercourse corridors.
- b. Make positive progress towards achieving “good” status or potential under the Water Framework Directive in the boroughs surface and ground water bodies;
- c. Manage water demand and improve water efficiency through appropriate water conservation techniques including rainwater harvesting and grey-water recycling; and
- d. Dispose of surface water appropriately and improve water quality through the incorporation of SuDS, in accordance with Policy CC4.

19 . Climate Change

- 19.24** Barnsley's water resources form an important part of the environment and can provide wildlife habitats and encourage biodiversity, provide opportunities for leisure and recreation and help alleviate flood risk.
- 19.25** This policy seeks to address the key objectives of the Water Framework Directive and Humber River Basin Management Plan, specifically those of the latter which relate to the Don and Rother catchment, the catchment in which the borough lies.

Appendix F
Correspondence

Herod, Elanna

From: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>
Sent: 02 February 2022 12:43
To: Herod, Elanna
Subject: RE: P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Filed by Newforma

Hi Elanna,

So as discussed

Outfall 1 – 81.41 l/s less 30% = 57 l/s – to discharge to the 680 x 780 mm brick egg public surface water sewer in Old Mill Lane.

Outfall 2 – 92 l/s less 30% = 64.4 l/s to discharge to the 680 x 780 mm brick egg public surface water sewer in Old Mill Lane.

Outfall 3 – 16.6 l/s less 30% = 11.62 l/s to discharge to the 680 x 780 mm brick egg public surface water sewer in Old Mill Lane.

So in total 133.02 l/s in total can discharge to the 680 x 780 mm brick egg public surface water sewer in Old Mill Lane

Outfall 4 – 55.39 l/s less 30% = 38.7 l/s to discharge to the 300 mm public surface water sewer in Regent Street

So in total 38.7 l/s in total can discharge to discharge to the 300 mm public surface water sewer in Regent Street.

Kind Regards



Chris Roberts
Pre-Development Technician
Developer Services
Tel: 0345 1 20 84 82

From: Herod, Elanna <Elanna.Herod@bdp.com>
Sent: 02 February 2022 10:44

To: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>
Subject: RE: P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

Ok that's great thanks.

Kind regards,

Elanna Herod
Senior Civil Engineer

BDP

Postal address:

11 Ducie Street, PO Box 85, Piccadilly Basin
Manchester M60 3JA, United Kingdom
Location postcode for sat nav purposes: M1 2JB

T 0161 828 2230
E elanna.herod@bdp.com
www.bdp.com

Please consider the environment before printing this e-mail



From: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>
Sent: 02 February 2022 10:43
To: Herod, Elanna <Elanna.Herod@bdp.com>
Subject: RE: P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

I'll call you just after 12

From: Herod, Elanna <Elanna.Herod@bdp.com>
Sent: 02 February 2022 10:42
To: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>
Subject: RE: P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

Hi Chris,

Apologies I was in a meeting this morning. Unfortunately I have another one starting at 11am, which is only meant to be 30mins but in the off chance it drags on I can be free for a chat anytime after 12 if that suits?

Kind regards,

Elanna Herod
Senior Civil Engineer

BDP

Postal address:

11 Ducie Street, PO Box 85, Piccadilly Basin
Manchester M60 3JA, United Kingdom
Location postcode for sat nav purposes: M1 2JB

T 0161 828 2230
E elanna.herod@bdp.com
www.bdp.com

Please consider the environment before printing this e-mail

From: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>
Sent: 02 February 2022 10:29
To: Herod, Elanna <Elanna.Herod@bdp.com>
Subject: RE: P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

Hi Elanna,

Just tried to call but you must be busy.

We use Colebrook White when checking the max flow rates off sewers and my figures are quite different to yours on the maximum carrying capacity. I can see you have based your rates on 1 in 1.

Outfall 4

Calculation of Flow Rates Colebrook White Formula		
Pipe Diameter	225	mm
Gradient	88	
k	0.6	mm
Velocity	1.39	m/s
Flow	55.39	litres/second

I also looked at outfalls 1 and they come out as 81.41 l/s not 98.8 l/s.

Are you free for a call.

Regards

Chris

-----Original Message-----

From: Herod, Elanna <Elanna.Herod@bdp.com>

Sent: 01 February 2022 16:04

To: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>

Subject: RE: P3002352 The Seam, Barnsley – Discharge Rate Enquiry W012019

Hi Chris,

Outfall 4 = 225mm dia at an estimated gradient of 1:88.

This will be confirmed following the CCTV Survey.

= discharge rate for 1 in 1 year = 108.6 l/s

Kind regards,

Elanna Herod
Senior Civil Engineer

BDP

Postal address:

11 Ducie Street, PO Box 85, Piccadilly Basin Manchester M60 3JA, United Kingdom Location
postcode for sat nav purposes: M1 2JB

T 0161 828 2230

E elanna.herod@bdp.com

www.bdp.com

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-----Original Message-----

From: Chris.Roberts@yorkshirewater.co.uk <Chris.Roberts@yorkshirewater.co.uk> On Behalf Of
technical.sewerage@yorkshirewater.co.uk

Sent: 01 February 2022 12:48

To: Herod, Elanna <Elanna.Herod@bdp.com>

Subject: RE: P3002352 The Seam, Barnsley – Discharge Rate Enquiry W012019

Hi Elanna,

I've stated the wrong area in my request its Outfall 4 not area 4 I needed the flow rate
calculation for. Would you have it available?

Thanks

Chris

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| From: |

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|"Herod, Elanna"

<Elanna.Herod@bdp.com>

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| To: |

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|Chris Roberts/Water Business Unit/YWS/Yorkshire

Water@O365

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|Technical

Sewerage@NotesMail

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| Date: |

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|19/01/2022 10:02

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| Subject: |

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|RE: P3002352 The Seam, Barnsley - Discharge Rate Enquiry

W012019

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(02) VR

19.01.2022

Hi Chris.

Thank you for your email.

As requested, the pipe size and gradients for the outfall pipes are as follows:

Outfall 1 (Area 1/orange) = 150mm dia at a gradient of 1:10
= 150mm dia at a gradient of 1:9.4
= Combined discharge rate for 1 in 1 year = 98.8 l/s

Outfall 3 (Area 4/yellow) = 225mm dia at an estimated gradient of 1:18.
This will be confirmed following the CCTV Survey.
= discharge rate for 1 in 1 year = 16.6 l/s

Kind regards,

Elanna Herod
Senior Civil Engineer

BDP

Postal address:

11 Ducie Street, PO Box 85, Piccadilly Basin Manchester M60 3JA, United Kingdom Location
postcode for sat nav purposes: M1 2JB

T 0161 828 2230

E elanna.herod@bdp.com

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-----Original Message-----

From: Chris.Roberts@yorkshirewater.co.uk

<Chris.Roberts@yorkshirewater.co.uk> On Behalf Of technical.sewerage@yorkshirewater.co.uk

Sent: 18 January 2022 12:19

To: Herod, Elanna <Elanna.Herod@bdp.com>

Subject: Re: P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

Dear Ms Herod,

Thank you for the additional information.

I need a bit more information to back up the microdrainage as it appears some areas mainly

Area 1 / Orange Zone discharge via small diameter 150 mm diameter pipes and would be acting as a throttle.

Area 4 discharges via a 225 mm diameter pipe and could be acting as a throttle.

What I need to know is a calculation of the final run of private surface water pipework before it enters the public sewer at the above two locations confirming the pipe size and gradient.

Also as per my earlier correspondence we will only accept rates based on the 1 in 1 year storm event. That rate is then set up to and including the 1 in 100 year event.

Retained/unaltered areas can continue to discharge as they already do.

Once I have a better understanding of the above I will be able to comment on options 1 and 2. We may also need to carry out a bit of modelling to understand the increase on the surface water sewers system in Regent Street and Old Mill Lane.

Kind Regards

(Embedded image moved to file: pic12423.gif)

*** Please note, all correspondence must be sent to technical.sewerage@yorkshirewater.co.uk and will be responded to within 10 working days ***

|----->

| From: |

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|"Herod, Elanna" <Elanna.Herod@bdp.com>

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| To: |

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|Chris Roberts/Water Business Unit/YWS/Yorkshire Water@O365

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| Cc: |

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|Technical Sewerage@NotesMail, "Nicholls, David" <David.Nicholls@bdp.com>

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| Date: |

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|13/01/2022 14:26

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| Subject: |

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|P3002352 The Seam, Barnsley - Discharge Rate Enquiry W012019

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VR DATED 13/1/2022

EXTERNAL SOURCE - THINK BEFORE YOU CLICK

Good afternoon Chris,

In September 2020 we submitted a pre-development enquiry (ref. W012019) for the proposed development of the Digital Media Centre in Barnsley, South Yorkshire, S270 2JW to inform the outline drainage strategy for the site.

