

The Printworks, High Road West
Drainage Strategy

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author

Marc Jones

date

16/08/23

approved

Les Johnson

signature



date

16/08/23

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Glossary

Term	Definition
CDA	Critical Drainage Area
EA	Environment Agency
NPPF	National Planning Policy Framework
SuDS	Sustainable urban Drainage System
TW	Thames Water

1 Introduction

1.1 Background

This Drainage Strategy report has been prepared by Buro Happold to support the full planning application for the development known as The Printworks, High Road West. This report will review and discuss the following:

- Review of the existing external sewer network
- Surface water drainage strategy
- Foul water drainage strategy.

This report is informed by the following data:

- Thames Water Asset records
- Proposed development plans produced by F3 Architects
- External landscape plan produced by Re-Form Architects
- Flood Risk Assessment prepared by Buro Happold.

This report sets out the anticipated measures that could be incorporated into the detailed design stage in order to control both the quantity and quality of foul and surface water discharge from the site. Details of the foul and surface water drainage design are expected to be submitted to the local planning authority, the London Borough of Haringey (LBH), prior to the commencement of each relevant stage of the development, following consultation with relevant stakeholders as necessary. This will ensure that the foul and surface water drainage details are appropriately designed and controlled.

1.2 Site Description

The proposed development is located within the London Borough of Haringey (LBH) and is formed of the following site, hereafter referred to as 'the Site',

- 819-829 High Road, Tottenham, N17 8ER (The Printworks)

The Site is currently occupied by a number of retail units and a private commercial operation (La Royale Banqueting Suite). The nearest watercourse is the River Moselle, 100m south of the site. This watercourse is classified as a Main River, which is understood to flow below ground in a culvert, from west to east along the alignment of White Hart Lane. According to the British Geological Survey, nearby historic boreholes suggest that the underlying ground conditions consist of London Clay.

1.3 Proposed Development

Full planning application for the demolition of existing buildings and structures to the rear of 819-829 High Road; the demolition of 829 High Road; and redevelopment for purpose-built student accommodation (Sui Generis) and supporting flexible commercial, business and service uses (Class E), hard and soft landscaping, parking, and associated

works. To include the change of use of 819-827 High Road to student accommodation (Sui Generis) and commercial, business and service (Class E) uses.

Site location and summary of the development is provided in Figure 1-1 and Table 1-1 below.



Figure 1-1: Existing Site Plan

Table 1-1: Summary of Proposed Development

Site	Site Area (ha)	Student Bed Spaces (ensuite + studios)	Commercial Floorspace (m²) (GIA)
The Printworks	0.3598	287	216

2 Existing Drainage

2.1 Existing Infrastructure

The Asset Location Search provided by Thames Water (TW) indicates that the existing site is served by TW sewers to the north of the site on Brunswick Square with smaller diameter sewers falling within the footprint of the site. On Brunswick Square, there is a 152mm surface water sewer and a 250mm foul sewer. The indicative alignment of the surface water and foul water sewers in relation to the proposed development is shown in Figure 2-1. The full TW Asset Map is provided in Appendix A.

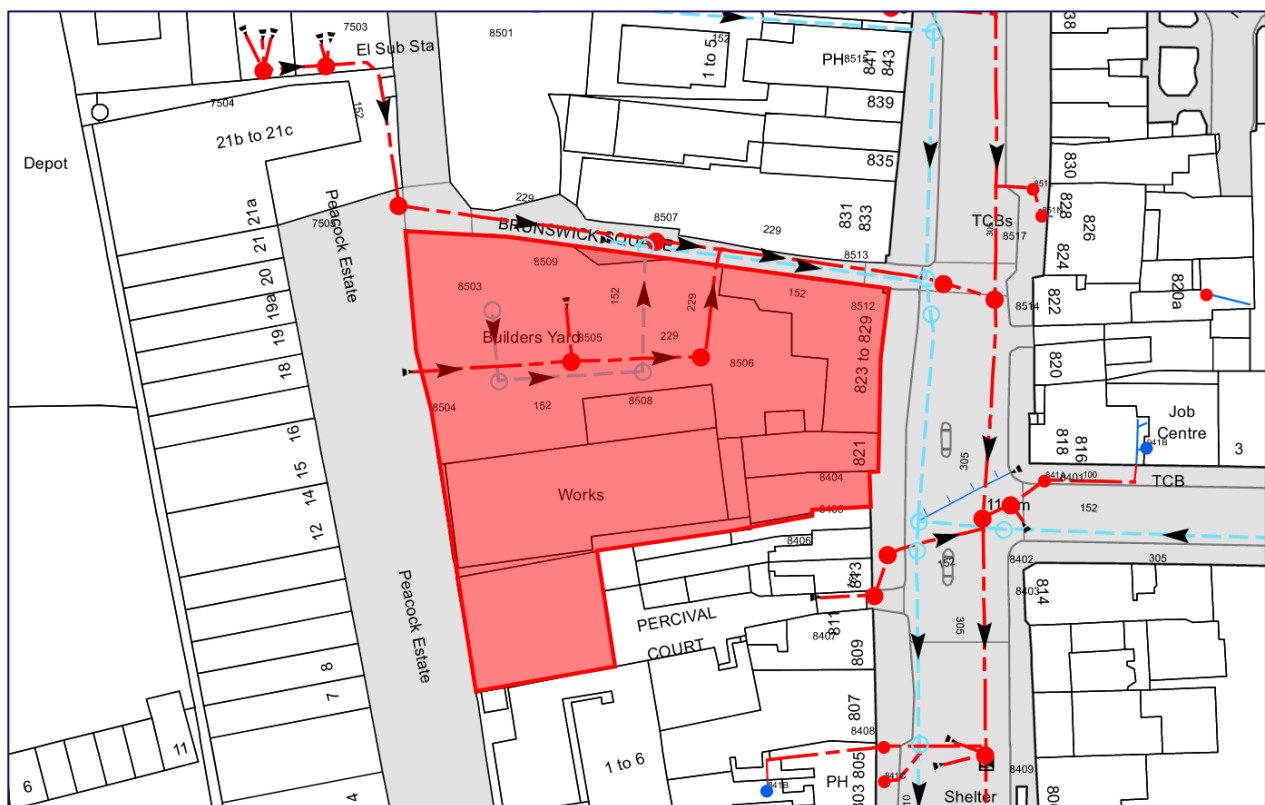


Figure 2-1: Thames Water Wastewater Asset Map, with site location shown by red shading (Source: Groundwise)

From a review of The Haringey Development Management Development Plan Document (DPD), it is understood that the local area where the site is located has been identified as an area within the Borough which is at greatest risk of surface water flooding, and therefore defined as a Critical Drainage Area (CDA).

2.2 Surface Water

The existing surface water sewer located to the north of the site in Brunswick Square as shown on the TW asset map is 152mm, and it is not known whether there are any mechanisms to limit the rate of surface water discharge from the existing site.

In the absence of more detailed site information, it is therefore assumed that all surface water is currently discharged unrestricted without attenuation, directly to the 152mm surface water sewer on Brunswick Square.

The existing surface water runoff rate has been calculated in order to demonstrate that the proposed development achieves an improvement in surface water discharge from the existing condition.

The existing surface water runoff rate has been estimated using the Rational Method in accordance with the CIRIA SuDS Manual¹.

$$Q = 2.78 C i A$$

Where:

- Q is the runoff rate in l/s
- C is the dimensionless runoff coefficient
- i is the rainfall intensity in mm/hr
- A is the total catchment area in ha

The existing plot does not contain any vegetation and is covered entirely by impermeable surfaces. It is therefore assumed that there is no possibility for infiltration, and that all surface water from

the existing site is discharged to the existing TW sewer network, giving a runoff coefficient of 0.95.

A rainfall intensity of 50mm/hr has been used, in accordance with the recommendations of The SuDS Manual.

The total site area is approximately 0.3598ha.

The existing surface water runoff rate for the entire site is therefore estimated to be **47.51 l/s** or **132.05 l/s/ha**

A proportion of the existing Thames Water assets are located within the site boundary, these include MH 8503, MH 8504 and MH 8508 as well as associated 152mm diameter pipework which is connected to the 152mm pipework within Brunswick Square. The existing TW assets within the site boundary will require abandonment to facilitate the future development at this site.

2.3 Foul Water

In the absence of more detailed information, it is assumed that foul water from the existing buildings on the Printworks development site is discharged to the 250mm foul sewer network on Brunswick Park unrestricted via pipework contained within the site boundary.

The existing foul water discharge from the site has been estimated based on the assumption that domestic foul water flows are generated from the commercial units at a rate of 0.6 litres/second/hectare of commercial floor area; and where the proportion of wet industry is unknown an average flow of 0.7 litres/second/hectare of commercial floor area for trade effluent, in accordance with the latest Water UK Sewerage Sector Guidance² (SSG).

The existing commercial buildings at the Printworks cover approximately 2,774m². It is therefore estimated that the foul water discharge rate from the existing site is **0.36 l/s**.

¹ CIRIA (2015). *CIRIA C753 The SuDS Manual*.

² Water UK (2021). Sewerage Sector Guidance Appendix C – Design and Construction Guidance v2.1. [Online]. Available at: <https://www.water.org.uk/wp-content/uploads/2021/07/SSG-App-C-Des-Con-Guide-v-2.1-250521-for-publication.pdf>. [Accessed 9 July 2021].

A proportion of the existing Thames Water assets are located within the site boundary, these include MH 8506 and MH 8509 as well as associated 250mm diameter pipework which is connected to the 250mm pipework within Brunswick Square. The existing TW assets within the site boundary will require abandonment to facilitate the future development at this site. There are believed to be units located on Peacock Estate to the west of the Printworks development which currently discharge into the aforementioned sewers which are to be abandoned, if this is proven to be the case following a CCTV survey of the existing sewer arrangements then these existing connections from Peacock Estate will need to be diverted to MH 7505 where Brunswick Square meets Peacock Estate.

3 Proposed Surface Water Drainage

3.1 Planning Policy

The surface water drainage strategy described within this report has been developed in accordance with the policies and guidance applicable to the proposed development, including the National Planning Policy Framework, the London Plan and Haringey Planning Policy. In accordance with the aforementioned planning policy documents, sustainable urban drainage systems and a surface water attenuation strategy for the proposed development are required.

The National Planning Policy Framework³ (NPPF) provides national policy for dealing with surface water, with a focus on sustainable development. NPPF requires that developments incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate and to include mitigation for the anticipated impacts of climate change.

The London Plan 2021⁴, Policy SI 13 Sustainable drainage:

- A. Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.
- B. Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:
 - 1. Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
 - 2. Rainwater infiltration to ground at or close to source
 - 3. Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
 - 4. Rainwater discharge direct to a watercourse (unless not appropriate)
 - 5. Controlled rainwater discharge to a surface water sewer or drain
 - 6. Controlled rainwater discharge to a combined sewer.
- C. *Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.*
- D. *Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.*

The Haringey Local Plan, Development Management Development Plan Document (DPD)⁵, Policy DM25 Sustainable Urban Drainage Systems:

³ Ministry of Housing, Communities and Local Government (2021). *National Planning Policy Framework*.

⁴ Greater London Authority (2021). *The London Plan: The Spatial Development Strategy for Greater London, March 2021*.

⁵ London Borough of Haringey (2017). *Development Management DPD*.

- A. *All proposals for new development must seek to manage surface water as close to its source as possible in line with the London Plan drainage hierarchy.*
- B. *The Council will require Sustainable Drainage Systems (SuDS) to be sensitively incorporated into new development by way of site layout and design, having regard to the following requirements:*
1. All major development proposals will be required to reduce surface water flows to a greenfield run-off rate for a 1 in 100 year critical storm event;
 2. All minor development proposals should aim to achieve a greenfield run-off rate and, at a minimum, achieve a 50 per cent reduction on existing site run-off rates;
 3. All other development should seek to achieve a greenfield run-off rate and include at least one 'at source' SuDS measure resulting in a net improvement in water quantity or quality discharging to a sewer; and
 4. For all development where a greenfield runoff rate cannot be achieved justification must be provided to demonstrate that the run-off rate has been reduced as much as possible.
- C. *Where Sustainable Drainage Systems are implemented they will be expected to:*
5. Meet the requirements set out in the Council's relevant local standards and guidance, or national standards where agreed;
 6. Incorporate measures identified in the Surface Water Management Plan;
 7. Be designed to maximise biodiversity and local amenity benefits, and where appropriate, ensure that SuDS techniques provide for clean and safe water at the surface;
 8. Improve water quality; and
 9. Function effectively over the lifespan of the development.
- D. *Where SuDS cannot be implemented due to site constraints (such as land contamination or space limitations) robust justification must be provided along with proposed alternative sustainable approaches to surface water management.*

3.2 Climate Change

The climate change allowances are based on Table 3-1 Peak Rainfall Intensity Allowance in Small Catchments (less than 5km²) or Urban Drainage Catchments (based on a 1961 to 1990 baseline), produced by the Environment Agency⁶ (EA).

Table 3-1: Peak Rainfall Intensity Allowance in Small Catchments (less than 5km²) or Urban Drainage Catchments (based on a 1961 to 1990 baseline)

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

For the proposed development, the site is considered at the upper end and the design life of the building is more than 50 years. From the table, the potential change in the peak rainfall intensity allowance anticipated is 40%.

3.3 Sustainable Urban Drainage Systems (SuDS)

The proposed development considers the use of sustainable drainage techniques in accordance with the NPPF, the London Plan 2021 and the Haringey Planning Policy. The London Plan 2021 contains a hierarchy of sustainable methods of capturing and storing rainwater in a descending order: from drainage into the ground to recharging water resources. Where infiltration is not possible, surface water should be stored on site in open water features and then released at a controlled rate. The final option is to store surface water in tanks or cellular storage.

The purpose of SuDS is to mimic the natural run off characteristics of the site and remove pollutants from the urban run off at source.

A summary of the drainage options identified within these drainage hierarchies and the application of these to the proposed development is given in Table 3-2.

Table 3-2: Summary of proposed surface water drainage options in accordance with the London Plan drainage hierarchy

Drainage Option	Proposed Development
Rainwater use as a resource (rainwater harvesting, blue roofs for irrigation)	The collection and storage of rainwater for later use within the building and across the site will be developed at detailed design stage for each of the buildings. For the purposes of this report, it is assumed that there will be no reuse of rainwater, as this represents the most conservative scenario.
Rainwater infiltration to ground or close to source	According to the British Geological Survey, nearby historic boreholes suggest that the underlying ground conditions consist of impermeable London Clay. It is therefore considered that infiltration SuDS techniques are not suitable for the site.
Attenuation within green infrastructure for gradual release (green roofs, rain gardens, etc.)	Tree pits/rain gardens at the north of the site, below ground attenuation with permeable surfaces within the courtyard areas and blue roofs at roof level have been proposed to attenuate surface water in order to reduce the peak flow rate of surface water being discharged to the local sewer network.