We are now looking to progress Phase 1 of the development situated in the east of the site and would like to confirm discharge rates and connection locations. Although the remainder of the site is proposed to be developed at a later stage, we are potentially looking at the option at having one outfall into the public surface water sewer on Old Mill Lane. We would therefore like to clarify discharge rates for this area as well to inform any futureproofing that may be required within the Phase 1 drainage design.

Please see attached site location plan and phasing plan for your reference.

The redline boundary extends to approximately 4.48Ha and can be broken down into the following areas:

Phase 1 - 2.05 Ha

Phase 2 - 1.55 ha

Retained Areas - 0.88Ha

A GPR Survey of the site undertaken in January 2018 showed the site to be served by a separate surface water network with an assumed connection to the nearby public surface water sewers. A CCTV Survey is currently being procured to confirm the routes and condition of the existing network.

Based on the available data the following discharge locations have been assumed/identified across the whole site:

Outfall 1 - Assumed connection to 680mm Brick public surface water sewer on Old Mill Lane to the north of the site

Outfall 2 - Public surface water sewer on County Way to the north west of the site

Outfall 3 - Discharges to the east via a large backdrop through an existing retaining wall to the public surface water sewer on Eldon Street.

Outfall 4 - Discharges to the south to the public surface water sewer on Regent Street.

A sketch showing the catchment areas (SK-C-0001) and discharge locations has been attached for your review.

The site is currently 100% impermeable and is predominantly utilised as a car park with Media Centre buildings. Using the 2-pipe method in MicroDrainage, the existing discharge rate from each outfall location is tabulated below. However, please note that since the retained areas, which include the existing buildings and access roads, are not proposed to be changed as part of the future developments these areas have been excluded from the runoff rate calculations.

Return period	Outfall Reference and catchment area				

Surface water runoff from the new development areas to be directed to the north to the 680mm public surface water sewer with a 30% reduction on existing rates. Total rates to the sewer on Old Mill lane are proposed to be:

Return period	Phase 1 (2.05Ha) reduced rate	Phase 2 (1.55Ha) reduced rate	Total rate to north sewer
1	172.3	135.7	308.0
30	443.6	324.5	768.1
100	570.5	411.3	981.8

Option 2

Surface water runoff from new development areas to be directed to the public surface water sewer on Regent Street through existing connection with a 30% reduction on existing rates. Total rate to south will be:

Return period	Discharge rate from retained buildings	Phase 2 reduced south sewer	Total rate to
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1	94.4	135.7	229.6
30	227.1	324.5	558.9
100	287.0	411.3	706.8

Based on the above information I would be grateful if you could please confirm/advise on the following:

Are the proposed rates and connection points for Phase 1 acceptable in principle?

Are the proposed rates for phase 2 acceptable in principle?

Is it acceptable to have a joint connection for Phase 1 and 2 to the sewer on Old Mill Lane at the combined rate calculated above?

If not, is it acceptable to discharge Phase 2 to the south to the sewer on Regent Street at the reduced rate with the retained buildings discharging as existing?

Kind regards,

Elanna Herod

Senior Civil Engineer

BDP

Postal address:

11 Ducie Street, PO Box 85, Piccadilly Basin Manchester M60 3JA, United Kingdom Location
postcode for sat nav purposes: M1 2JB

T 0161 828 2230

E elanna.herod@bdp.com

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[IMAGE]

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(See attached file: image001.png)(See attached file: Site Information.zip) (See attached file: DIGITAL.pdf)

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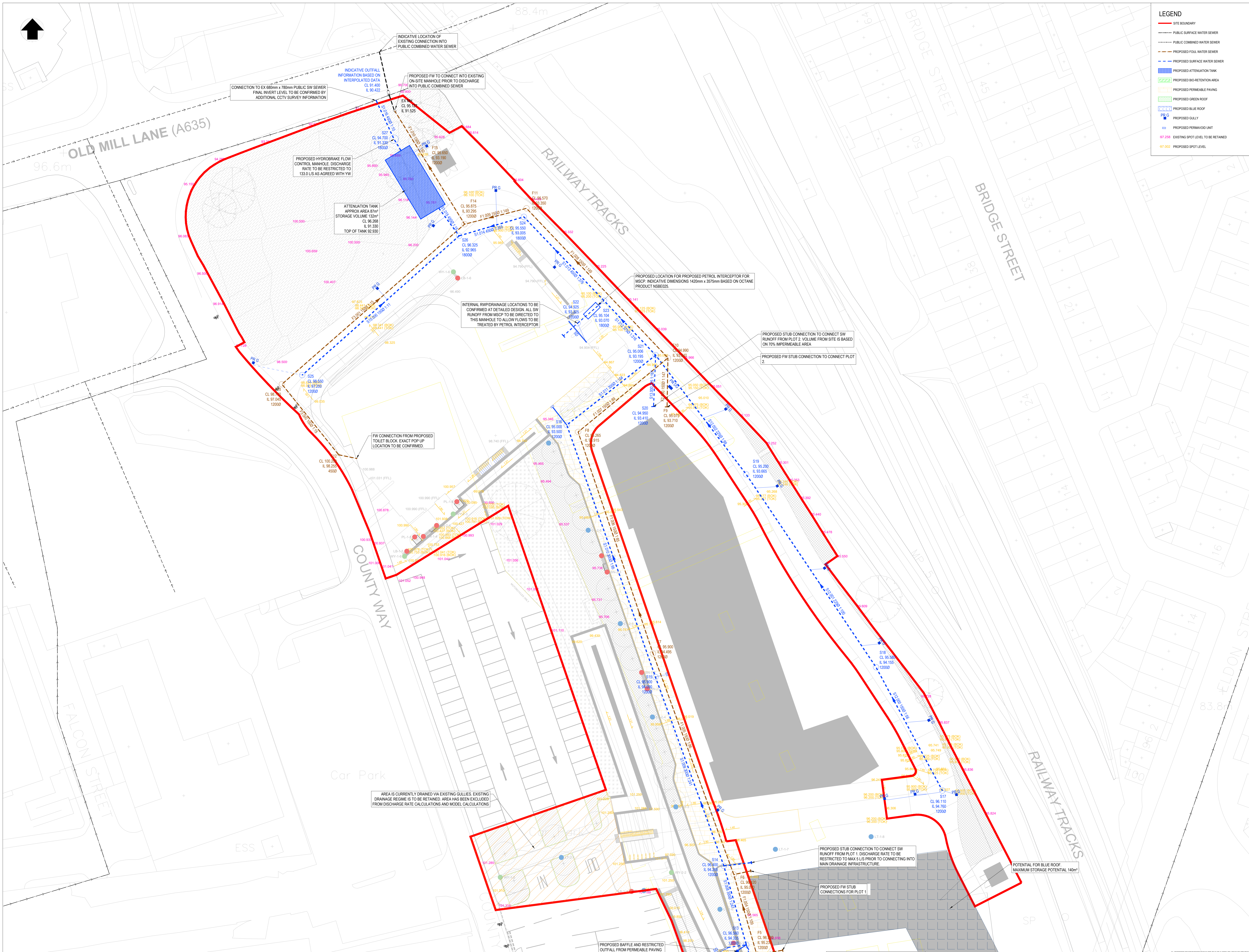
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Appendix G

Outline Proposed Below Ground Drainage Strategy Plan



LEGEND

- SITE BOUNDARY
- PUBLIC SURFACE WATER SEWER
- PUBLIC COMBINED WATER SEWER
- PROPOSED FOUW WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED ATTENUATION TANK
- PROPOSED BIO-RETENTION AREA
- PROPOSED PERMEABLE PAVING
- PROPOSED GREEN ROOF
- PROPOSED BLUE ROOF
- PROPOSED GULLY
- PROPOSED PERMEABLE UNIT
- EXISTING SPOT LEVEL TO BE RETAINED
- PROPOSED SPOT LEVEL

BUILDING DESIGN PARTNERSHIP SHALL HAVE NO RESPONSIBILITY FOR ANY USE MADE OF THIS DOCUMENT OTHER THAN THAT FOR WHICH IT WAS PREPARED AND ISSUED. ALL DIMENSIONS SHOULD BE CHECKED ON SITE. DO NOT SCALE FROM THIS DRAWING. ANY DRAWING ERRORS OR OMISSIONS SHOULD BE BROUGHT TO THE ATTENTION OF BUILDING DESIGN PARTNERSHIP AT THE ADDRESS SHOWN BELOW.

NOTES

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- THIS DRAWING IS BASED ON:
 - TOPOGRAPHICAL AND UTILITY SURVEY PREPARED BY 1ST HORIZON IN 2018
 - LANDSCAPE GENERAL ARRANGEMENT DWG REF 10052406-ARC-XX-XX-M2-LA-0002 PREPARED BY ARCADIS
- THE SURFACE WATER DRAINAGE HAS BEEN DESIGNED FOR NO SURCHARGE FOR A 1 IN 30 YEAR RAINFALL EVENT PLUS 35% ALLOWANCE AND NO FLOODING FOR 1 IN 100 YEAR PLUS 40% ALLOWANCE FOR CLIMATE CHANGE. THE SURFACE WATER NETWORK HAS BEEN DESIGNED TO RESTRICT THE DISCHARGE RATE FROM THE SITE TO 133.0 L/S UP TO THE 1:100 RAINFALL EVENT PLUS 40% CLIMATE CHANGE ALLOWANCE.
- THE FOUW WATER DRAINAGE HAS BEEN DESIGNED BASED ON THE TOTAL NUMBER OF DISCHARGE UNITS OF 19.00'S AND A FACTOR OF 0.7 IN ACCORDANCE WITH BS EN 12056-2:2000, SYSTEM II. PEAK FOUW WATER RATE CALCULATED AT 9 L/S BASED ON MIXED USE OFFICE/LABORATORY.
- CONNECTIONS TO THE PUBLIC SEWER ARE SUBJECT TO SECTION 106 OF THE WATER INDUSTRY ACT 1989. APPROVAL NO WORKS AFFECTING THE PUBLIC SEWERAGE SYSTEM MAY BE CARRIED OUT WITHOUT YVWS PRIOR WRITTEN CONSENT.
- ALL DRAINAGE TO BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH BS EN 12056-1:2000, BS EN 752:2017, AND BS EN 165:2015.
- LOCATION OF SW/WATER DOWNPIPES AND SV/S HAVE NOT BEEN CONFIRMED. FOUW WATER AND SURFACE WATER CONNECTIONS FROM THE BUILDINGS ARE SHOWN FOR INFORMATION ONLY TO INDICATE THE DIRECTION OF FLOW TO THE MAIN DRAINAGE RINS. PROPOSED CONNECTIONS ARE TO BE CONFIRMED AT THE DETAILED DESIGN STAGE.
- THIS DRAWING IS FOR THE PURPOSES OF COMMUNICATING AN OUTLINE DRAINAGE STRATEGY AND SHOULD NOT BE USED FOR COSTING, CONSTRUCTION, OR ANY OTHER PURPOSE.

P03 UPDATED MASTERPLAN & BOUNDARY NC DN 06/07/22
 P02 UPDATED TO SUIT LATEST MASTERPLAN EH DN 24/06/22
 P01 FOR INFORMATION EH DN 28/01/22

BARNSELY METROPOLITAN BOROUGH COUNCIL

BDP.

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 Piccadilly Basin
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 United Kingdom
 T +44 (0)161 828 2200
 www.bdp.com

THE SEAM, BARNSELY

P3002270 COMMERCIAL IN CONFIDENCE

SURFACE WATER AND FOUW WATER DRAINAGE STRATEGY 1:500 @ A0 27/01/22

SEAM-BDP-ZZ-XX-DR-C-520001 P03



LEGEND

- SITE BOUNDARY
- PUBLIC SURFACE WATER SEWER
- PUBLIC COMBINED WATER SEWER
- PROPOSED FOULED WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED ATTENUATION TANK
- PROPOSED BIO RETENTION AREA
- PROPOSED PERMEABLE PAVING
- PROPOSED GREEN ROOF
- PROPOSED BLUE ROOF
- PROPOSED GULLY
- PROPOSED PERIMETER UNIT
- EXISTING SPOT LEVEL TO BE RETAINED
- PROPOSED SPOT LEVEL

- NOTES**
- ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED. WHERE THERE APPEARS TO BE A CONFLICT BETWEEN DIMENSIONS OR WHERE DIMENSIONS CANNOT BE DETERMINED FROM THE DRAWINGS, CONSULT THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
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 - LANDSCAPE GENERAL ARRANGEMENT DWG REF 1002406-ARC-XX-XX-M2-LA-0002 PREPARED BY ARCHIS
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 - THE FOUL WATER DRAINAGE HAS BEEN DESIGNED BASED ON THE TOTAL NUMBER OF DISCHARGE UNITS OF 19,025 AND A FACTOR OF 0.7 IN ACCORDANCE WITH BS EN 12056-2:2000, SYSTEM II. PEAK FOUL WATER RATE CALCULATED AT 9 l/s BASED ON MIXED USE OFFICE/LABORATORY.
 - CONNECTIONS TO THE PUBLIC SEWER ARE SUBJECT TO SECTION 106 OF THE WATER INDUSTRY ACT 1989 APPROVAL. NO WORKS AFFECTING THE PUBLIC SEWERAGE SYSTEM MAY BE CARRIED OUT WITHOUT YW'S PRIOR WRITTEN CONSENT.
 - ALL DRAINAGE TO BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH BS EN 12056-1:2000, BS EN 752:2017, AND BS EN 1830:2015.
 - LOCATION OF SANITARY DOWNPIPES AND SVFS HAVE NOT BEEN CONFIRMED. FOUL WATER AND SURFACE WATER CONNECTIONS FROM THE BUILDINGS ARE SHOWN FOR INFORMATION ONLY TO INDICATE THE DIRECTION OF FLOW TO THE MAIN DRAINAGE RUNS. PROPOSED CONNECTIONS ARE TO BE CONFIRMED AT THE DETAILED DESIGN STAGE.
 - THIS DRAWING IS FOR THE PURPOSES OF COMMUNICATING AN OUTLINE DRAINAGE STRATEGY AND SHOULD NOT BE USED FOR COSTING, CONSTRUCTION, OR ANY OTHER PURPOSE.

P102 UPDATED MASTERPLAN & BOUNDARY NC EH 07/02/22
 P01 FOR PLANNING EH DN 24/06/22

BARNSELY METROPOLITAN BOROUGH COUNCIL

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P3002270 COMMERCIAL IN CONFIDENCE

SURFACE WATER AND FOUL WATER DRAINAGE STRATEGY 1:500 @ A0 24/06/22

SEAM-BDP-ZZ-XX-DR-C-520002 P02

Building Design Partnership Ltd		Page 1
11 Ducie Street Piccadilly Basin Manchester M1 2JB	P3002270 THE SEAM SW NETWORK P1	
Date 20/06/2022 File SW Network P02.MDX	Designed by EH Checked by	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD







FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.355	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits


Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow














PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	12.886	0.130	99.1	0.020	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	34.626	0.345	100.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	5.461	0.080	68.3	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	14.021	0.140	100.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	22.301	0.225	99.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	6.741	0.065	103.7	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.21	95.960	0.020	0.0	0.0	0.0	1.01	17.8	2.7
S1.001	50.00	5.79	95.830	0.020	0.0	0.0	0.0	1.00	17.7	2.7
S2.000	50.00	5.07	96.250	0.000	0.0	0.0	0.0	1.22	21.5	0.0
S1.002	50.00	6.02	95.485	0.020	0.0	0.0	0.0	1.00	17.7	2.7
S1.003	50.00	6.39	95.345	0.020	0.0	0.0	0.0	1.01	17.8	2.7
S3.000	50.00	5.15	96.090	0.000	0.0	0.0	0.0	0.75	5.9	0.0


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Network Design Table for Storm














PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.004	13.519	0.135	100.1	0.057	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.000	28.637	1.085	26.4	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.000	19.345	0.190	101.8	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.001	2.286	0.025	91.4	0.026	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	10.740	0.110	97.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.000	3.017	0.165	18.3	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.006	19.308	0.195	99.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	3.398	0.047	72.3	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.007	19.308	0.195	99.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.000	26.184	0.275	95.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	35.252	0.040	881.3	0.037	0.00	0.0	0.600	o	100	Pipe/Conduit	
S8.002	59.470#	0.505	117.8	0.063	0.00	0.0	0.600	o	100	Pipe/Conduit	
S8.003	1.000	0.010	100.0	0.053	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	50.00	6.61	95.120	0.077	0.0	0.0	0.0	1.00	17.7	10.4
S4.000	50.00	5.24	96.070	0.033	0.0	0.0	0.0	1.97	34.8	4.5
S5.000	50.00	5.32	96.880	0.000	0.0	0.0	0.0	1.00	17.6	0.0
S5.001	50.00	5.36	96.690	0.026	0.0	0.0	0.0	1.05	18.6	3.5
S1.005	50.00	6.79	94.985	0.136	0.0	0.0	0.0	1.02	18.0«	18.4
S6.000	50.00	5.03	96.050	0.000	0.0	0.0	0.0	1.81	14.2	0.0
S1.006	50.00	7.11	94.875	0.136	0.0	0.0	0.0	1.01	17.8«	18.4
S7.000	50.00	5.05	95.920	0.000	0.0	0.0	0.0	1.18	20.9	0.0
S1.007	50.00	7.43	94.680	0.145	0.0	0.0	0.0	1.01	17.8«	19.6
S8.000	50.00	5.42	96.980	0.000	0.0	0.0	0.0	1.03	18.2	0.0
S8.001	50.00	7.76	96.705	0.037	0.0	0.0	0.0	0.25	2.0«	5.0
S8.002	50.00	9.16	96.665	0.100	0.0	0.0	0.0	0.71	5.6«	13.5
S8.003	50.00	9.18	96.160	0.153	0.0	0.0	0.0	0.77	6.0«	20.7