⁶ Environment Agency (2020). *Flood risk assessments: climate change allowances*. [online] Available at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>. [Accessed 12 May 2021].

Discharge directly to a watercourse	Nearest watercourse is the Moselle River (culverted) located in White Hart Lane approximately 100m to the south of the development. It is not feasible to discharge to this watercourse as it is not in close proximity to the site
Discharge to a surface water sewer	The surface water from the Printworks development is proposed to discharge to the existing TW surface water sewer located in High Road via attenuation and a flow restriction device. This attenuation will limit the flow rate of surface water entering the surface water network.
Discharge to combined sewer	Not applicable

3.3.1 SuDS Techniques for the Proposed Development

Permeable Surfaces

Permeable surfaces are underlain with a pavement construction that allows rainwater to pass through the surface via voids, be treated and stored in a sub-base aggregate where it either slowly infiltrates into the ground or passes on to the next stage in the drainage system. Due to the ground conditions and previous land uses, ground infiltration is not considered for this site and therefore geocellular storage is proposed underneath the permeable surfaces to attenuate surface water from the site.

It is proposed that permeable surfaces are incorporated within the courtyard areas with below ground attenuation.

Blue Roofs

Blue roofs provide attenuation at roof level closer to source. These can be areas of living vegetation with a porous media or modular surface which are installed on the top of buildings. The vegetation and porous media layers will offer treatment benefits prior to the release of the water to the below ground drainage infrastructure.

Blue roofs are proposed at roof level.

Bioretention Systems

Bioretention systems and rain gardens are small landscaped depressions that can reduce runoff rates and volumes, whilst providing a form of treatment by filtering the run off through engineered soils and vegetation. Planted areas and tree pits across the site can be utilised as bioretention systems.

Geocellular storage crates provide an underground storage structure with a high void ratio that is suitable for attenuating surface water flows. The flows can be released either into the in-situ ground through infiltration (if ground conditions permit), or into the public sewer drainage system via flow control devices.

Due to the restricted external space for other SuDS, underground storage structures will form part of a series of attenuation features which will contribute to attenuating the 1:30 and 1:100 year storm events.

Attenuation is proposed at two locations along Brunswick Square and further bioretention systems are proposed in the two courtyard areas at L00

3.4 Contributing Areas

The proposed drainage system has been modelled in MicroDrainage. The areas that contribute to surface water runoff have been calculated using the runoff coefficients for the proposed surfacing types.

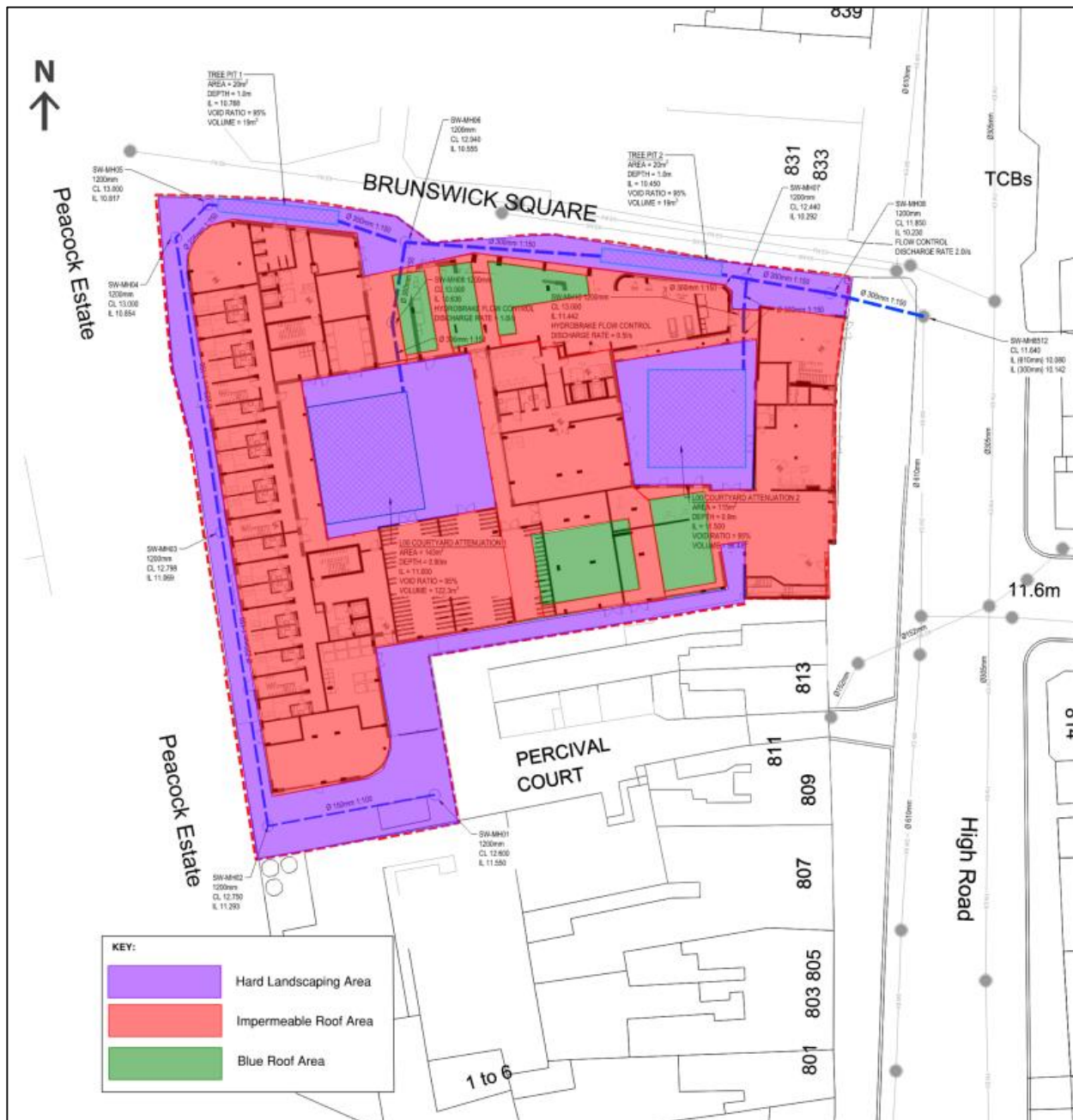


Figure 3-1: Overview of Contributing Areas

A summary of the contributing areas for the development are detailed in Table 3-3 below:

Table 3-3: Contributing Areas

Land Use	Area (ha)	Runoff Coefficient	Effective Area (ha)
Hard Landscaping	0.126	0.9	0.113
Impermeable Roof	0.150	0.95	0.144
Blue Roof	0.074	0.7	0.052
Total	0.350	-	0.309

3.5 Pollution Control

Each of the attenuation systems deployed on the network contributes to pollution control. The process of infiltration, which is a key principle in permeable surfaces, tree pits and blue roof systems, removes silt and pollutants from run-off, and prevents the egress of wind-borne debris into the network. Silt traps and permeable geo-textiles will be deployed on the cellular storage systems to a similar effect.

3.6 Maintenance of SuDS

Regular maintenance of the sustainable urban drainage system is essential to maintain its performance for the entire lifespan of the development and to avoid failure of the mechanical/electrical components.

It is anticipated that the maintenance of the SuDS features particularly the geocellular storage will be undertaken by an experienced contractor. The suppliers of SuDS products will normally offer a maintenance contract for periodic inspections to check for blockages and flushing of the system to remove silt and debris that has built up in the system over time.

For the planted areas, early maintenance should involve regular inspection, removal of invasive vegetation and possibly irrigation during long dry periods, particularly in soils with high void ratios. Appropriate irrigation schedules should be developed with the expertise of an arboriculturist/landscape architect with local knowledge.

An agreed maintenance regime and programme is to be developed in accordance with the equipment manufacturers recommendations. See Appendix E for SuDS Maintenance Plan for further details.

3.7 Discharge Rate

The greenfield runoff rate for the site has been estimated using the FEH method, as recommended by the LLFA⁷.

The runoff rate for the mean annual flood, Q_{MED} , is given by:

$$Q_{MED} = 8.3062AREA^{0.8510} \cdot 0.1536\left(\frac{1000}{SAAR}\right) \cdot FARL^{3.4451} \cdot 0.0460^{BFIHOST^2}$$

Where:

Q_{MED} is the runoff rate for the median annual flow rate in m³/s, the 1:2 year event

$AREA$ is the area of the catchment in km²

$SAAR$ is the Standard Average Annual Rainfall for the period 1961-1990, in mm

$FARL$ is the measurement of the attenuation influence of water bodies in the catchment.

$BFIHOST$ is the measure of the level of base flow from the catchment derived from the UK Hydrology of Soil Types (HOST) Classification

The total site area is approximately 0.00359km², or 0.359ha. The values for $SAAR$ and $BFIHOST$ for the site were obtained from the FEH Web Service. The $SAAR$ is 627mm/hr, and the $BFIHOST$ value for the site is 0.595.

The $FARL$ value is a measurement of the attenuation influence of water bodies in the catchment, such as lakes, etc. As there are no waterbodies present within the catchment, the $FARL$ will be irrelevant for this development site runoff estimation, so this factor becomes 1.0 and therefore drops out.

⁷ London Borough of Haringey (2016). SuDS Design Requirements for LLFA Technical Assessment (ver. 1)

The guidance within the SuDS Manual recommends that for sites less than 50ha, the formula should be applied for 50ha and the resulting Q_{BAR} scaled based on the ratio of the actual site area to the applied area of 50ha.

Q_{MED} for the site is therefore 0.56 l/s.

Q_{BAR} is the peak rate of flow from a catchment for the mean annual flood (a return period of approximately 1:2.3 years). Therefore a conversion factor of 1.14 needs to be applied to determine Q_{BAR} .

Q_{BAR} for the site is therefore 0.64 l/s

The value of Q_{BAR} can then be factored by regional growth curves to obtain the greenfield runoff rate for specific return periods.

The site is in hydrometric area 6. Table 24.2 of the SuDS Manual gives the growth curve factor for a 100 year return period rainfall event in hydrometric area 6 as 3.19.

The 1 in 100 year greenfield runoff rate, Q_{100} , for the site is therefore estimated to be 2.03 l/s.

Table 3-4: Summary of Greenfield Discharge Rates for different Return Periods

Return Period	Growth Curve Factor	Greenfield Discharge Rate
Q_{BAR} (l/s)		0.64
1 in 1 year (l/s)	0.85	0.54
1 in 30 years (l/s)	2.4	1.54
1 in 100 years (l/s)	3.19	2.03

In order to meet the requirements of the LLFA and the London Plan, where surface water is discharged to the TW network, where possible it should be restricted to the greenfield rate, **2.03 l/s** (5.66 l/s/ha).

3.8 Attenuation Design

The surface covering the proposed development is predominantly impermeable surfaces. The area of impermeable surfaces have been calculated from the proposed development drawings.

The volume of storage required to attenuate the surface water flows from the site to the calculated greenfield runoff rate has been estimated using Microdrainage software package for a 1 in 100 year storm event with a 40% increase to allow for the anticipated increase in storm intensity as a result of climate change. Table 3-5 provides a summary of the discharge rate and required attenuation for the site.

Table 3-5: Summary of Surface Water Attenuation Requirements

Area Ref.	Catchment Area (m ²)	Area of Impermeable Surfacing (m ²)	Discharge Point	Discharge Rate (l/s)	Attenuation Volume (m ³)
Printworks	3,594	3,090	Gravity connection to TW sewer to the east of proposed development area (610mm – High Road)	2.03	301

The total estimated attenuation volume required for the entire proposed development is 301m³ to restrict discharge to greenfield runoff rates.

It is proposed attenuation volume is provided on blue roofs, below ground via bioretention and geocellular storage in the hard-landscaped area along the north of the site as well as in the two courtyard areas at L00

For the purpose of this drainage strategy it is assumed that the attenuation is provided using a proprietary modular geocellular system, with a void ratio of 95%. Table 3-6 provides a summary of the proposed dimensions of the attenuation features.

Table 3-6: Summary of proposed attenuation features

Area Ref.	Attenuation Volume (m ³)	Depth of Geocellular Attenuation Unit (m)	Plan Area of Attenuation (m ²)
L00 Courtyard 1	122.3	0.90	143
L00 Courtyard 2	98.4	0.90	115
Tree pit 1	19.0	1.00	20
Tree pit 2	19.0	1.00	20
Blue Roof 1	8.0	0.15	56
Blue Roof 2	6.3	0.15	44
Blue Roof 3	10.5	0.15	73.5
Blue Roof 4	10.5	0.15	73.5
Blue Roof 5	6.6	0.15	46

The total volume of attenuation provided on the site to restrict discharge to greenfield runoff rates is 301m³.

The surface water flows from The Printworks and external landscape are proposed to be collected in a dedicated surface water drainage system and conveyed, via gravity to the existing sewer network under the Brunswick Square discharging at a rate of **2.0 l/s** which is in line with the calculated greenfield runoff rate of 2.03 l/s.