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PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.000	58.500	0.545	107.3	0.009	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.008	17.280	0.070	246.9	0.068	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	42.201	0.175	241.1	0.000	0.00	5.0	0.600	o	300	Pipe/Conduit	
S10.000	62.609	0.820	76.4	0.044	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.010	56.236	0.590	95.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	58.906	0.900	65.5	0.041	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.011	23.811	0.230	103.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	29.504	0.530	55.7	0.042	5.00	0.0	0.600	o	150	Pipe/Conduit	
S12.001	48.995	0.490	100.0	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	31.520	0.320	98.5	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	10.832	0.065	166.6	0.202	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	15.800	0.050	316.0	0.006	0.00	0.0	0.600	o	375	Pipe/Conduit	
S14.000	7.312	0.030	243.7	0.193	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S9.000	50.00	6.31	96.605	0.009	0.0	0.0	0.0	0.74	5.8	1.2
S1.008	50.00	9.47	94.335	0.375	0.0	0.0	0.0	1.00	70.4	50.8
S1.009	50.00	10.17	94.265	0.375	5.0	0.0	0.0	1.01	71.3	55.8
S10.000	50.00	6.18	96.370	0.044	0.0	0.0	0.0	0.88	6.9	6.0
S1.010	50.00	10.75	94.090	0.419	5.0	0.0	0.0	1.61	113.9	61.7
S11.000	50.00	6.03	95.550	0.041	0.0	0.0	0.0	0.95	7.5	5.6
S1.011	50.00	11.01	93.500	0.460	5.0	0.0	0.0	1.55	109.2	67.3
S12.000	50.00	5.36	94.760	0.042	0.0	0.0	0.0	1.35	23.9	5.7
S12.001	50.00	5.99	94.155	0.086	0.0	0.0	0.0	1.31	52.0	11.6
S12.002	50.00	6.39	93.665	0.130	0.0	0.0	0.0	1.32	52.4	17.6
S13.000	50.00	5.18	93.410	0.202	0.0	0.0	0.0	1.01	40.2	27.4
S1.012	50.00	11.27	93.195	0.798	5.0	0.0	0.0	1.01	112.0«	113.1
S14.000	50.00	5.15	93.325	0.193	0.0	0.0	0.0	0.83	33.1	26.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.013	24.443	0.065	376.0	0.030	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.014	14.205	0.040	355.1	0.014	0.00	0.0	0.600	o	450	Pipe/Conduit	
S15.000	44.155	3.935	11.2	0.042	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.015	24.554	1.635	15.0	0.014	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.016	9.075	0.908	10.0	0.021	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.013	50.00	11.66	93.070	1.021	5.0	0.0	0.0	1.04	165.8	143.3
S1.014	50.00	11.88	93.005	1.035	5.0	0.0	0.0	1.07	170.7	145.2
S15.000	50.00	5.24	97.200	0.042	0.0	0.0	0.0	3.02	53.5	5.7
S1.015	50.00	11.96	92.965	1.091	5.0	0.0	0.0	5.27	837.7	152.7
S1.016	50.00	11.98	91.330	1.112	5.0	0.0	0.0	6.46	1027.3	155.6

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backd (mm)
S1	97.050	1.090	Open Manhole	450	S1.000	95.960	150				
S2	97.258	1.428	Open Manhole	450	S1.001	95.830	150	S1.000	95.830	150	
S3_BIO	97.300	1.050	Open Manhole	450	S2.000	96.250	150				
S4	97.250	1.765	Open Manhole	450	S1.002	95.485	150	S1.001	95.485	150	
								S2.000	96.170	150	
S5	97.270	1.925	Open Manhole	1200	S1.003	95.345	150	S1.002	95.345	150	
S5_BIO	97.140	1.050	Open Manhole	450	S3.000	96.090	100				
S6	97.200	2.080	Open Manhole	1200	S1.004	95.120	150	S1.003	95.120	150	
								S3.000	96.025	100	
S7	97.130	1.060	Open Manhole	1200	S4.000	96.070	150				
SDUMMY	97.280	0.400	Junction		S5.000	96.880	150				
SPP	97.090	0.400	Junction		S5.001	96.690	150	S5.000	96.690	150	
S8	97.095	2.110	Open Manhole	450	S1.005	94.985	150	S1.004	94.985	150	
								S4.000	94.985	150	
								S5.001	96.665	150	
S9_BIO	97.100	1.050	Open Manhole	450	S6.000	96.050	100				
S10	97.100	2.225	Open Manhole	450	S1.006	94.875	150	S1.005	94.875	150	
								S6.000	95.885	100	
S11_BIO	96.970	1.050	Open Manhole	450	S7.000	95.920	150				
S12	96.890	2.210	Open Manhole	450	S1.007	94.680	150	S1.006	94.680	150	
								S7.000	95.873	150	
Sdummy	97.380	0.400	Junction		S8.000	96.980	150				
SPP	97.105	0.400	Junction		S8.001	96.705	100	S8.000	96.705	150	
SPP	97.062	0.397	Junction		S8.002	96.665	100	S8.001	96.665	100	
SPP	96.560	0.400	Junction		S8.003	96.160	100	S8.002	96.160	100	
SPP	97.103	0.498	Junction		S9.000	96.605	100				
S13	96.560	2.225	Open Manhole	1200	S1.008	94.335	300	S1.007	94.485	150	
								S8.003	96.150	100	
								S9.000	96.060	100	
S14	96.400	2.135	Open Manhole	1200	S1.009	94.265	300	S1.008	94.265	300	
SPP	96.720	0.350	Junction		S10.000	96.370	100				
S15	95.900	1.810	Open Manhole	1200	S1.010	94.090	300	S1.009	94.090	300	
								S10.000	95.550	100	
SPP	95.900	0.350	Open Manhole	1200	S11.000	95.550	100				
S16	95.000	1.500	Open Manhole	1200	S1.011	93.500	300	S1.010	93.500	300	
								S11.000	94.650	100	
S17	96.110	1.350	Open Manhole	1200	S12.000	94.760	150				
S18	95.580	1.425	Open Manhole	1200	S12.001	94.155	225	S12.000	94.230	150	

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Back
S19	95.200	1.535	Open Manhole	1200	S12.002	93.665	225	S12.001	93.665	225	
S20_PLOT 2	94.950	1.540	Open Manhole	1200	S13.000	93.410	225				
S21	95.006	1.811	Open Manhole	1350	S1.012	93.195	375	S1.011	93.270	300	
								S12.002	93.345	225	
								S13.000	93.345	225	
S22_MSCP	94.925	1.600	Open Manhole	1200	S14.000	93.325	225				
S23	95.104	2.034	Open Manhole	1800	S1.013	93.070	450	S1.012	93.145	375	
								S14.000	93.295	225	
S24	95.550	2.545	Open Manhole	1500	S1.014	93.005	450	S1.013	93.005	450	
S25	98.550	1.350	Open Manhole	1200	S15.000	97.200	150				
S26	96.325	3.360	Open Manhole	1800	S1.015	92.965	450	S1.014	92.965	450	
								S15.000	93.265	150	
S27	94.700	3.370	Open Manhole	1800	S1.016	91.330	450	S1.015	91.330	450	
S	91.400	0.978	Open Manhole	0		OUTFALL		S1.016	90.422	450	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	434640.210	406583.243	434640.210	406583.243	Required	
S2	434637.087	406595.745	434637.087	406595.745	Required	
S3_BIO	434641.920	406628.434	434641.920	406628.434	Required	
S4	434647.368	406628.810	434647.368	406628.810	Required	
S5	434639.086	406640.123	434639.086	406640.123	Required	
S5_BIO	434639.627	406658.369	434639.627	406658.369	Required	
S6	434645.626	406661.443	434645.626	406661.443	Required	

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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S7	434672.139	406665.967	434672.139	406665.967	Required	
SDUMMY	434649.396	406656.172			No Entry	
SPP	434647.188	406675.391			No Entry	
S8	434644.946	406674.945	434644.946	406674.945	Required	
S9_BIO	434636.203	406674.915	434636.203	406674.915	Required	
S10	434634.490	406677.398	434634.490	406677.398	Required	
S11_BIO	434627.917	406692.405	434627.917	406692.405	Required	
S12	434628.778	406695.692	434628.778	406695.692	Required	
Sdummy	434633.335	406594.303			No Entry	
SPP	434633.642	406620.485			No Entry	
SPP	434632.228	406655.709			No Entry	
S13	434623.087	406714.301	434623.087	406714.301	Required	
S14	434618.355	406730.920	434618.355	406730.920	Required	
SPP	434627.201	406712.658			No Entry	
S15	434603.955	406770.702	434603.955	406770.702	Required	