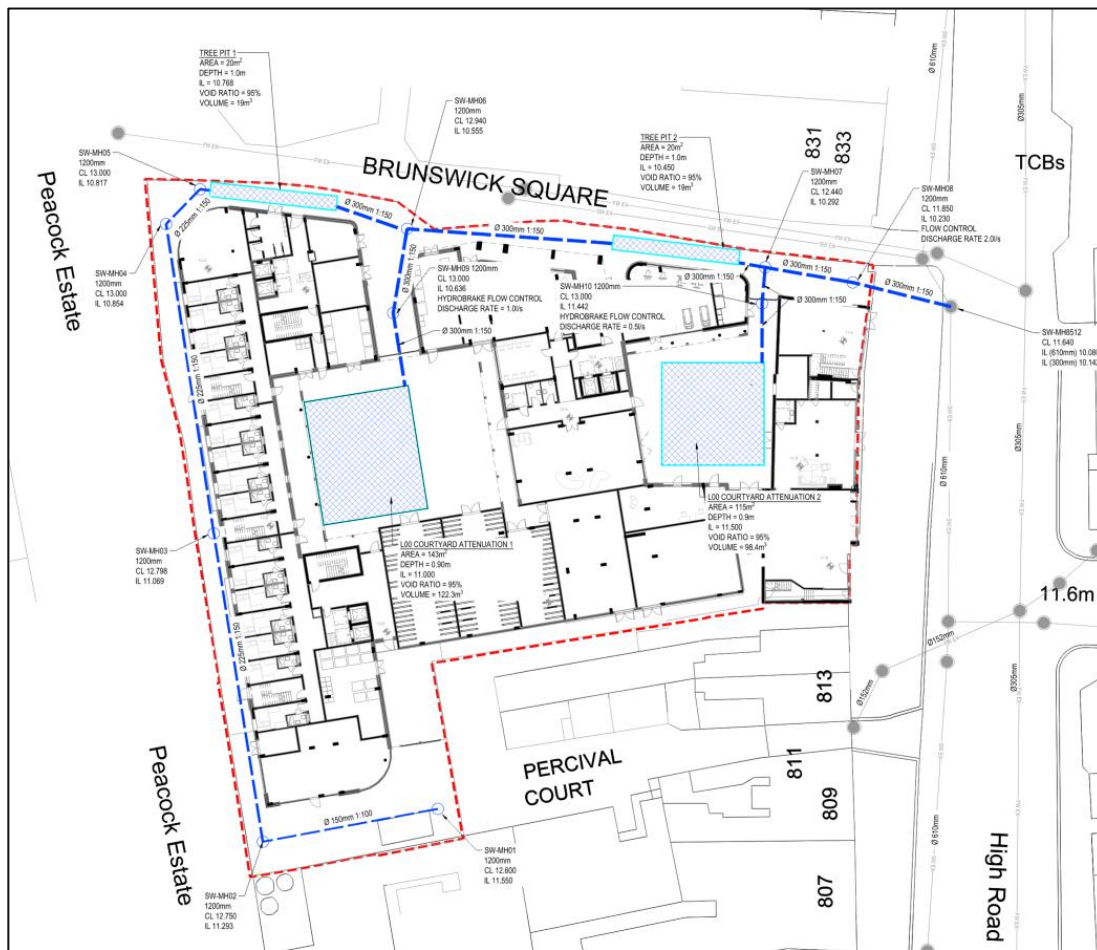


Figure 3-2: Surface Water Drainage Proposal – Ground Floor L00

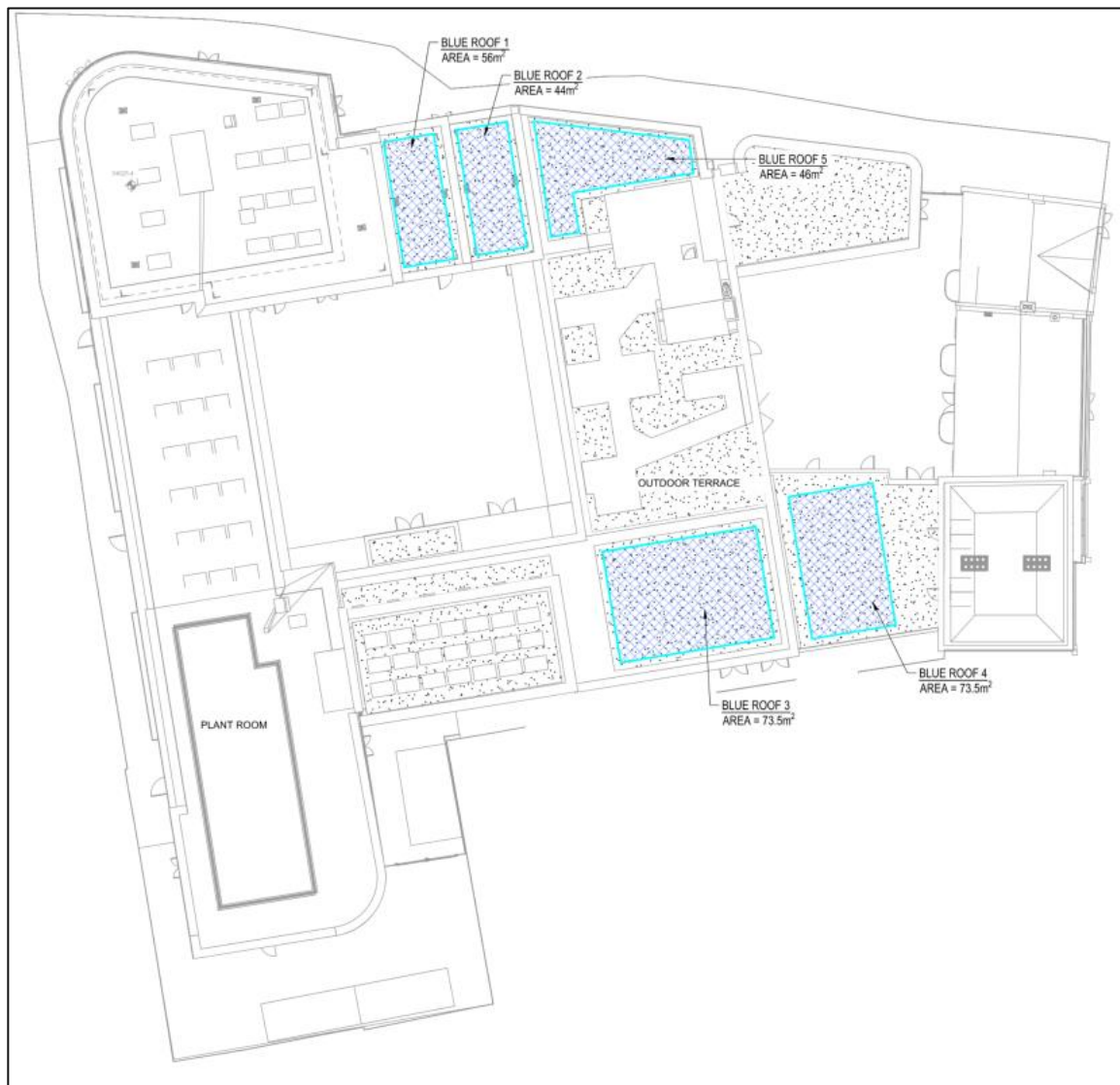


Figure 3-3: Surface Water Drainage Proposal – Roof Arrangement

3.9 Discharge Location

It is proposed that the majority of the surface water from the site, including the buildings, paved areas and communal areas is discharged via gravity to the Thames Water surface water drainage network.

There is an existing 152mm TW surface water sewer located in Brunswick Square to the north of the site, however this sewer has insufficient capacity to accommodate the surface water flows from the development and therefore it is proposed that a connection is made to the 610mm sewer located on High Road via manhole 8512.

3.10 Exceedance Flows

The development site is relatively flat with marginal falls from the north western corner of the site. The high point of the external landscape is located at the north western corner of the site (13.770m). From this location the ground elevation falls to the south (12.600m) and east of the site towards the High Road (11.840m).

With below ground attenuation located across the development site, should one of the SuDS features in these areas fail and result in surface water to overflow, the surface water should run along the surface to the next attenuation area. The attenuation has been sized to prevent flooding for the 1 in 100 year rainfall event with a 40% allowance for climate change.

4 Proposed Foul Water Drainage

4.1 Discharge Rate

An initial assessment of the foul water discharge rates for the residential and commercial units in the Printworks development are given in Table 4-1. This has been made using the following assumptions:

- Foul discharges for the residential units have been calculated based on the highest estimated number of residential units and residential foul water generated at a peak rate of 4,000 litres/unit/day in line with the latest Water UK Sewerage Sector Guidance (SSG, Appendix C, version 2.1).

$$\text{Peak Foul Flow Rate} = \frac{\text{Units} \times 4,000 \text{ litres/unit/day}}{24 \times 60 \times 60}$$

- Foul discharges for commercial units have been calculated based on non-residential floorspace, 0.6 l/s/ha for domestic use and 0.7 l/s/ha for trade effluent (SSG, Appendix C, version 2.1).

$$\text{Peak Foul Flow Rate} = \text{Floorspace} \times 1.3 \text{ litres/second/hectare}$$

Table 4-1: Summary of estimated peak foul water discharge rates from the Printworks

Building Use	Number of Units / Floorspace	Peak Foul Flow Rate (l/s)	Discharge Locations
Residential (Student Accommodation)	287	13.29	250mm – Brunswick Square
Commercial	216m ² (0.022ha)	0.03	
Total		13.32	

Based on the existing foul load estimate for the Printworks, 0.36 l/s, there will be an increase of 12.96 l/s in the foul water discharge as a result of the proposed development.

The foul water flows anticipated to be generated from the site represent an increase from the estimated foul water discharged to the TW sewer network from the existing development. A pre-development enquiry has been submitted to TW in order to present the proposed drainage strategy and to understand the potential impact of the foul water flows on the existing TW network.

4.2 Discharge Location

Given that the existing foul drainage connections from the existing Printworks site are unknown, a proportion of the existing foul sewers are located within the site which will require abandonment, it is therefore not considered feasible that the existing connections can be utilised.

Following consultation with TW and further site investigation in the form of a CCTV survey, if it is proven that the existing connections in Brunswick Square outside of the footprint of the development site is of sufficient capacity and in satisfactory condition then consideration will be given for it to be reused.

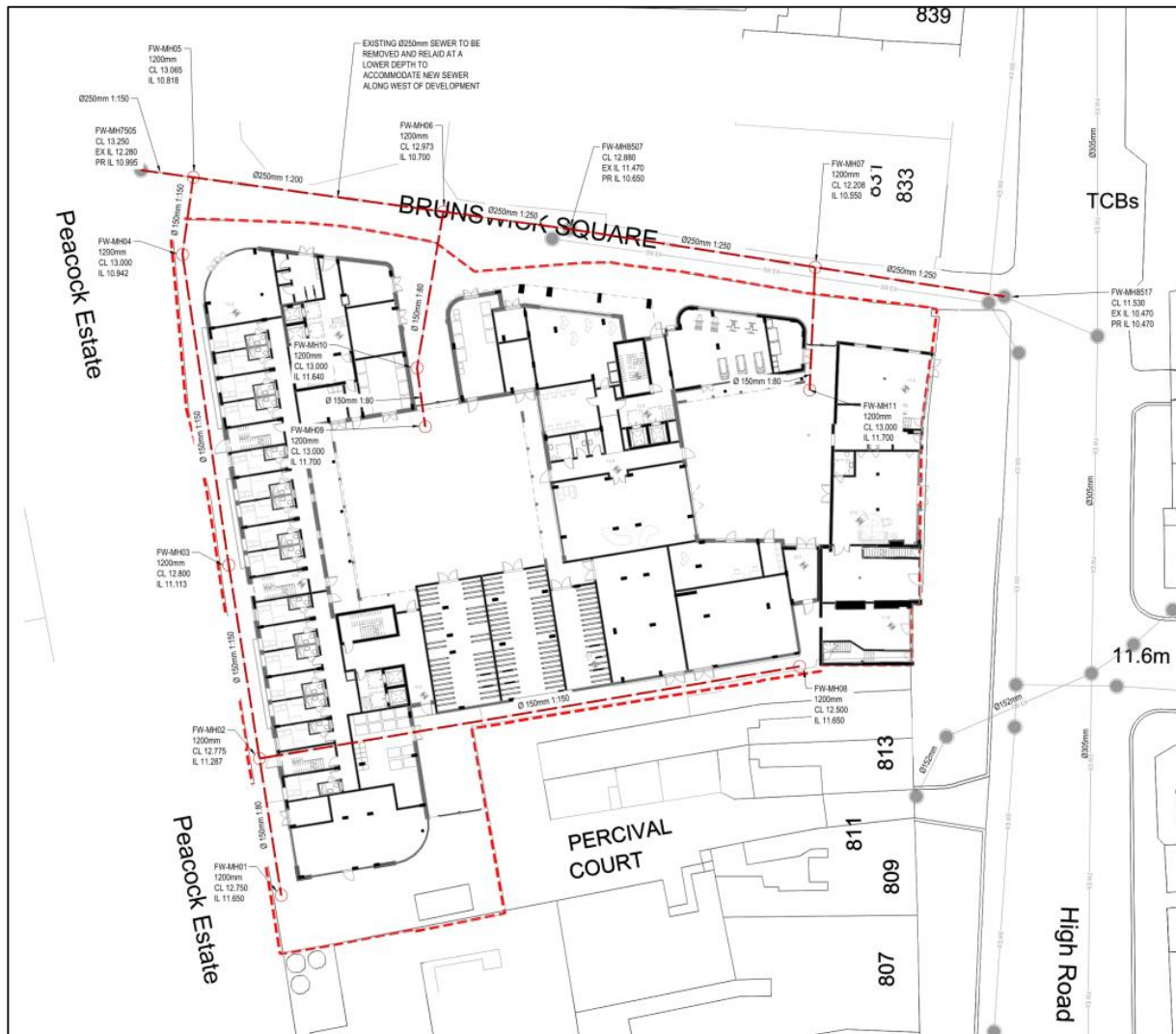


Figure 4-1: Foul Drainage Proposal

As detailed in Figure 4-1, the foul water discharge from the Printworks is proposed to discharge to the existing 250mm foul sewer located on Brunswick Square via manhole 8507 and a further foul sewer is to be installed at the south of the site which is proposed to pass underneath a proportion of the Printworks building to the west before running along the western perimeter and discharge to a re-graded 250mm sewer on Brunswick Square.

The existing 250mm sewer on Brunswick Square will need to be lowered and re-graded in order to collect the upstream discharges from the south of the development.

Should the lowering and regrading of the existing 250mm sewer on Brunswick Square prove difficult to achieve, a potential alternative is to install a further foul sewer at the south of the site which can discharge to manhole 8407 on the 152mm TW sewer. If a new foul sewer at the south of the site at this location which passes through Percival Court prior to discharging to manhole 8407 is required, this area outside of the redline boundary for the Printworks site is

understood to be third party land and likely to have it's own complications. If this is to be pursued foul drainage from the site will discharge north and south to a combination of the existing 250mm in Brunswick Square and the 152mm to the south east.

5 Summary

The proposed surface water discharge rate for the development has been reduced to 2.0 l/s which is in line with the greenfield rate for the 1 in 100 year event for the site (2.03 l/s). The surface water network is proposed to discharge to the 610mm TW surface water sewer on High Road via TW manhole 8512.

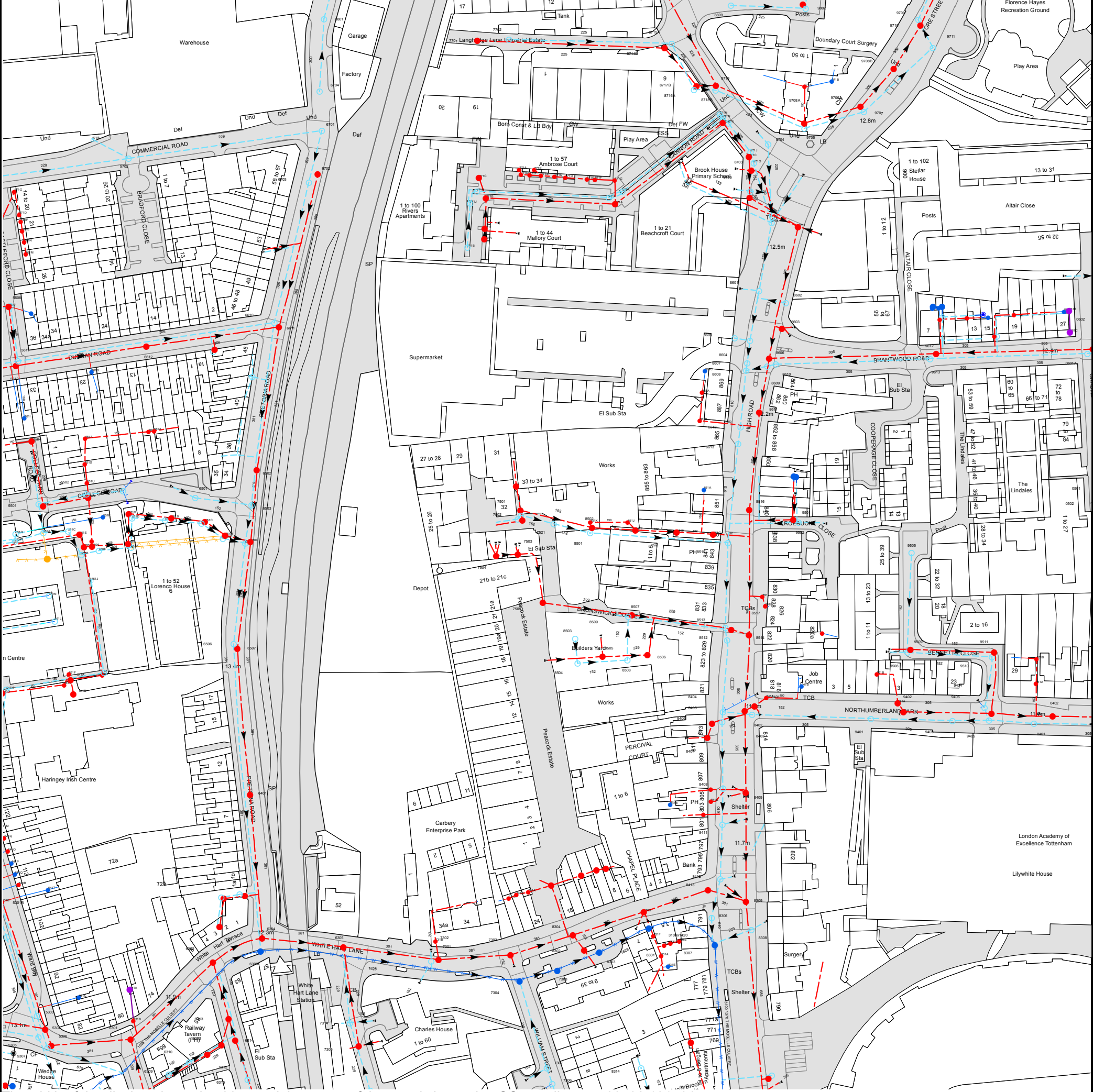
The surface water drainage strategy has been developed in accordance with the drainage hierarchy set out in the London Plan. The surface water strategy has been developed to attenuate surface water in a combination of below ground drainage systems in the form of permeable surfacing with below ground geocellular storage within the two courtyards at L00, as well as bioretention areas on the pavement onto Brunswick Square. Blue roofs are proposed at roof level to reduce the rate of runoff and pre-treat runoff prior to entry to the below ground drainage system. The implementation of SuDS features will help to attenuate and reduce the surface water discharge rate from the proposed development.

The proposed peak foul water discharge rate for The Printworks is 13.29 l/s which is an increase from the estimated existing peak rate of 0.36 l/s and is proposed to discharge to the existing 250mm foul sewer located on Brunswick Square via TW manhole 8507.

Consultation with Thames Water has been carried out as part of a pre-development enquiry for the proposed development. We are currently awaiting response from Thames Water to confirm whether they have any objection to the proposed drainage strategy.

Appendix A Thames Water Asset Map

Asset Location Search Sewer Map - ALS/ALS Standard/2021_ 4407250



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 533792,191561
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
96XQ	n/a	n/a
96XY	n/a	n/a
96XT	n/a	n/a
9614	n/a	n/a
9615	n/a	n/a
0611	n/a	n/a
061A	n/a	n/a
061B	n/a	n/a
061C	n/a	n/a
0601A	12.39	11.08
0602	12.38	10.94
95XW	n/a	n/a
9502	12.28	11.36
941B	n/a	n/a
951A	n/a	n/a
9401	11.53	10.22
951B	n/a	n/a
941A	n/a	n/a
9402	11.68	10.37
9508	12.18	10.99
9509	12.18	10.69
9505	12.12	11.19
9403	11.54	10.23
9406	11.66	10.27
9405	11.59	10.26
9510	11.79	10.75
9404	11.68	10.23
9511	11.77	10.45
0401	11.58	10.31
041A	n/a	n/a
051B	n/a	n/a
0402	11.69	10.1
0502	11.99	11.01
0501	12.01	10.47
861C	n/a	n/a
8605	12.6	11.08
8608	12.25	10.68
8607	12.27	10.74
871C	13.2	10.61
871H	13.2	10.6
8604	12.29	10.72
8706	12.74	11.38
871J	13.2	11.37
8703	12.74	11.38
871O	13.2	11.29
8601	12.36	10.97
8609	12.32	11.31
8704	13.04	11.72
8606	12.3	9.94
8705	12.64	11.18
8610	12.33	11.21
8603	12.45	11.03
8602	12.23	11.6
9701	12.44	10.25
9613	12.41	11.33
96XS	n/a	n/a
96XP	n/a	n/a
9612	12.38	10.62
96XR	n/a	n/a
96XX	n/a	n/a
96YQ	n/a	n/a
8714B	13.56	11.62
8715A	13.41	12.14
8716A	13.85	11.88
8717B	13.84	n/a
8718B	13.31	11.73
8719	13.31	11.23
871M	n/a	n/a
871N	13.2	11.6
871B	13.2	10.71
871I	13.2	11.58
8809	13.33	12.15
9801	13.31	11.65
9705	13.16	11.73
9708A	12.8	10.5
971A	n/a	n/a
9802	13.29	11.96
971B	n/a	n/a
9706A	12.66	10.58
9707	12.69	n/a
9708B	12.88	10.48
9709	13.16	n/a
9710	12.86	n/a
9711	12.89	11.73
8411	11.34	9.8
8438	n/a	n/a
841B	n/a	n/a
841C	n/a	n/a
8409	11.52	9.02
8437	n/a	n/a
8408	11.41	9.83

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8407	11.8	10.93
8406	11.61	10.65
8405	11.42	9.88
8402	11.55	n/a
8404	11.46	9.91
8403	11.52	9.2
8401	11.46	10.09
841A	n/a	n/a
8504	13.12	12.16
8508	12.79	12.05
8505	12.83	12.03
8506	12.81	11.83
8512	11.64	10.08
8503	12.89	12.42
8514	11.61	9.38
8517	11.53	10.47
8513	11.55	10.04
8509	12.94	11.61
8507	12.88	11.47
851N	n/a	n/a
7505	13.25	12.28
851L	n/a	n/a
7504	n/a	n/a
7503	13.84	13.14
8515	11.96	10.28
851G	n/a	n/a
8501	n/a	n/a
851H	n/a	n/a
851I	n/a	n/a
8502	12.89	11.33
7521	n/a	n/a
851K	n/a	n/a
851J	n/a	n/a
7519	n/a	n/a
9501	12.24	11.09
7518	n/a	n/a
7502	n/a	n/a
7501	13.89	12.38
8516	11.91	9.63
851A	n/a	n/a
7520	n/a	n/a
95XV	n/a	n/a
8613	12.06	10.41
8612	12.1	10.47
861B	n/a	n/a
8611	12.21	9.82
861A	n/a	n/a
871A	13.08	11.01
871L	n/a	n/a
871K	13.1	11.72
871G	13.4	11.47
871F	13.35	11.9
871E	13.35	11.95
871D	13.35	12.06
771G	13.35	12.08
771E	13.35	12.11
771F	13.35	12.16
771D	13.35	12.2
771K	13.4	12.47
771A	13.4	12.25
7702	14.06	12.79
66YQ	n/a	n/a
66YW	n/a	n/a
66YT	n/a	n/a
6611	13.39	11.65
6610	13.36	11.93
761B	13.45	11.9
761A	13.35	12.2
771I	13.35	12.1
771J	n/a	n/a
771B	13.35	11.33
771H	13.45	11.85
6703	13.92	12.19
771C	13.45	11.5
6702	13.95	11.93
6701	13.96	12.3
6704	13.86	12.67
7701	14.17	12.45
6801	13.99	12.61
5502	15.42	14.27
551U	n/a	n/a
5504	15.41	14.39
551J	15.6	14.5
5506	15.44	12.62
5508	15.4	12.85
551D	16.1	13.5
551R	15.95	14.95
551I	16.1	13.95
5503	15.3	14.41
551W	15.58	12.4
551X	15.35	12.33
651A	15.58	12.33
651D	15.35	12.25

Manhole Reference	Manhole Cover Level	Manhole Invert Level
651E	15.5	12.16
651B	15.47	12.22
6501	14	12.47
651F	15.11	12.07
651C	15.11	12.34
651G	n/a	11.97
651H	n/a	12.05
6506	13.43	11.37
6507	13.48	11.13
6505	13.37	11.52
6504	13.26	11.33
6503	13.33	11.54
6502	13.23	11.28
541D	16.5	14.95
541H	16	13.35
551P	15.9	14.31
551Q	15.9	14.65
561D	n/a	n/a
5501	15.55	14.23
551A	15.75	13.67
551V	n/a	n/a
551N	16.3	15.4
551L	16.3	15.4
541C	15.9	15.35
551C	15.55	13.32
551F	16.44	15.54
541A	16.4	13.7
541B	n/a	13.88
551E	15.6	13.8
551B	15.65	12.98
5505	15.84	12.98
551S	n/a	n/a
561A	n/a	n/a
5629	n/a	n/a
5607	13.95	12.96
5608	13.91	13.15
561M	n/a	n/a
561N	n/a	n/a
571E	n/a	n/a
571F	n/a	n/a
571D	n/a	n/a
571G	n/a	n/a
5702	13.77	12.76
571B	n/a	n/a
661B	n/a	n/a
661A	n/a	n/a
561I	n/a	n/a
561B	n/a	n/a
5612	13.91	12.11
5611	13.87	12.37
6612	13.48	11.82
8333	n/a	n/a
8332	n/a	n/a
7307	12.12	10.95
7306	12.12	11.23
8314	n/a	n/a
8331	n/a	n/a
7304	12.02	9.53
7308	11.88	9.47
831E	n/a	n/a
831A	n/a	n/a
7303	12.13	9.39
8303	11.77	9.4
8302	11.84	10.04
831D	n/a	n/a
8307	11.3	9.5
831C	n/a	n/a
831B	n/a	n/a
831F	n/a	n/a
8304	11.84	9.22
8308	11.25	10.42
8301	11.56	9.53
8306	11.37	9.64
8305	11.42	9.08
8309	11.43	8.76
731A	n/a	n/a
741B	n/a	n/a
741A	n/a	n/a
8413	11.35	8.37
7401	n/a	n/a
8412	11.35	9.75
8434	n/a	n/a
8435	n/a	n/a
8436	n/a	n/a
7315	12.5	10.8
6315	12.74	9.51
6309	12.8	11.99
6310	12.69	11.83
6312	12.6	11.05
5307	12.7	10.49
7305	12.31	10.53
5306	12.72	10.81
6303	12.36	11.04

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6314	12.36	11.04
6301	12.21	10.56
7314	12.2	10.84
631B	n/a	n/a
6313	12.28	10.97
531B	n/a	n/a
541N	n/a	n/a
5302	14.12	11.66
541O	n/a	n/a
541P	n/a	n/a
541Q	n/a	n/a
541R	n/a	n/a
541T	n/a	n/a
531C	n/a	n/a
631A	n/a	n/a
6302	12.01	10.05
63WX	n/a	n/a
63WY	n/a	n/a
63WW	n/a	n/a
64YV	n/a	n/a
64YS	n/a	n/a
6401	13.34	10.37
6306	11.96	10.03
6304	12.05	9.89
6305	12.11	9.68
7302	12.16	10.33
731B	n/a	n/a
7301	12.18	9.5
53WP	n/a	n/a
53VS	n/a	n/a
53VX	n/a	n/a
5303	13.08	10.64
5305	12.94	10.86
5304	12.93	11.05
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

	Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Trunk Surface Water
	Trunk Foul
	Storm Relief
	Trunk Combined
	Vent Pipe
	Bio-solids (Sludge)
	Proposed Thames Surface Water Sewer
	Proposed Thames Water Foul Sewer
	Gallery
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Sludge Rising Main
	Proposed Thames Water Rising Main
	Vacuum

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or 'D' on a manhole level indicates that data is unavailable.

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

	Air Valve
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

	Control Valve
	Drop Pipe
	Ancillary
	Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

	Outfall
	Undefined End
	Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

	Public/Private Pumping Station
	Change of characteristic indicator (C.O.C.I.)
	Invert Level
	Summit

Areas

Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

	Foul Sewer
	Surface Water Sewer
	Combined Sewer
	Gully
	Culverted Watercourse
	Proposed
	Abandoned Sewer

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0800 009 4540.