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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SPP	434602.774	406767.550	434602.774	406767.550	Required	
S16	434585.273	406823.796	434585.273	406823.796	Required	
S17	434664.383	406746.785	434664.383	406746.785	Required	
S18	434650.414	406772.772	434650.414	406772.772	Required	
S19	434623.057	406813.418	434623.057	406813.418	Required	
S20_PLOT 2	434603.550	406827.694	434603.550	406827.694	Required	
S21	434603.988	406838.517	434603.988	406838.517	Required	
S22_MSCP	434587.546	406845.253	434587.546	406845.253	Required	
S23	434593.121	406849.985	434593.121	406849.985	Required	
S24	434576.230	406867.653	434576.230	406867.653	Required	
S25	434529.541	406834.317	434529.541	406834.317	Required	
S26	434562.600	406863.651	434562.600	406863.651	Required	
S27	434548.885	406884.017	434548.885	406884.017	Required	
S	434545.077	406892.254			No Entry	

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PIPELINE SCHEDULES for Storm


Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	97.050	95.960	0.940	Open Manhole	450
S1.001	o	150	S2	97.258	95.830	1.278	Open Manhole	450
S2.000	o	150	S3_BIO	97.300	96.250	0.900	Open Manhole	450
S1.002	o	150	S4	97.250	95.485	1.615	Open Manhole	450
S1.003	o	150	S5	97.270	95.345	1.775	Open Manhole	1200
S3.000	o	100	S5_BIO	97.140	96.090	0.950	Open Manhole	450
S1.004	o	150	S6	97.200	95.120	1.930	Open Manhole	1200
S4.000	o	150	S7	97.130	96.070	0.910	Open Manhole	1200
S5.000	o	150	SDUMMY	97.280	96.880	0.250	Junction	
S5.001	o	150	SPP	97.090	96.690	0.250	Junction	
S1.005	o	150	S8	97.095	94.985	1.960	Open Manhole	450

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	12.886	99.1	S2	97.258	95.830	1.278	Open Manhole	450
S1.001	34.626	100.4	S4	97.250	95.485	1.615	Open Manhole	450
S2.000	5.461	68.3	S4	97.250	96.170	0.930	Open Manhole	450
S1.002	14.021	100.2	S5	97.270	95.345	1.775	Open Manhole	1200
S1.003	22.301	99.1	S6	97.200	95.120	1.930	Open Manhole	1200
S3.000	6.741	103.7	S6	97.200	96.025	1.075	Open Manhole	1200
S1.004	13.519	100.1	S8	97.095	94.985	1.960	Open Manhole	450
S4.000	28.637	26.4	S8	97.095	94.985	1.960	Open Manhole	450
S5.000	19.345	101.8	SPP	97.090	96.690	0.250	Junction	
S5.001	2.286	91.4	S8	97.095	96.665	0.280	Open Manhole	450
S1.005	10.740	97.6	S10	97.100	94.875	2.075	Open Manhole	450

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.000	o	100	S9_BIO	97.100	96.050	0.950	Open Manhole	450
S1.006	o	150	S10	97.100	94.875	2.075	Open Manhole	450
S7.000	o	150	S11_BIO	96.970	95.920	0.900	Open Manhole	450
S1.007	o	150	S12	96.890	94.680	2.060	Open Manhole	450
S8.000	o	150	Sdummy	97.380	96.980	0.250	Junction	
S8.001	o	100	SPP	97.105	96.705	0.300	Junction	
S8.002	o	100	SPP	97.062	96.665	0.297	Junction	
S8.003	o	100	SPP	96.560	96.160	0.300	Junction	
S9.000	o	100	SPP	97.103	96.605	0.398	Junction	
S1.008	o	300	S13	96.560	94.335	1.925	Open Manhole	1200
S1.009	o	300	S14	96.400	94.265	1.835	Open Manhole	1200
S10.000	o	100	SPP	96.720	96.370	0.250	Junction	
S1.010	o	300	S15	95.900	94.090	1.510	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.000	3.017	18.3	S10	97.100	95.885	1.115	Open Manhole	450
S1.006	19.308	99.0	S12	96.890	94.680	2.060	Open Manhole	450
S7.000	3.398	72.3	S12	96.890	95.873	0.867	Open Manhole	450
S1.007	19.308	99.0	S13	96.560	94.485	1.925	Open Manhole	1200
S8.000	26.184	95.2	SPP	97.105	96.705	0.250	Junction	
S8.001	35.252	881.3	SPP	97.062	96.665	0.297	Junction	
S8.002	59.470#	117.8	SPP	96.560	96.160	0.300	Junction	
S8.003	1.000	100.0	S13	96.560	96.150	0.310	Open Manhole	1200
S9.000	58.500	107.3	S13	96.560	96.060	0.400	Open Manhole	1200
S1.008	17.280	246.9	S14	96.400	94.265	1.835	Open Manhole	1200
S1.009	42.201	241.1	S15	95.900	94.090	1.510	Open Manhole	1200
S10.000	62.609	76.4	S15	95.900	95.550	0.250	Open Manhole	1200
S1.010	56.236	95.3	S16	95.000	93.500	1.200	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S11.000	o	100	SPP	95.900	95.550	0.250	Open Manhole	1200
S1.011	o	300	S16	95.000	93.500	1.200	Open Manhole	1200
S12.000	o	150	S17	96.110	94.760	1.200	Open Manhole	1200
S12.001	o	225	S18	95.580	94.155	1.200	Open Manhole	1200
S12.002	o	225	S19	95.200	93.665	1.310	Open Manhole	1200
S13.000	o	225	S20_PLOT 2	94.950	93.410	1.315	Open Manhole	1200
S1.012	o	375	S21	95.006	93.195	1.436	Open Manhole	1350
S14.000	o	225	S22_MSCP	94.925	93.325	1.375	Open Manhole	1200
S1.013	o	450	S23	95.104	93.070	1.584	Open Manhole	1800
S1.014	o	450	S24	95.550	93.005	2.095	Open Manhole	1500
S15.000	o	150	S25	98.550	97.200	1.200	Open Manhole	1200
S1.015	o	450	S26	96.325	92.965	2.910	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S11.000	58.906	65.5	S16	95.000	94.650	0.250	Open Manhole	1200
S1.011	23.811	103.5	S21	95.006	93.270	1.436	Open Manhole	1350
S12.000	29.504	55.7	S18	95.580	94.230	1.200	Open Manhole	1200
S12.001	48.995	100.0	S19	95.200	93.665	1.310	Open Manhole	1200
S12.002	31.520	98.5	S21	95.006	93.345	1.436	Open Manhole	1350
S13.000	10.832	166.6	S21	95.006	93.345	1.436	Open Manhole	1350
S1.012	15.800	316.0	S23	95.104	93.145	1.584	Open Manhole	1800
S14.000	7.312	243.7	S23	95.104	93.295	1.584	Open Manhole	1800
S1.013	24.443	376.0	S24	95.550	93.005	2.095	Open Manhole	1500
S1.014	14.205	355.1	S26	96.325	92.965	2.910	Open Manhole	1800
S15.000	44.155	11.2	S26	96.325	93.265	2.910	Open Manhole	1800
S1.015	24.554	15.0	S27	94.700	91.330	2.920	Open Manhole	1800

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.016	o	450	S27	94.700	91.330	2.920	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.016	9.075	10.0	S	91.400	90.422	0.528	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.016	S	91.400	90.422	0.000	0	0


Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	9
Number of Online Controls	5	Number of Time/Area Diagrams	0
Number of Offline Controls	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.355		

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Online Controls for Storm

Orifice Manhole: SPP, DS/PN: S5.001, Volume (m³): 0.3

Diameter (m) 0.062 Discharge Coefficient 0.600 Invert Level (m) 96.690

Orifice Manhole: SPP, DS/PN: S8.001, Volume (m³): 0.5

Diameter (m) 0.061 Discharge Coefficient 0.600 Invert Level (m) 96.705

Orifice Manhole: SPP, DS/PN: S8.002, Volume (m³): 0.3

Diameter (m) 0.038 Discharge Coefficient 0.600 Invert Level (m) 96.665

Orifice Manhole: SPP, DS/PN: S8.003, Volume (m³): 0.5

Diameter (m) 0.065 Discharge Coefficient 0.600 Invert Level (m) 96.160

Hydro-Brake® Optimum Manhole: S27, DS/PN: S1.016, Volume (m³): 12.2

Unit Reference	MD-SHE-0428-1330-2350-1330
Design Head (m)	2.350
Design Flow (l/s)	133.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	428
Invert Level (m)	91.330
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.350	132.9
Flush-Flo™	0.768	133.0
Kick-Flo®	1.645	111.7
Mean Flow over Head Range	-	112.8