Appendix B Greenfield Runoff Rates

Calculated by:

Marc Jones

Site name:

Printworks

Site location:

London

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

51.60641° N

Longitude:

0.06863° W

Reference:

1031112914

Date:

Jun 14 2023 10:53

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):

0.36

Methodology

Q_{MED} estimation method:

Calculate from BFI and SAAR

BFI and SPR method:

Specify BFI manually

HOST class:

N/A

BFI / BFIHOST:

0.595

Q_{MED} (l/s):

Q_{BAR} / Q_{MED} factor:

1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	625	625
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

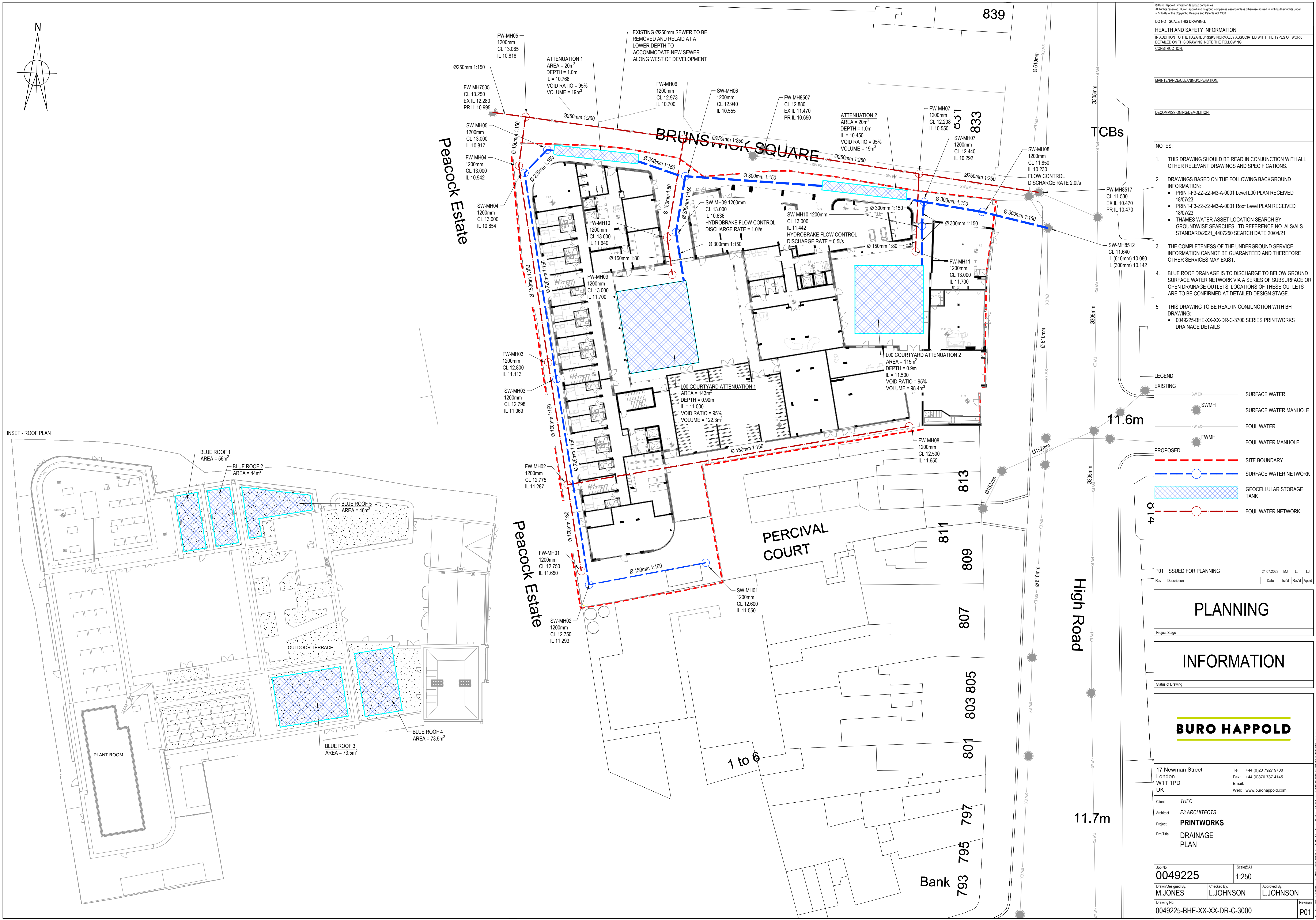
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

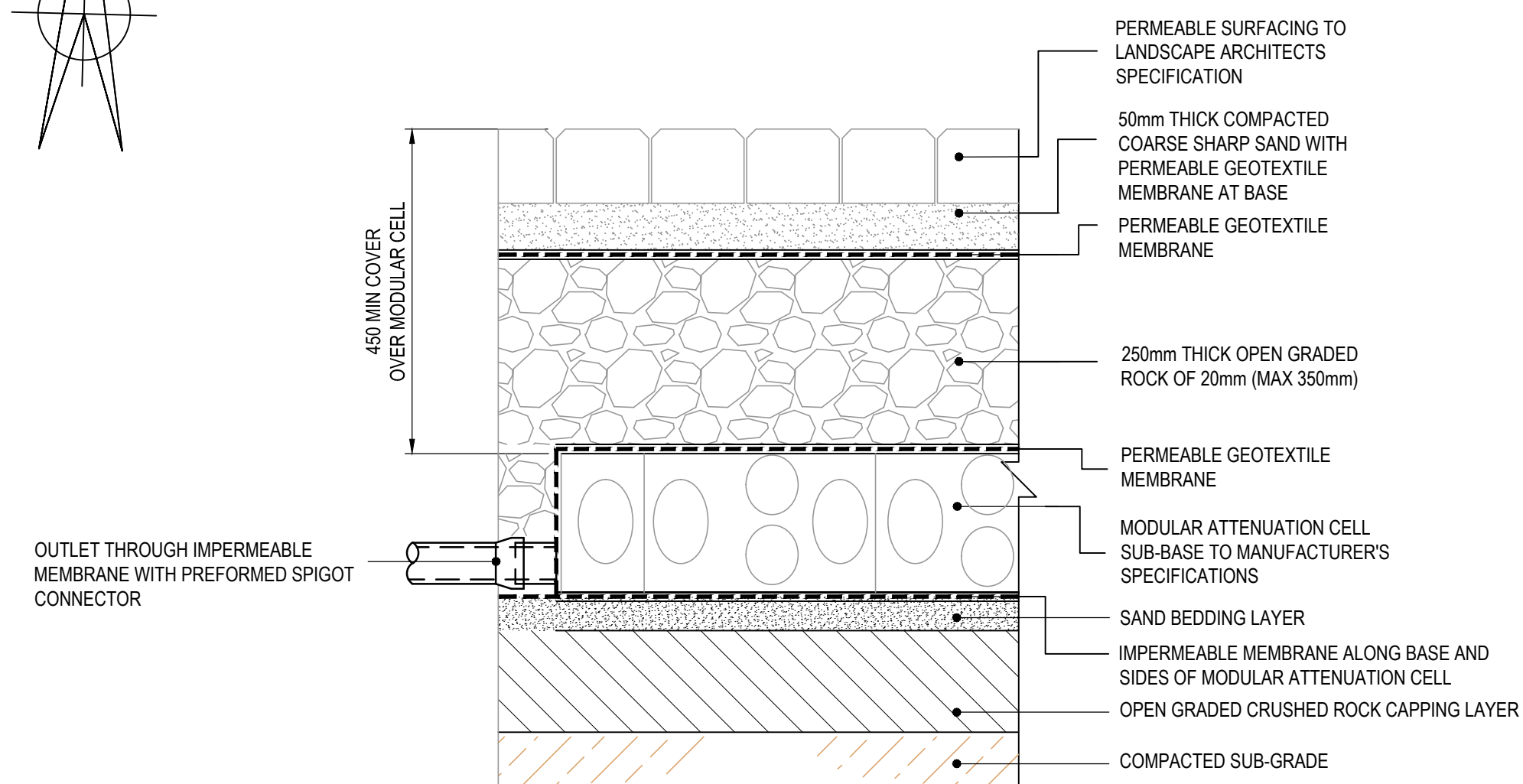
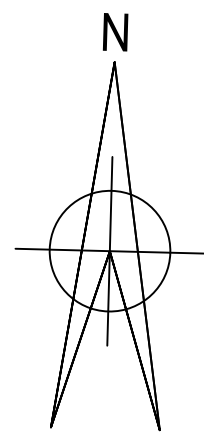
Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):		0.63
1 in 1 year (l/s):		0.54
1 in 30 years (l/s):		1.45
1 in 100 year (l/s):		2.02
1 in 200 years (l/s):		2.36

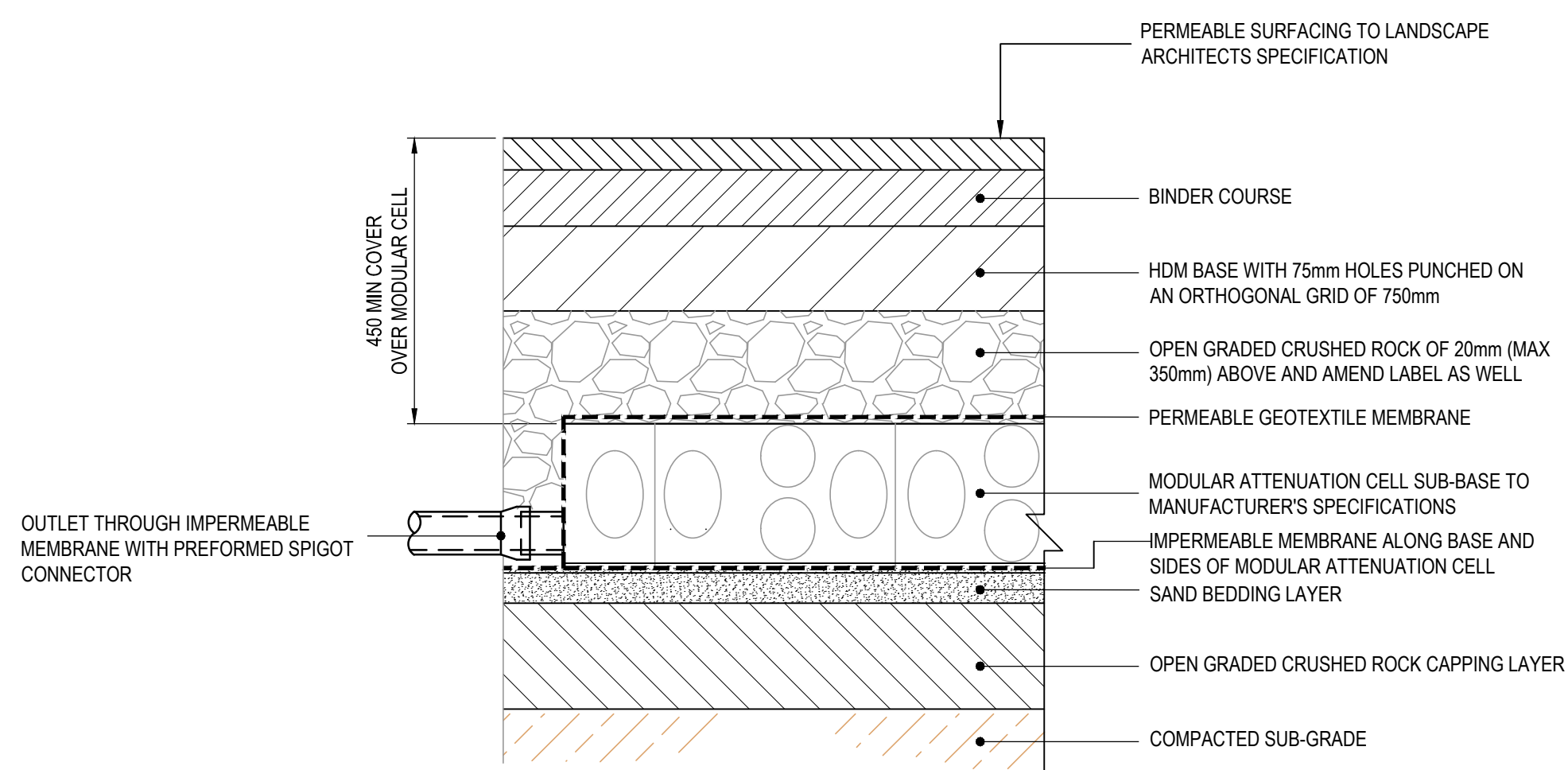
This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix C Proposed Drainage Plan

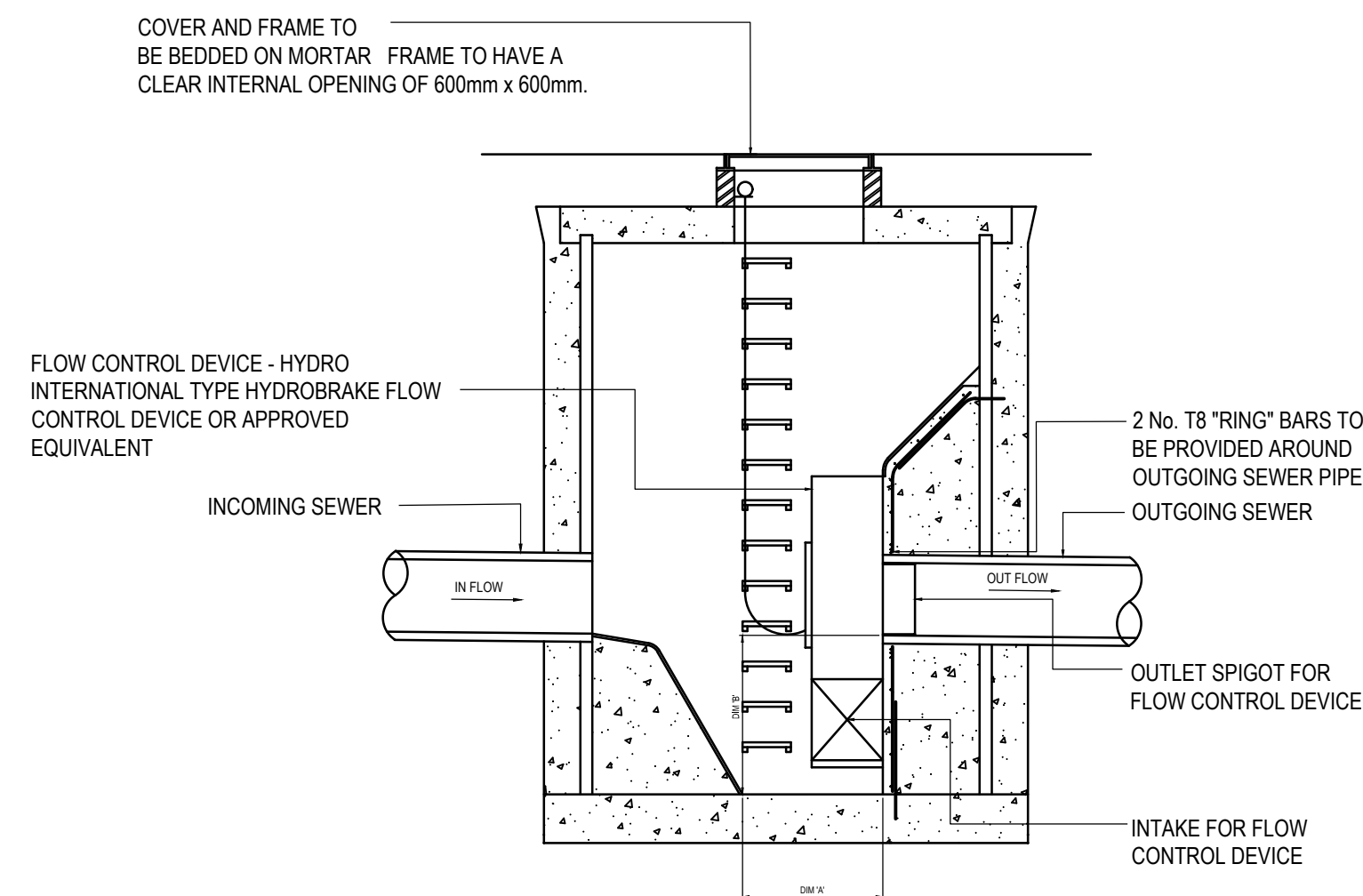




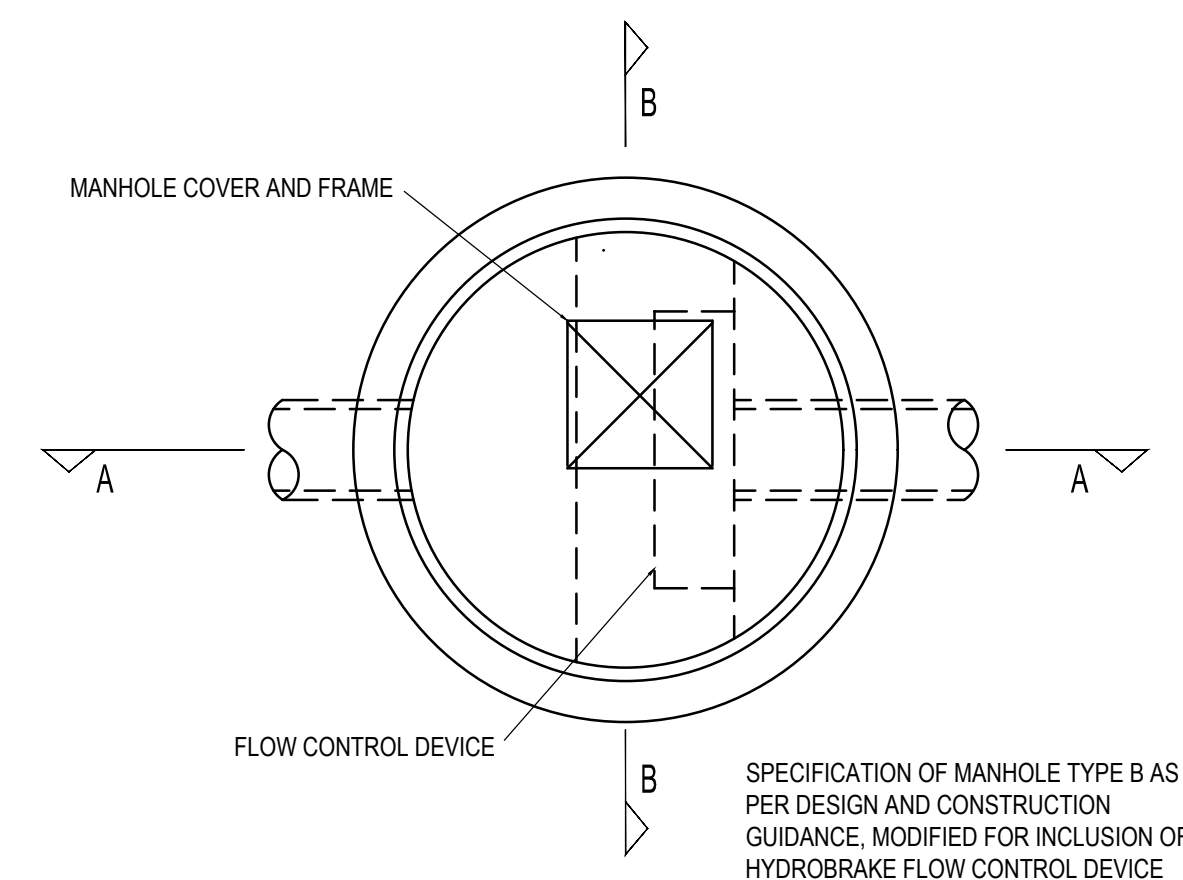
TYPICAL PERMEABLE PAVEMENT ARRANGEMENT
OPTION 1
NTS



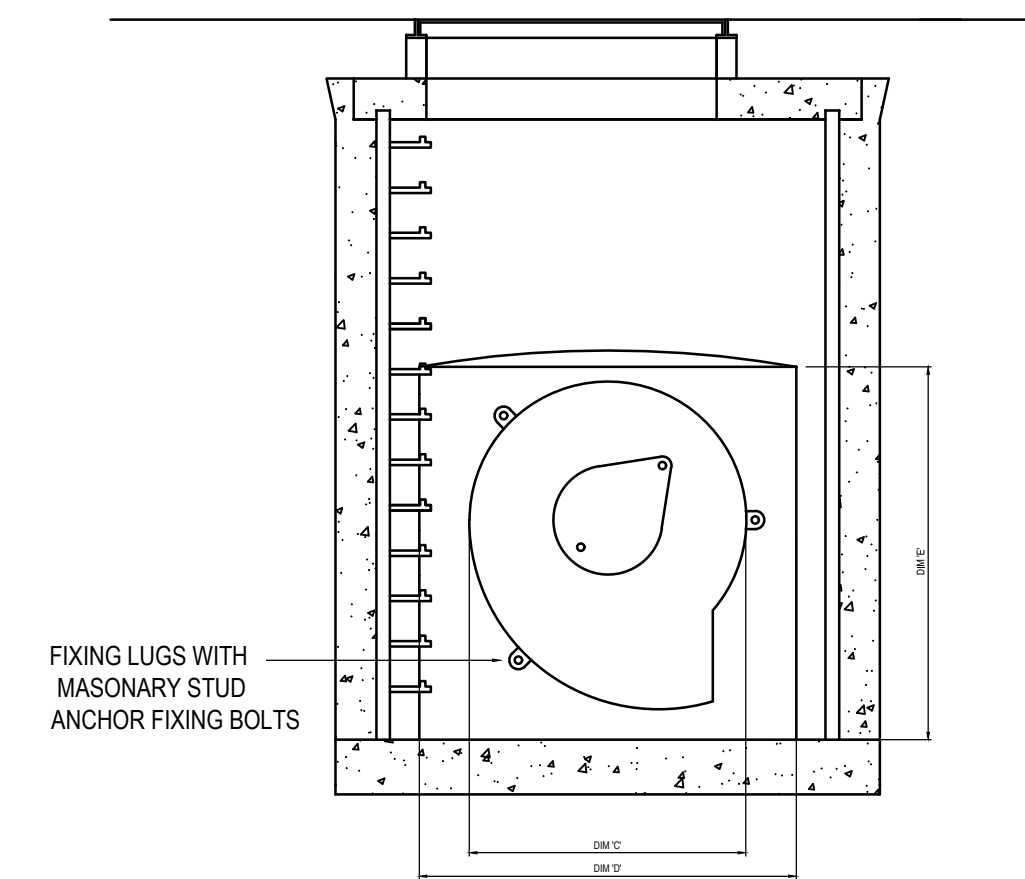
TYPICAL PERMEABLE PAVEMENT ARRANGEMENT
OPTION 2
NTS



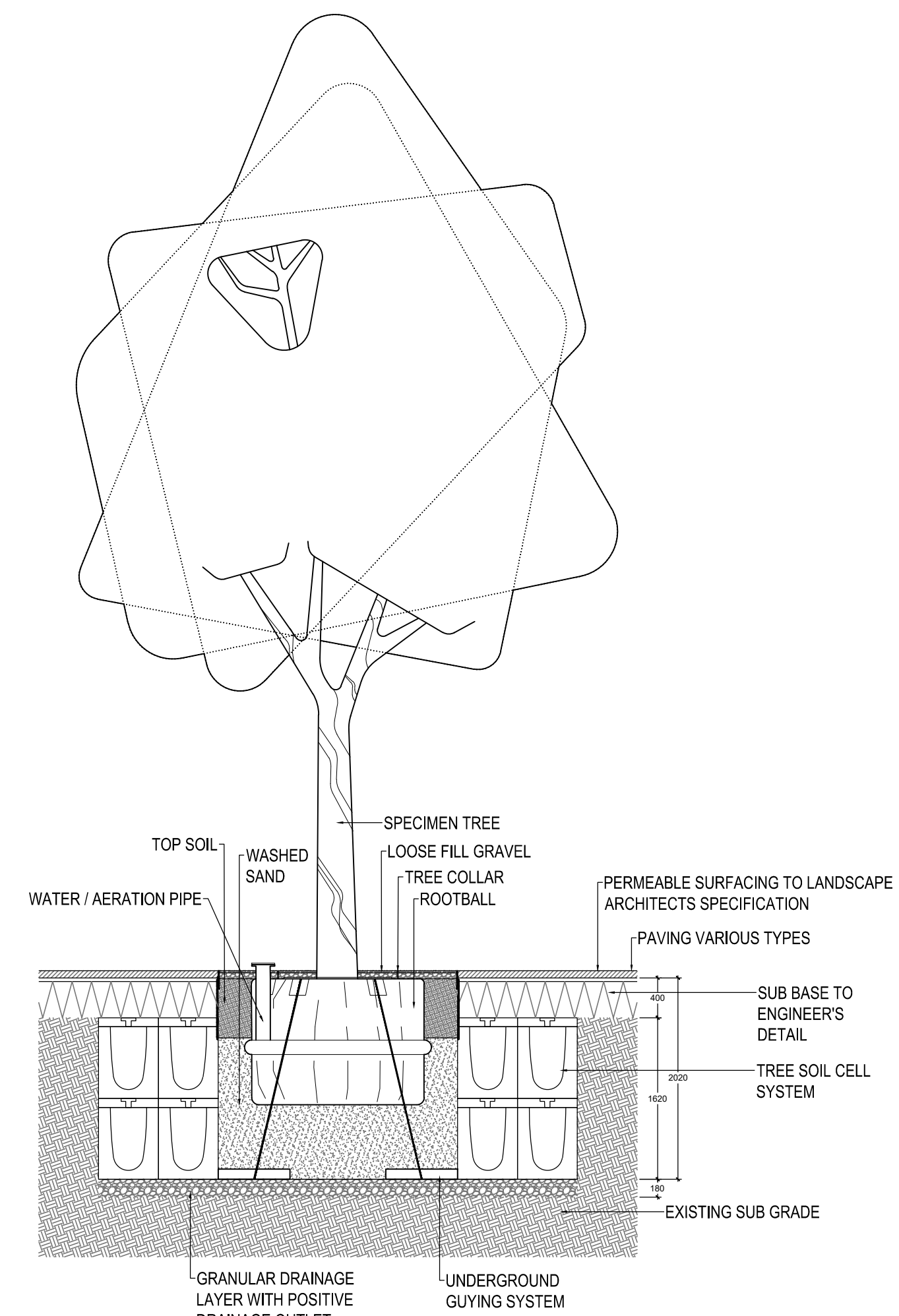
SECTION 'A - A'



MANHOLE DETAIL WITH HYDROBRAKE -
TYPE B
NTS



SECTION 'B - B'



TYPICAL TREE PIT DETAIL
NTS

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH BH DRAWINGS:
 - OVERVIEW: 0049225-BHE-XX-XX-DR-C-3000
 - DRAINAGE DETAILS: 0049225-BHE-XX-XX-DR-C-3700 SERIES

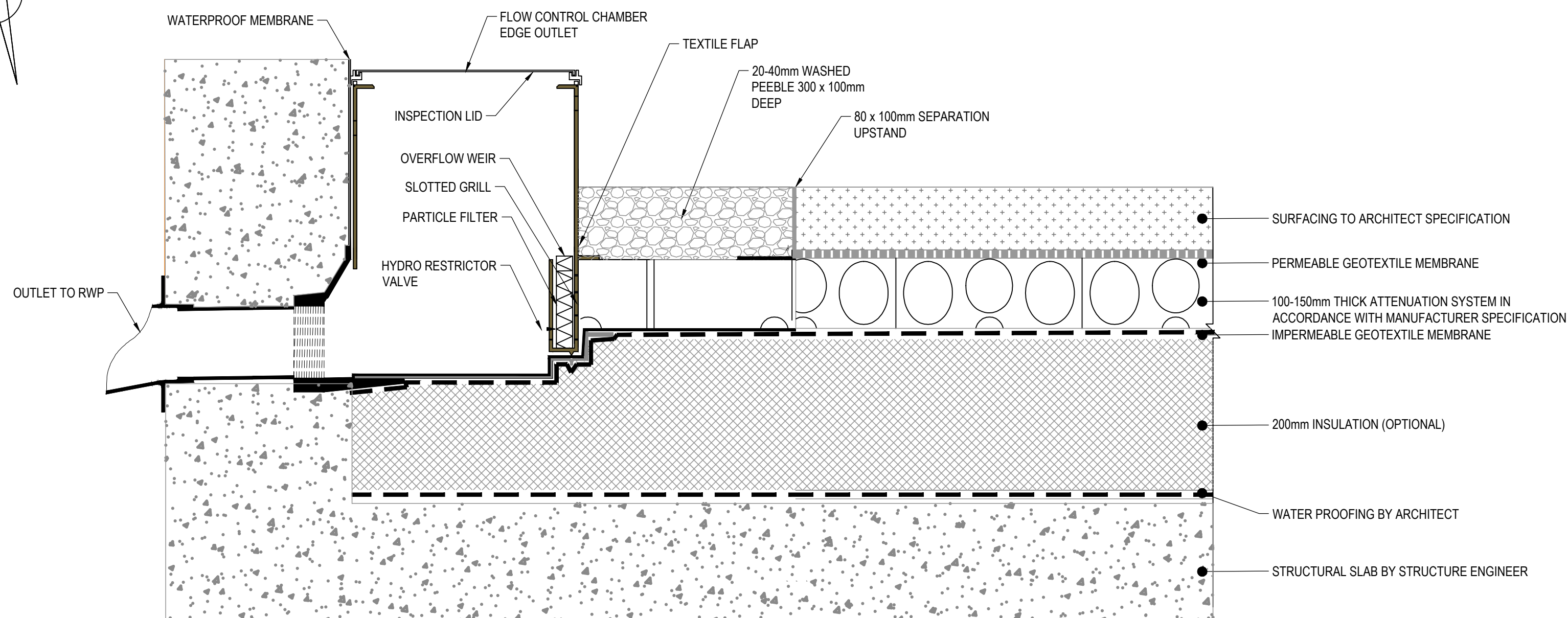


Diagram illustrating the cross-section of a Blue Roof Podium, showing the following components and layers:

- BLUE ROOF PODIUM OUTLET CHAMBER**: The uppermost chamber containing the outlet.
- SIPHONIC VERTICAL OUTLET WITH FLOW RESTRICTOR**: The vertical pipe leading from the outlet chamber.
- SURFACING TO ARCHITECT SPECIFICATION**: The top layer of the roof.
- PERMEABLE GEOTEXTILE MEMBRANE**: The layer immediately below the surfacing.
- 100-150mm THICK ATTENUATION SYSTEM IN ACCORDANCE WITH MANUFACTURER SPECIFICATION**: The middle layer designed for water attenuation.
- IMPERMEABLE GEOTEXTILE MEMBRANE**: The layer below the attenuation system.
- 200mm INSULATION (OPTIONAL)**: The optional insulation layer.
- WATER PROOFING BY ARCHITECT**: The waterproofing layer.
- STRUCTURAL SLAB BY STRUCTURE ENGINEER**: The base structural slab.