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	11.5	0.800	132.9	2.000	122.9	4.000	172.2
0.200	41.4	1.000	131.5	2.200	128.7	4.500	182.4
0.300	81.4	1.200	128.8	2.400	134.3	5.000	192.1
0.400	119.0	1.400	124.3	2.600	139.6	5.500	201.3
0.500	128.8	1.600	115.1	3.000	149.7	6.000	210.0
0.600	131.5	1.800	116.7	3.500	161.4	6.500	218.4

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Hydro-Brake® Optimum Manhole: S27, DS/PN: S1.016, Volume (m³): 12.2

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
7.000	226.5	8.000	241.8	9.000	256.2		
7.500	234.3	8.500	249.1	9.500	263.1		

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Offline Controls for Storm

Pipe Manhole: SPP, DS/PN: S5.001, Loop to PN: S6.000

Diameter (m)	0.100	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	10000.0	Coefficient of Contraction	0.600
Length (m)	1.000	Upstream Invert Level (m)	96.790

Pipe Manhole: SPP, DS/PN: S8.001, Loop to PN: S2.000


Diameter (m)	0.100	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	10000.0	Coefficient of Contraction	0.600
Length (m)	1.000	Upstream Invert Level (m)	96.805

Pipe Manhole: SPP, DS/PN: S8.002, Loop to PN: S3.000

Diameter (m)	0.100	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	10000.0	Coefficient of Contraction	0.600
Length (m)	1.000	Upstream Invert Level (m)	96.765

Pipe Manhole: SPP, DS/PN: S8.003, Loop to PN: S7.000

Diameter (m)	0.100	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	10000.0	Coefficient of Contraction	0.600
Length (m)	1.000	Upstream Invert Level (m)	96.260

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Storage Structures for Storm

Porous Car Park Manhole: S7, DS/PN: S4.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	2.0
Membrane Percolation (mm/hr)	1000	Length (m)	81.0
Max Percolation (l/s)	45.0	Slope (1:X)	68.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	96.070	Membrane Depth (mm)	0

Porous Car Park Manhole: SPP, DS/PN: S5.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	11.0
Membrane Percolation (mm/hr)	1000	Length (m)	15.0
Max Percolation (l/s)	45.8	Slope (1:X)	102.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	96.690	Cap Volume Depth (m)	0.200

Porous Car Park Manhole: SPP, DS/PN: S8.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	11.0
Membrane Percolation (mm/hr)	1000	Length (m)	26.4
Max Percolation (l/s)	80.7	Slope (1:X)	95.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	96.705	Cap Volume Depth (m)	0.200

Porous Car Park Manhole: SPP, DS/PN: S8.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.0
Membrane Percolation (mm/hr)	1000	Length (m)	47.0
Max Percolation (l/s)	182.8	Slope (1:X)	881.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	96.665	Cap Volume Depth (m)	0.200

Porous Car Park Manhole: SPP, DS/PN: S8.003

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.5
Membrane Percolation (mm/hr)	1000	Length (m)	59.0
Max Percolation (l/s)	139.3	Slope (1:X)	118.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	96.160	Cap Volume Depth (m)	0.200

Porous Car Park Manhole: SPP, DS/PN: S9.000

Infiltration Coefficient Base (m/hr)	0.00000	Max Percolation (l/s)	32.5
Membrane Percolation (mm/hr)	1000	Safety Factor	2.0

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Porous Car Park Manhole: SPP, DS/PN: S9.000

Porosity	0.30	Slope (1:X)	107.0
Invert Level (m)	96.605	Depression Storage (mm)	5
Width (m)	2.0	Evaporation (mm/day)	3
Length (m)	58.5	Membrane Depth (mm)	0

Porous Car Park Manhole: SPP, DS/PN: S10.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.5
Membrane Percolation (mm/hr)	1000	Length (m)	62.6
Max Percolation (l/s)	113.0	Slope (1:X)	76.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	96.370	Membrane Depth (mm)	0


Porous Car Park Manhole: SPP, DS/PN: S11.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	58.9
Max Percolation (l/s)	130.9	Slope (1:X)	66.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	95.550	Membrane Depth (mm)	0

Cellular Storage Manhole: S27, DS/PN: S1.016

Invert Level (m)	91.330	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	87.0	87.0	1.601	0.0	146.7
1.600	87.0	146.7			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 9
Number of Online Controls 5 Number of Time/Area Diagrams 0
Number of Offline Controls 4 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.361
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	1	+0%	30/15 Summer			
S1.001	S2	15 Winter	1	+0%	30/15 Summer			
S2.000	S3_BIO	15 Summer	1	+0%	100/15 Summer			
S1.002	S4	15 Winter	1	+0%	30/15 Summer			
S1.003	S5	15 Winter	1	+0%	30/15 Summer			
S3.000	S5_BIO	15 Summer	1	+0%	30/15 Winter			
S1.004	S6	15 Winter	1	+0%	30/15 Summer			
S4.000	S7	15 Winter	1	+0%	100/15 Summer			
S5.000	SDUMMY	15 Summer	1	+0%				
S5.001	SPP	60 Winter	1	+0%	100/15 Winter		30/15 Summer	20
S1.005	S8	15 Winter	1	+0%	30/15 Summer			
S6.000	S9_BIO	15 Summer	1	+0%	100/15 Winter			
S1.006	S10	15 Winter	1	+0%	30/15 Summer			
S7.000	S11_BIO	15 Summer	1	+0%				
S1.007	S12	15 Winter	1	+0%	30/15 Summer			
S8.000	Sdummy	15 Summer	1	+0%				
S8.001	SPP	360 Winter	1	+0%	1/360 Winter		1/120 Winter	47
S8.002	SPP	480 Winter	1	+0%	30/30 Winter		30/30 Winter	32
S8.003	SPP	120 Winter	1	+0%	30/15 Summer		30/15 Summer	35
S9.000	SPP	60 Winter	1	+0%				
S1.008	S13	15 Winter	1	+0%	100/15 Summer			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	96.000	-0.110	0.000	0.16			2.5	OK
S1.001	S2	95.869	-0.111	0.000	0.15			2.5	OK
S2.000	S3_BIO	96.250	-0.150	0.000	0.00			0.0	OK
S1.002	S4	95.524	-0.111	0.000	0.15			2.5	OK
S1.003	S5	95.383	-0.112	0.000	0.15			2.5	OK
S3.000	S5_BIO	96.090	-0.100	0.000	0.00			0.0	OK
S1.004	S6	95.197	-0.073	0.000	0.52			8.5	OK
S4.000	S7	96.106	-0.114	0.000	0.12		5	4.2	OK
S5.000	SDUMMY	96.880	-0.150	0.000	0.00			0.0	OK*
S5.001	SPP	96.747	-0.093	0.000	0.09	0.0	20	1.0	OK*
S1.005	S8	95.088	-0.047	0.000	0.79			12.7	OK
S6.000	S9_BIO	96.050	-0.100	0.000	0.00			0.0	OK
S1.006	S10	94.972	-0.053	0.000	0.74			12.4	OK
S7.000	S11_BIO	95.920	-0.150	0.000	0.00			0.0	OK
S1.007	S12	94.783	-0.047	0.000	0.80			13.5	OK
S8.000	Sdummy	96.980	-0.150	0.000	0.00			0.0	OK*
S8.001	SPP	96.805	0.000	0.000	0.35	0.0	258	0.7	FLOOD RISK*
S8.002	SPP	96.723	-0.042	0.000	0.11	0.0	224	0.6	OK*
S8.003	SPP	96.241	-0.019	0.000	0.46	0.0	44	1.8	OK*
S9.000	SPP	96.623	-0.082	0.000	0.07		10	0.4	OK*
S1.008	S13	94.455	-0.180	0.000	0.33			19.9	OK

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S2.000	S3_BIO	
S1.002	S4	
S1.003	S5	
S3.000	S5_BIO	
S1.004	S6	
S4.000	S7	
S5.000	SDUMMY	
S5.001	SPP	
S1.005	S8	
S6.000	S9_BIO	
S1.006	S10	
S7.000	S11_BIO	
S1.007	S12	
S8.000	Sdummy	
S8.001	SPP	
S8.002	SPP	
S8.003	SPP	
S9.000	SPP	

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Piccadilly Basin
Manchester M1 2JB