OUTLET TO RWP

VEGETATION BARRIER - MINIMUM 300mm WIDE

20-40mm WASHED PEEBLE 300 x 100mm DEEP

80 x 100mm SEPARATION UPSTAND

SURFACING TO ARCHITECT SPECIFICATION

PERMEABLE GEOTEXTILE MEMBRANE

100-150mm THICK ATTENUATION SYSTEM IN ACCORDANCE WITH MANUFACTURER SPECIFICATION

IMPERMEABLE GEOTEXTILE FILTER MEMBRANE

200mm INSULATION (OPTIONAL)

WATER PROOFING BY ARCHITECT

STRUCTURAL SLAB BY STRUCTURE ENGINEER

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P01 ISSUED FOR PLANNING 24.07.2023AHMJLJ <table><tr><th>Rev</th><th>Description</th><th>Date</th><th>Iss'd</th><th>Rev'd</th><th>App'd</th></tr></table> PLANNING Project Stage INFORMATION Status of Drawing BURO HAPPOLD 17 Newman Street London W1T 1PD UK Tel: +44 (0)20 7527 9700 Fax: +44 (0)870 787 4145 Email: Web: www.burohappold.com <table><tr><td>Client</td><td>THFC</td></tr><tr><td>Architect</td><td>F3 ARCHITECTS</td></tr><tr><td>Project</td><td>PRINTWORKS</td></tr><tr><td>Dwg Title</td><td>DRAINAGE DETAILS SHEET 2</td></tr></table> <table><tr><td>Job No.</td><td>0049225</td><td>Scale@A1</td></tr><tr><td>Drawn/Designed By</td><td>A.HAQUE</td><td>NTS</td></tr><tr><td>Checked By</td><td>M.JONES</td><td>Approved By</td></tr><tr><td></td><td></td><td>L.JOHNSON</td></tr><tr><td>Drawing No.</td><td>0049225-BHE-XX-XX-DR-C-3702</td><td>Revision</td></tr><tr><td></td><td></td><td>P01</td></tr></table>					Rev	Description	Date	Iss'd	Rev'd	App'd	Client	THFC	Architect	F3 ARCHITECTS	Project	PRINTWORKS	Dwg Title	DRAINAGE DETAILS SHEET 2	Job No.	0049225	Scale@A1	Drawn/Designed By	A.HAQUE	NTS	Checked By	M.JONES	Approved By			L.JOHNSON	Drawing No.	0049225-BHE-XX-XX-DR-C-3702	Revision			P01
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Appendix D Hydraulic Modelling

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Camden Mill Lower Bristol Road Bath		
Date 28/07/2023 12:39 File 230717 PW SW.MDX	Designed by mjones 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

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location GB 533705 191591 TQ 33705 91591	
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
S1.000	18.191	0.182	100.0	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	33.649	0.224	150.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	32.158	0.214	150.0	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	5.588	0.037	150.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	7.286	0.049	150.0	0.002	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	12.779	0.138	92.3	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	10.979	0.107	102.6	0.130	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	11.967	0.107	111.8	0.000	0.00	0.0	0.600	o	300	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	5.30	11.550	0.019	0.0	0.0	0.0	1.01	17.8	2.6
S1.001	50.00	5.83	11.293	0.031	0.0	0.0	0.0	1.07	42.4	4.2
S1.002	50.00	6.33	11.069	0.038	0.0	0.0	0.0	1.07	42.4	5.1
S1.003	50.00	6.42	10.854	0.042	0.0	0.0	0.0	1.07	42.4	5.7
S1.004	50.00	6.53	10.817	0.044	0.0	0.0	0.0	1.07	42.4	6.0
S1.005	50.00	6.69	10.768	0.047	0.0	0.0	0.0	1.36	54.1	6.4
S2.000	50.00	5.12	11.000	0.130	0.0	0.0	0.0	1.55	109.7	17.6
S2.001	50.00	5.25	10.893	0.130	0.0	0.0	0.0	1.49	105.0	17.6

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<u>Network Design Table for Storm</u>													
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	
S3.000	7.305	0.112	65.2	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit			
S3.001	2.131	8.602	0.2	0.001	0.00	0.0	0.600	o	150	Pipe/Conduit			
S2.002	4.740	0.081	58.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit			
S1.006	15.910	0.106	150.1	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit			
S4.000	4.004	0.068	58.9	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit			
S4.001	4.004	8.000	0.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit			
S1.007	23.556	0.157	150.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit			
S5.000	10.784	0.184	58.6	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit			
S5.001	9.620	7.666	1.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit			
S6.000	7.743	0.132	58.7	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit			
S6.001	6.617	7.718	0.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit			
S5.002	8.679	0.058	150.0	0.063	0.00	0.0	0.600	o	300	Pipe/Conduit			
S7.000	5.656	0.105	53.9	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit			
<u>Network Results Table</u>													
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)			
S3.000	50.00	5.10	19.500	0.007	0.0	0.0	0.0	1.25	22.0	0.9			
S3.001	50.00	5.10	19.388	0.007	0.0	0.0	0.0	20.44	361.1	1.0			
S2.002	50.00	5.29	10.636	0.137	0.0	0.0	0.0	2.06	145.6	18.6			
S1.006	50.00	6.90	10.555	0.189	0.0	0.0	0.0	1.28	90.6	25.6			
S4.000	50.00	5.05	19.500	0.007	0.0	0.0	0.0	1.31	23.2	0.9			
S4.001	50.00	5.06	19.432	0.007	0.0	0.0	0.0	14.37	254.0	0.9			
S1.007	50.00	7.20	10.449	0.201	0.0	0.0	0.0	1.28	90.6	27.2			
S5.000	50.00	5.14	19.500	0.011	0.0	0.0	0.0	1.32	23.3	1.4			
S5.001	50.00	5.15	19.316	0.011	0.0	0.0	0.0	9.07	160.3	1.4			
S6.000	50.00	5.10	19.500	0.009	0.0	0.0	0.0	1.32	23.3	1.2			
S6.001	50.00	5.11	19.368	0.009	0.0	0.0	0.0	10.98	194.0	1.2			
S5.002	50.00	5.27	11.500	0.082	0.0	0.0	0.0	1.28	90.6	11.1			
S7.000	50.00	5.07	19.500	0.006	0.0	0.0	0.0	1.37	24.3	0.9			
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Camden Mill Lower Bristol Road Bath										
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<u>Manhole Schedules for Storm</u>										
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)
S1	12.600	1.050	Open Manhole	1200	S1.000	11.550	150			
S2	12.750	1.457	Open Manhole	1200	S1.001	11.293	225	S1.000	11.368	150
S3	12.798	1.729	Open Manhole	1200	S1.002	11.069	225	S1.001	11.069	225
S4	13.000	2.146	Open Manhole	1200	S1.003	10.854	225	S1.002	10.854	225
S5	13.000	2.183	Open Manhole	1200	S1.004	10.817	225	S1.003	10.817	225
STree Pit 1	12.940	2.172	Open Manhole	1200	S1.005	10.768	225	S1.004	10.768	225
SCourtyard L00	13.000	2.000	Open Manhole	1200	S2.000	11.000	300			
S8	13.000	2.107	Open Manhole	1200	S2.001	10.893	300	S2.000	10.893	300
SBlue Roof 1	20.000	0.500	Junction		S3.000	19.500	150			
S9	20.000	0.612	Junction		S3.001	19.388	150	S3.000	19.388	150
S10	13.000	2.364	Open Manhole	1200	S2.002	10.636	300	S2.001	10.786	300
								S3.001	10.786	150
S6	12.940	2.385	Open Manhole	1200	S1.006	10.555	300	S1.005	10.630	225
								S2.002	10.555	300
SBlue Roof 2	20.000	0.500	Junction		S4.000	19.500	150			
S11	20.000	0.568	Junction		S4.001	19.432	150	S4.000	19.432	150
STree Pit 2	12.940	2.491	Open Manhole	1200	S1.007	10.449	300	S1.006	10.449	300
								S4.001	11.432	150
SBlue Roof 3	20.000	0.500	Junction		S5.000	19.500	150			
S14	20.000	0.684	Junction		S5.001	19.316	150	S5.000	19.316	150
SBlue Roof 4	20.000	0.500	Junction		S6.000	19.500	150			
S16	20.000	0.632	Junction		S6.001	19.368	150	S6.000	19.368	150
SCourtyard 2 L00	13.000	1.500	Open Manhole	1200	S5.002	11.500	300	S5.001	11.650	150
								S6.001	11.650	150
SBlue Roof 5	20.000	0.500	Junction		S7.000	19.500	150			
S16	20.000	0.605	Junction		S7.001	19.395	150	S7.000	19.395	150
S10	13.000	1.558	Open Manhole	1200	S5.003	11.442	300	S5.002	11.442	300
								S7.001	11.592	150
S7	12.440	2.148	Open Manhole	1200	S1.008	10.292	300	S1.007	10.292	300
								S5.003	11.384	300
S8	11.900	1.670	Open Manhole	1200	S1.009	10.230	300	S1.008	10.230	300
SMH 8512	11.640	1.498	Open Manhole	0		OUTFALL		S1.009	10.142	300
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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., (mm)	L*W
S1.000	o	150		S1 12.600	11.550	0.900	Open Manhole		1200
S1.001	o	225		S2 12.750	11.293	1.232	Open Manhole		1200
S1.002	o	225		S3 12.798	11.069	1.504	Open Manhole		1200
S1.003	o	225		S4 13.000	10.854	1.921	Open Manhole		1200
S1.004	o	225		S5 13.000	10.817	1.958	Open Manhole		1200
S1.005	o	225	STree Pit 1	12.940	10.768	1.947	Open Manhole		1200
S2.000	o	300	SCourtyard L00	13.000	11.000	1.700	Open Manhole		1200
S2.001	o	300	S8	13.000	10.893	1.807	Open Manhole		1200
S3.000	o	150	SBlue Roof 1	20.000	19.500	0.350	Junction		
S3.001	o	150	S9	20.000	19.388	0.462	Junction		
S2.002	o	300	S10	13.000	10.636	2.064	Open Manhole		1200
S1.006	o	300	S6	12.940	10.555	2.085	Open Manhole		1200
S4.000	o	150	SBlue Roof 2	20.000	19.500	0.350	Junction		
S4.001	o	150	S11	20.000	19.432	0.418	Junction		
S1.007	o	300	STree Pit 2	12.940	10.449	2.191	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., (mm)	L*W
S1.000	18.191	100.0		S2 12.750	11.368	1.232	Open Manhole		1200
S1.001	33.649	150.0		S3 12.798	11.069	1.504	Open Manhole		1200
S1.002	32.158	150.0		S4 13.000	10.854	1.921	Open Manhole		1200
S1.003	5.588	150.0		S5 13.000	10.817	1.958	Open Manhole		1200
S1.004	7.286	150.0	STree Pit 1	12.940	10.768	1.947	Open Manhole		1200
S1.005	12.779	92.3	S6	12.940	10.630	2.085	Open Manhole		1200
S2.000	10.979	102.6	S8	13.000	10.893	1.807	Open Manhole		1200
S2.001	11.967	111.8	S10	13.000	10.786	1.914	Open Manhole		1200
S3.000	7.305	65.2	S9	20.000	19.388	0.462	Junction		
S3.001	2.131	0.2	S10	13.000	10.786	2.064	Open Manhole		1200
S2.002	4.740	58.5	S6	12.940	10.555	2.085	Open Manhole		1200
S1.006	15.910	150.1	STree Pit 2	12.940	10.449	2.191	Open Manhole		1200
S4.000	4.004	58.9	S11	20.000	19.432	0.418	Junction		
S4.001	4.004	0.5	STree Pit 2	12.940	11.432	1.358	Open Manhole		1200
S1.007	23.556	150.0	S7	12.440	10.292	1.848	Open Manhole		1200
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<u>PIPELINE SCHEDULES for Storm</u> <u>Upstream Manhole</u> <table><thead><tr><th>PN</th><th>Hyd Sect</th><th>Diam (mm)</th><th>MH Name</th><th>C.Level (m)</th><th>I.Level (m)</th><th>D.Depth (m)</th><th>MH Connection</th><th>MH DIAM., L*W (mm)</th></tr></thead><tbody><tr><td>S5.000</td><td>o</td><td>150</td><td>SBlue Roof 3</td><td>20.000</td><td>19.500</td><td>0.350</td><td>Junction</td><td></td></tr><tr><td>S5.001</td><td>o</td><td>150</td><td>S14</td><td>20.000</td><td>19.316</td><td>0.534</td><td>Junction</td><td></td></tr><tr><td>S6.000</td><td>o</td><td>150</td><td>SBlue Roof 4</td><td>20.000</td><td>19.500</td><td>0.350</td><td>Junction</td><td></td></tr><tr><td>S6.001</td><td>o</td><td>150</td><td>S16</td><td>20.000</td><td>19.368</td><td>0.482</td><td>Junction</td><td></td></tr><tr><td>S5.002</td><td>o</td><td>300</td><td>SCourtyard 2 L00</td><td>13.000</td><td>11.500</td><td>1.200</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S7.000</td><td>o</td><td>150</td><td>SBlue Roof 5</td><td>20.000</td><td>19.500</td><td>0.350</td><td>Junction</td><td></td></tr><tr><td>S7.001</td><td>o</td><td>150</td><td>S16</td><td>20.000</td><td>19.395</td><td>0.455</td><td>Junction</td><td></td></tr><tr><td>S5.003</td><td>o</td><td>300</td><td>S10</td><td>13.000</td><td>11.442</td><td>1.258</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S1.008</td><td>o</td><td>300</td><td>S7</td><td>12.440</td><td>10.292</td><td>1.848</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S1.009</td><td>o</td><td>300</td><td>S8</td><td>11.900</td><td>10.230</td><td>1.370</td><td>Open Manhole</td><td>1200</td></tr></tbody></table> <u>Downstream Manhole</u> <table><thead><tr><th>PN</th><th>Length (m)</th><th>Slope (1:X)</th><th>MH Name</th><th>C.Level (m)</th><th>I.Level (m)</th><th>D.Depth (m)</th><th>MH Connection</th><th>MH DIAM., L*W (mm)</th></tr></thead><tbody><tr><td>S5.000</td><td>10.784</td><td>58.6</td><td>S14</td><td>20.000</td><td>19.316</td><td>0.534</td><td>Junction</td><td></td></tr><tr><td>S5.001</td><td>9.620</td><td>1.3</td><td>SCourtyard 2 L00</td><td>13.000</td><td>11.650</td><td>1.200</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S6.000</td><td>7.743</td><td>58.7</td><td>S16</td><td>20.000</td><td>19.368</td><td>0.482</td><td>Junction</td><td></td></tr><tr><td>S6.001</td><td>6.617</td><td>0.9</td><td>SCourtyard 2 L00</td><td>13.000</td><td>11.650</td><td>1.200</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S5.002</td><td>8.679</td><td>150.0</td><td>S10</td><td>13.000</td><td>11.442</td><td>1.258</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S7.000</td><td>5.656</td><td>53.9</td><td>S16</td><td>20.000</td><td>19.395</td><td>0.455</td><td>Junction</td><td></td></tr><tr><td>S7.001</td><td>3.335</td><td>0.4</td><td>S10</td><td>13.000</td><td>11.592</td><td>1.258</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S5.003</td><td>8.710</td><td>150.2</td><td>S7</td><td>12.440</td><td>11.384</td><td>0.756</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S1.008</td><td>9.317</td><td>150.3</td><td>S8</td><td>11.900</td><td>10.230</td><td>1.370</td><td>Open Manhole</td><td>1200</td></tr><tr><td>S1.009</td><td>13.243</td><td>150.5</td><td>SMH 8512</td><td>11.640</td><td>10.142</td><td>1.198</td><td>Open Manhole</td><td>0</td></tr></tbody></table>									PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)	S5.000	o	150	SBlue Roof 3	20.000	19.500	0.350	Junction		S5.001	o	150	S14	20.000	19.316	0.534	Junction		S6.000	o	150	SBlue Roof 4	20.000	19.500	0.350	Junction		S6.001	o	150	S16	20.000	19.368	0.482	Junction		S5.002	o	300	SCourtyard 2 L00	13.000	11.500	1.200	Open Manhole	1200	S7.000	o	150	SBlue Roof 5	20.000	19.500	0.350	Junction		S7.001	o	150	S16	20.000	19.395	0.455	Junction		S5.003	o	300	S10	13.000	11.442	1.258	Open Manhole	1200	S1.008	o	300	S7	12.440	10.292	1.848	Open Manhole	1200	S1.009	o	300	S8	11.900	10.230	1.370	Open Manhole	1200	PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)	S5.000	10.784	58.6	S14	20.000	19.316	0.534	Junction		S5.001	9.620	1.3	SCourtyard 2 L00	13.000	11.650	1.200	Open Manhole	1200	S6.000	7.743	58.7	S16	20.000	19.368	0.482	Junction		S6.001	6.617	0.9	SCourtyard 2 L00	13.000	11.650	1.200	Open Manhole	1200	S5.002	8.679	150.0	S10	13.000	11.442	1.258	Open Manhole	1200	S7.000	5.656	53.9	S16	20.000	19.395	0.455	Junction		S7.001	3.335	0.4	S10	13.000	11.592	1.258	Open Manhole	1200	S5.003	8.710	150.2	S7	12.440	11.384	0.756	Open Manhole	1200	S1.008	9.317	150.3	S8	11.900	10.230	1.370	Open Manhole	1200	S1.009	13.243	150.5	SMH 8512	11.640	10.142	1.198	Open Manhole	0
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<u>Area Summary for Storm</u>							
Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)	
1.000	Classification	Hardstanding	90	0.021	0.019	0.019	
1.001	Classification	Hardstanding	90	0.013	0.012	0.012	
1.002	Classification	Hardstanding	90	0.008	0.007	0.007	
1.003	Classification	Hardstanding	90	0.005	0.005	0.005	
1.004	Classification	Hardstanding	90	0.002	0.002	0.002	
1.005	Classification	Hardstanding	90	0.003	0.003	0.003	
2.000	Classification	Courtyard & Green Roof	70	0.031	0.022	0.022	
	Classification	Roof	95	0.026	0.025	0.047	
	Classification	Roof	95	0.028	0.027	0.073	
	Classification	Roof	95	0.024	0.023	0.096	
	Classification	Roof	95	0.012	0.011	0.107	
	Classification	Roof	95	0.005	0.005	0.112	
	Classification	Roof	95	0.009	0.009	0.121	
	Classification	Roof	95	0.009	0.009	0.130	
2.001	-	-	100	0.000	0.000	0.000	
3.000	Classification	Courtyard & Green Roof	70	0.009	0.007	0.007	
3.001	Classification	Hardstanding	90	0.001	0.001	0.001	
2.002	-	-	100	0.000	0.000	0.000	
1.006	Classification	Hardstanding	90	0.005	0.005	0.005	
4.000	Classification	Courtyard & Green Roof	70	0.008	0.005	0.005	
	Classification	Roof	95	0.002	0.002	0.007	
4.001	-	-	100	0.000	0.000	0.000	
1.007	Classification	Hardstanding	90	0.006	0.005	0.005	
5.000	Classification	Courtyard & Green Roof	70	0.010	0.007	0.007	
	Classification	Roof	95	0.004	0.004	0.011	
5.001	-	-	100	0.000	0.000	0.000	
6.000	Classification	Courtyard & Green Roof	70	0.012	0.009	0.009	
6.001	-	-	100	0.000	0.000	0.000	
5.002	Classification	Courtyard & Green Roof	70	0.022	0.016	0.016	
	Classification	Roof	95	0.018	0.017	0.032	
	Classification	Roof	95	0.001	0.001	0.034	
	Classification	Roof	95	0.012	0.011	0.045	
	Classification	Courtyard & Green Roof	70	0.026	0.018	0.063	
7.000	Classification	Courtyard & Green Roof	70	0.009	0.006	0.006	
7.001	-	-	100	0.000	0.000	0.000	
5.003	-	-	100	0.000	0.000	0.000	
1.008	Classification	Hardstanding	90	0.004	0.004	0.004	
	Classification	Hardstanding	90	0.001	0.001	0.005	
1.009	Classification	Hardstanding	90	0.004	0.004	0.004	
				Total	Total	Total	
				0.351	0.298	0.298	
<u>Free Flowing Outfall Details for Storm</u>							
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)	
S1.009	SMH 8512	11.640	10.142	10.080	0	0	
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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 8	Number of Time/Area Diagrams 0
Number of Offline Controls 0	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S9, DS/PN: S3.001, Volume (m³): 0.1