P3002270 THE SEAM
SW NETWORK P1




Date 20/06/2022
File SW Network P02.MDX

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Level Exceeded
S1.008	S13	


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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.009	S14	15 Winter	1	+0%	100/15 Summer			
S10.000	SPP	30 Winter	1	+0%	30/15 Summer			
S1.010	S15	30 Winter	1	+0%	100/15 Summer			
S11.000	SPP	60 Winter	1	+0%	30/15 Summer			
S1.011	S16	30 Winter	1	+0%	30/15 Summer			
S12.000	S17	15 Winter	1	+0%	100/15 Summer			
S12.001	S18	15 Winter	1	+0%	30/15 Winter			
S12.002	S19	15 Winter	1	+0%	30/15 Summer			
S13.000	S20_PLOT 2	15 Winter	1	+0%	30/15 Summer			
S1.012	S21	15 Winter	1	+0%	30/15 Summer			
S14.000	S22_MSCP	15 Winter	1	+0%	30/15 Summer			
S1.013	S23	15 Winter	1	+0%	30/15 Summer			
S1.014	S24	15 Winter	1	+0%	30/15 Summer			
S15.000	S25	15 Winter	1	+0%				
S1.015	S26	15 Winter	1	+0%	100/30 Winter			
S1.016	S27	30 Winter	1	+0%	30/15 Summer			

PN	US/MH Name	Water Surcharged Flooded			Half Drain Pipe		Status	
		Level (m)	Depth (m)	Volume (m ³)	Flow / Overflow Cap. (l/s)	Time (mins)		Pipe Flow (l/s)
S1.009	S14	94.392	-0.173	0.000	0.36		24.2	OK
S10.000	SPP	96.415	-0.055	0.000	0.41		7 2.8	OK*
S1.010	S15	94.187	-0.203	0.000	0.23		24.5	OK
S11.000	SPP	95.587	-0.063	0.000	0.29		10 2.1	OK
S1.011	S16	93.605	-0.195	0.000	0.26		25.6	OK
S12.000	S17	94.809	-0.101	0.000	0.23		5.3	OK
S12.001	S18	94.224	-0.156	0.000	0.20		9.9	OK
S12.002	S19	93.749	-0.141	0.000	0.29		14.4	OK
S13.000	S20_PLOT 2	93.559	-0.076	0.000	0.75		25.4	OK
S1.012	S21	93.412	-0.158	0.000	0.63		57.0	OK
S14.000	S22_MSCP	93.499	-0.051	0.000	0.92		24.2	OK
S1.013	S23	93.340	-0.180	0.000	0.59		81.2	OK
S1.014	S24	93.281	-0.174	0.000	0.69		81.6	OK
S15.000	S25	97.232	-0.118	0.000	0.10		5.4	OK
S1.015	S26	93.070	-0.345	0.000	0.12		86.7	OK
S1.016	S27	91.596	-0.184	0.000	0.13		17 67.3	OK

PN	US/MH Name	Level Exceeded
S1.009	S14	
S10.000	SPP	
S1.010	S15	
S11.000	SPP	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
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PN	US/MH Name	Level Exceeded
S1.011	S16	
S12.000	S17	
S12.001	S18	
S12.002	S19	
S13.000	S20_PLOT 2	
S1.012	S21	
S14.000	S22_MSCP	
S1.013	S23	
S1.014	S24	
S15.000	S25	
S1.015	S26	
S1.016	S27	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
 for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 9
 Number of Online Controls 5 Number of Time/Area Diagrams 0
 Number of Offline Controls 4 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.361
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+35%	30/15 Summer			
S1.001	S2	15 Winter	30	+35%	30/15 Summer			
S2.000	S3_BIO	15 Winter	30	+35%	100/15 Summer			
S1.002	S4	15 Winter	30	+35%	30/15 Summer			
S1.003	S5	15 Winter	30	+35%	30/15 Summer			
S3.000	S5_BIO	15 Winter	30	+35%	30/15 Winter			
S1.004	S6	15 Winter	30	+35%	30/15 Summer			
S4.000	S7	15 Winter	30	+35%	100/15 Summer			
S5.000	SDUMMY	15 Summer	30	+35%				
S5.001	SPP	30 Winter	30	+35%	100/15 Winter		30/15 Summer	20
S1.005	S8	15 Winter	30	+35%	30/15 Summer			
S6.000	S9_BIO	30 Winter	30	+35%	100/15 Winter			
S1.006	S10	30 Winter	30	+35%	30/15 Summer			
S7.000	S11_BIO	30 Winter	30	+35%				
S1.007	S12	30 Winter	30	+35%	30/15 Summer			
S8.000	Sdummy	15 Summer	30	+35%				
S8.001	SPP	120 Winter	30	+35%	1/360 Winter		1/120 Winter	47
S8.002	SPP	480 Winter	30	+35%	30/30 Winter		30/30 Winter	32
S8.003	SPP	60 Summer	30	+35%	30/15 Summer		30/15 Summer	35
S9.000	SPP	15 Winter	30	+35%				
S1.008	S13	15 Winter	30	+35%	100/15 Summer			


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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	96.396	0.286	0.000	0.49			7.9	SURCHARGED
S1.001	S2	96.373	0.393	0.000	0.40			6.9	SURCHARGED
S2.000	S3_BIO	96.331	-0.069	0.000	0.01			0.3	OK
S1.002	S4	96.332	0.697	0.000	0.50			8.2	SURCHARGED
S1.003	S5	96.311	0.816	0.000	0.63			10.7	SURCHARGED
S3.000	S5_BIO	96.288	0.098	0.000	0.04			0.2	SURCHARGED
S1.004	S6	96.291	1.021	0.000	1.05			17.1	SURCHARGED
S4.000	S7	96.194	-0.026	0.000	0.41		4	13.7	OK
S5.000	SDUMMY	96.880	-0.150	0.000	0.00			0.0	OK*
S5.001	SPP	96.828	-0.012	0.000	0.24	0.1	19	2.6	FLOOD RISK*
S1.005	S8	96.131	0.996	0.000	1.73			27.9	SURCHARGED
S6.000	S9_BIO	96.052	-0.098	0.000	0.00			0.1	OK
S1.006	S10	95.825	0.800	0.000	1.62			27.1	SURCHARGED
S7.000	S11_BIO	95.995	-0.075	0.000	0.46			6.3	OK
S1.007	S12	95.379	0.549	0.000	1.95			32.7	SURCHARGED
S8.000	Sdummy	96.980	-0.150	0.000	0.00			0.0	OK*
S8.001	SPP	96.899	0.094	0.000	0.98	0.3	76	1.9	FLOOD RISK*
S8.002	SPP	96.835	0.070	0.000	0.21	0.2	368	1.2	FLOOD RISK*
S8.003	SPP	96.360	0.100	0.000	0.92	6.0	44	3.6	FLOOD RISK*
S9.000	SPP	96.662	-0.043	0.000	0.59		5	3.5	OK*
S1.008	S13	94.611	-0.024	0.000	1.00			60.1	OK


**US/MH Level
PN Name Exceeded**

S1.000	S1	
S1.001	S2	
S2.000	S3_BIO	
S1.002	S4	
S1.003	S5	
S3.000	S5_BIO	
S1.004	S6	
S4.000	S7	
S5.000	SDUMMY	
S5.001	SPP	
S1.005	S8	
S6.000	S9_BIO	
S1.006	S10	
S7.000	S11_BIO	
S1.007	S12	
S8.000	Sdummy	
S8.001	SPP	
S8.002	SPP	
S8.003	SPP	
S9.000	SPP	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
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PN	US/MH Name	Level Exceeded
S1.008	S13	


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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.009	S14	15 Winter	30	+35%	100/15 Summer			
S10.000	SPP	30 Winter	30	+35%	30/15 Summer			
S1.010	S15	15 Winter	30	+35%	100/15 Summer			
S11.000	SPP	30 Winter	30	+35%	30/15 Summer			
S1.011	S16	15 Winter	30	+35%	30/15 Summer			
S12.000	S17	15 Winter	30	+35%	100/15 Summer			
S12.001	S18	15 Winter	30	+35%	30/15 Winter			
S12.002	S19	15 Winter	30	+35%	30/15 Summer			
S13.000	S20_PLOT 2	15 Winter	30	+35%	30/15 Summer			
S1.012	S21	15 Winter	30	+35%	30/15 Summer			
S14.000	S22_MSCP	15 Winter	30	+35%	30/15 Summer			
S1.013	S23	15 Winter	30	+35%	30/15 Summer			
S1.014	S24	15 Winter	30	+35%	30/15 Summer			
S15.000	S25	15 Winter	30	+35%				
S1.015	S26	15 Winter	30	+35%	100/30 Winter			
S1.016	S27	30 Winter	30	+35%	30/15 Summer			


PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.009	S14	94.502	-0.063	0.000	0.97		64.3	OK
S10.000	SPP	96.559	0.089	0.000	1.06	10	7.3	FLOOD RISK*
S1.010	S15	94.338	-0.052	0.000	0.65		70.5	OK
S11.000	SPP	95.709	0.059	0.000	1.03	8	7.6	FLOOD RISK
S1.011	S16	94.114	0.314	0.000	0.90		86.9	SURCHARGED
S12.000	S17	94.860	-0.050	0.000	0.76		17.4	OK
S12.001	S18	94.381	0.001	0.000	0.71		35.2	SURCHARGED
S12.002	S19	94.224	0.334	0.000	0.84		41.2	SURCHARGED
S13.000	S20_PLOT 2	94.283	0.648	0.000	2.20		74.4	SURCHARGED
S1.012	S21	94.002	0.432	0.000	1.94		175.2	SURCHARGED
S14.000	S22_MSCP	94.057	0.507	0.000	2.85		74.5	SURCHARGED
S1.013	S23	93.799	0.279	0.000	1.76		244.5	SURCHARGED
S1.014	S24	93.591	0.136	0.000	2.10		249.0	SURCHARGED
S15.000	S25	97.261	-0.089	0.000	0.34		17.7	OK
S1.015	S26	93.157	-0.258	0.000	0.38		264.0	OK
S1.016	S27	92.406	0.626	0.000	0.24	15	129.1	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.009	S14	
S10.000	SPP	
S1.010	S15	
S11.000	SPP	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Level Exceeded
S1.011	S16	
S12.000	S17	
S12.001	S18	
S12.002	S19	
S13.000	S20_PLOT 2	
S1.012	S21	
S14.000	S22_MSCP	
S1.013	S23	
S1.014	S24	
S15.000	S25	
S1.015	S26	
S1.016	S27	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000


Number of Input Hydrographs 0 Number of Storage Structures 9
Number of Online Controls 5 Number of Time/Area Diagrams 0
Number of Offline Controls 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.361
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	100	+40%	30/15 Summer			
S1.001	S2	30 Winter	100	+40%	30/15 Summer			
S2.000	S3_BIO	30 Winter	100	+40%	100/15 Summer			
S1.002	S4	30 Winter	100	+40%	30/15 Summer			
S1.003	S5	30 Winter	100	+40%	30/15 Summer			
S3.000	S5_BIO	15 Winter	100	+40%	30/15 Winter			
S1.004	S6	15 Winter	100	+40%	30/15 Summer			
S4.000	S7	30 Winter	100	+40%	100/15 Summer			
S5.000	SDUMMY	15 Summer	100	+40%				
S5.001	SPP	60 Winter	100	+40%	100/15 Winter		30/15 Summer	20
S1.005	S8	30 Winter	100	+40%	30/15 Summer			
S6.000	S9_BIO	15 Winter	100	+40%	100/15 Winter			
S1.006	S10	15 Winter	100	+40%	30/15 Summer			
S7.000	S11_BIO	15 Winter	100	+40%				
S1.007	S12	15 Winter	100	+40%	30/15 Summer			
S8.000	Sdummy	15 Summer	100	+40%				
S8.001	SPP	60 Summer	100	+40%	1/360 Winter		1/120 Winter	47
S8.002	SPP	360 Winter	100	+40%	30/30 Winter		30/30 Winter	32
S8.003	SPP	15 Summer	100	+40%	30/15 Summer		30/15 Summer	35
S9.000	SPP	15 Winter	100	+40%				
S1.008	S13	15 Winter	100	+40%	100/15 Summer			


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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	96.944	0.834	0.000	0.53		8.6	FLOOD RISK
S1.001	S2	96.912	0.932	0.000	0.40		6.9	SURCHARGED
S2.000	S3_BIO	96.880	0.480	0.000	0.35		6.2	SURCHARGED
S1.002	S4	96.871	1.236	0.000	0.64		10.4	SURCHARGED
S1.003	S5	96.823	1.328	0.000	0.67		11.3	SURCHARGED
S3.000	S5_BIO	96.770	0.580	0.000	0.06		0.3	SURCHARGED
S1.004	S6	96.774	1.504	0.000	1.51		24.6	SURCHARGED
S4.000	S7	96.510	0.290	0.000	0.43		8	14.4 SURCHARGED
S5.000	SDUMMY	96.880	-0.150	0.000	0.00		0.0	OK*
S5.001	SPP	96.863	0.023	0.000	0.28	0.2	30	3.0 FLOOD RISK*
S1.005	S8	96.488	1.353	0.000	1.75		28.2	SURCHARGED
S6.000	S9_BIO	96.217	0.067	0.000	0.03		0.3	SURCHARGED
S1.006	S10	96.217	1.192	0.000	1.72		28.9	SURCHARGED
S7.000	S11_BIO	96.010	-0.060	0.000	0.53		7.2	OK
S1.007	S12	95.823	0.993	0.000	2.12		35.5	SURCHARGED
S8.000	Sdummy	96.980	-0.150	0.000	0.00		0.0	OK*
S8.001	SPP	96.905	0.100	0.000	1.09	6.3	70	2.2 FLOOD RISK*
S8.002	SPP	96.865	0.100	0.000	0.23	2.5	414	1.3 FLOOD RISK*
S8.003	SPP	96.360	0.100	0.000	0.93	6.5	26	3.6 FLOOD RISK*
S9.000	SPP	96.675	-0.030	0.000	0.82		4	4.8 OK*
S1.008	S13	95.014	0.379	0.000	1.22		73.3	SURCHARGED

PN US/MH Name Level Exceeded

S1.000	S1	
S1.001	S2	
S2.000	S3_BIO	
S1.002	S4	
S1.003	S5	
S3.000	S5_BIO	
S1.004	S6	
S4.000	S7	
S5.000	SDUMMY	
S5.001	SPP	
S1.005	S8	
S6.000	S9_BIO	
S1.006	S10	
S7.000	S11_BIO	
S1.007	S12	
S8.000	Sdummy	
S8.001	SPP	
S8.002	SPP	
S8.003	SPP	
S9.000	SPP	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S1.008		S13

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.009	S14	15 Winter	100	+40%	100/15 Summer			
S10.000	SPP	30 Winter	100	+40%	30/15 Summer			
S1.010	S15	15 Winter	100	+40%	100/15 Summer			
S11.000	SPP	30 Winter	100	+40%	30/15 Summer			
S1.011	S16	15 Winter	100	+40%	30/15 Summer			
S12.000	S17	15 Winter	100	+40%	100/15 Summer			
S12.001	S18	15 Winter	100	+40%	30/15 Winter			
S12.002	S19	15 Winter	100	+40%	30/15 Summer			
S13.000	S20_PLOT 2	15 Winter	100	+40%	30/15 Summer			
S1.012	S21	15 Winter	100	+40%	30/15 Summer			
S14.000	S22_MSCP	15 Winter	100	+40%	30/15 Summer			
S1.013	S23	15 Winter	100	+40%	30/15 Summer			
S1.014	S24	30 Winter	100	+40%	30/15 Summer			
S15.000	S25	15 Winter	100	+40%				
S1.015	S26	30 Winter	100	+40%	100/30 Winter			
S1.016	S27	30 Winter	100	+40%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.009	S14	94.931	0.366	0.000	1.11		73.8	SURCHARGED
S10.000	SPP	96.632	0.162	0.000	1.10	13	7.6	FLOOD RISK*
S1.010	S15	94.751	0.361	0.000	0.76		81.7	SURCHARGED
S11.000	SPP	95.779	0.129	0.000	1.07	11	7.9	FLOOD RISK
S1.011	S16	94.482	0.682	0.000	1.03		99.8	SURCHARGED
S12.000	S17	95.237	0.327	0.000	0.90		20.5	SURCHARGED
S12.001	S18	94.901	0.521	0.000	0.77		38.2	SURCHARGED
S12.002	S19	94.672	0.782	0.000	1.06		51.9	SURCHARGED
S13.000	S20_PLOT 2	94.842	1.207	0.000	2.88		97.7	FLOOD RISK
S1.012	S21	94.341	0.771	0.000	2.37		214.6	SURCHARGED
S14.000	S22_MSCP	94.500	0.950	0.000	3.76		98.4	SURCHARGED
S1.013	S23	94.037	0.517	0.000	2.23		308.4	SURCHARGED
S1.014	S24	93.779	0.324	0.000	2.45		290.5	SURCHARGED
S15.000	S25	97.272	-0.078	0.000	0.46		23.8	OK
S1.015	S26	93.741	0.326	0.000	0.44		310.5	SURCHARGED
S1.016	S27	93.686	1.906	0.000	0.25	24	132.3	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.009	S14	
S10.000	SPP	
S1.010	S15	
S11.000	SPP	

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Date 20/06/2022 File SW Network P02.MDX	Designed by EH Checked by	
Innovyze	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S1.011		S16
S12.000		S17
S12.001		S18
S12.002		S19
S13.000	S20_PLOT 2	
S1.012		S21
S14.000	S22_MSCP	
S1.013		S23
S1.014		S24
S15.000		S25
S1.015		S26
S1.016		S27