Unit Reference	MD-SHE-0020-1000-0150-1000
Design Head (m)	0.150
Design Flow (l/s)	0.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	20
Invert Level (m)	19.388
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.150	0.1
Flush-Flo™	0.041	0.1
Kick-Flo®	0.102	0.1
Mean Flow over Head Range	-	0.1

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	0.1	1.200	0.2	3.000	0.4	7.000	0.6
0.200	0.1	1.400	0.2	3.500	0.4	7.500	0.6
0.300	0.1	1.600	0.3	4.000	0.4	8.000	0.6
0.400	0.1	1.800	0.3	4.500	0.4	8.500	0.6
0.500	0.2	2.000	0.3	5.000	0.5	9.000	0.6
0.600	0.2	2.200	0.3	5.500	0.5	9.500	0.6
0.800	0.2	2.400	0.3	6.000	0.5		
1.000	0.2	2.600	0.3	6.500	0.5		

Hydro-Brake® Optimum Manhole: S10, DS/PN: S2.002, Volume (m³): 3.5

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	10.636
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: S10, DS/PN: S2.002, Volume (m³): 3.5

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0
Flush-Flo™	0.205	0.8
Kick-Flo®	0.415	0.7
Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: S11, DS/PN: S4.001, Volume (m³): 0.1

Unit Reference	MD-SHE-0020-1000-0150-1000
Design Head (m)	0.150
Design Flow (l/s)	0.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	20
Invert Level (m)	19.432
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.150	0.1
Flush-Flo™	0.041	0.1
Kick-Flo®	0.102	0.1
Mean Flow over Head Range	-	0.1

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	0.1	0.300	0.1	0.500	0.2	0.800	0.2
0.200	0.1	0.400	0.1	0.600	0.2	1.000	0.2

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<u>Hydro-Brake® Optimum Manhole: S11, DS/PN: S4.001, Volume (m³): 0.1</u>					
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	0.2	2.400	0.3	5.000	0.5
1.400	0.2	2.600	0.3	5.500	0.5
1.600	0.3	3.000	0.4	6.000	0.5
1.800	0.3	3.500	0.4	6.500	0.5
2.000	0.3	4.000	0.4	7.000	0.6
2.200	0.3	4.500	0.4	7.500	0.6
<u>Hydro-Brake® Optimum Manhole: S14, DS/PN: S5.001, Volume (m³): 0.2</u>					
Unit Reference MD-SHE-0020-1000-0150-1000					
Design Head (m) 0.150					
Design Flow (l/s) 0.1					
Flush-Flo™ Calculated					
Objective Minimise upstream storage					
Application Surface					
Sump Available Yes					
Diameter (mm) 20					
Invert Level (m) 19.316					
Minimum Outlet Pipe Diameter (mm) 75					
Suggested Manhole Diameter (mm) 1200					
Control Points Head (m) Flow (l/s)					
Design Point (Calculated) 0.150 0.1					
Flush-Flo™ 0.041 0.1					
Kick-Flo® 0.102 0.1					
Mean Flow over Head Range - 0.1					
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)
0.100	0.1	1.200	0.2	3.000	0.4
0.200	0.1	1.400	0.2	3.500	0.4
0.300	0.1	1.600	0.3	4.000	0.4
0.400	0.1	1.800	0.3	4.500	0.4
0.500	0.2	2.000	0.3	5.000	0.5
0.600	0.2	2.200	0.3	5.500	0.5
0.800	0.2	2.400	0.3	6.000	0.5
1.000	0.2	2.600	0.3	6.500	0.5
<u>Hydro-Brake® Optimum Manhole: S16, DS/PN: S6.001, Volume (m³): 0.1</u>					
Unit Reference MD-SHE-0020-1000-0150-1000					
Design Head (m) 0.150					
Design Flow (l/s) 0.1					
Flush-Flo™ Calculated					
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<u>Hydro-Brake® Optimum Manhole: S16, DS/PN: S6.001, Volume (m³): 0.1</u> Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 20 Invert Level (m) 19.368 Minimum Outlet Pipe Diameter (mm) 75 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.150</td><td>0.1</td></tr><tr><td>Flush-Flo™</td><td>0.041</td><td>0.1</td></tr><tr><td>Kick-Flo®</td><td>0.102</td><td>0.1</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>0.1</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>0.1</td><td>1.200</td><td>0.2</td><td>3.000</td><td>0.4</td><td>7.000</td><td>0.6</td></tr><tr><td>0.200</td><td>0.1</td><td>1.400</td><td>0.2</td><td>3.500</td><td>0.4</td><td>7.500</td><td>0.6</td></tr><tr><td>0.300</td><td>0.1</td><td>1.600</td><td>0.3</td><td>4.000</td><td>0.4</td><td>8.000</td><td>0.6</td></tr><tr><td>0.400</td><td>0.1</td><td>1.800</td><td>0.3</td><td>4.500</td><td>0.4</td><td>8.500</td><td>0.6</td></tr><tr><td>0.500</td><td>0.2</td><td>2.000</td><td>0.3</td><td>5.000</td><td>0.5</td><td>9.000</td><td>0.6</td></tr><tr><td>0.600</td><td>0.2</td><td>2.200</td><td>0.3</td><td>5.500</td><td>0.5</td><td>9.500</td><td>0.6</td></tr><tr><td>0.800</td><td>0.2</td><td>2.400</td><td>0.3</td><td>6.000</td><td>0.5</td><td></td><td></td></tr><tr><td>1.000</td><td>0.2</td><td>2.600</td><td>0.3</td><td>6.500</td><td>0.5</td><td></td><td></td></tr></table> <u>Hydro-Brake® Optimum Manhole: S16, DS/PN: S7.001, Volume (m³): 0.1</u> Unit Reference MD-SHE-0020-1000-0150-1000 Design Head (m) 0.150 Design Flow (l/s) 0.1 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 20 Invert Level (m) 19.395 Minimum Outlet Pipe Diameter (mm) 75 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.150</td><td>0.1</td></tr><tr><td>Flush-Flo™</td><td>0.041</td><td>0.1</td></tr><tr><td>Kick-Flo®</td><td>0.102</td><td>0.1</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>0.1</td></tr></table> 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			Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.150	0.1	Flush-Flo™	0.041	0.1	Kick-Flo®	0.102	0.1	Mean Flow over Head Range	-	0.1	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	0.1	1.200	0.2	3.000	0.4	7.000	0.6	0.200	0.1	1.400	0.2	3.500	0.4	7.500	0.6	0.300	0.1	1.600	0.3	4.000	0.4	8.000	0.6	0.400	0.1	1.800	0.3	4.500	0.4	8.500	0.6	0.500	0.2	2.000	0.3	5.000	0.5	9.000	0.6	0.600	0.2	2.200	0.3	5.500	0.5	9.500	0.6	0.800	0.2	2.400	0.3	6.000	0.5			1.000	0.2	2.600	0.3	6.500	0.5			Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.150	0.1	Flush-Flo™	0.041	0.1	Kick-Flo®	0.102	0.1	Mean Flow over Head Range	-	0.1
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<u>Hydro-Brake® Optimum Manhole: S8, DS/PN: S1.009, Volume (m³): 2.5</u> Unit Reference MD-SHE-0061-2000-1500-2000 Design Head (m)1.500 Design Flow (l/s)2.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)61 Invert Level (m)10.230 Minimum Outlet Pipe Diameter (mm)75 Suggested Manhole Diameter (mm)1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>2.0</td></tr><tr><td>Flush-Flo™</td><td>0.269</td><td>1.6</td></tr><tr><td>Kick-Flo®</td><td>0.545</td><td>1.3</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>1.5</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>1.3</td><td>1.200</td><td>1.8</td><td>3.000</td><td>2.7</td><td>7.000</td><td>4.1</td></tr><tr><td>0.200</td><td>1.5</td><td>1.400</td><td>1.9</td><td>3.500</td><td>3.0</td><td>7.500</td><td>4.2</td></tr><tr><td>0.300</td><td>1.6</td><td>1.600</td><td>2.1</td><td>4.000</td><td>3.1</td><td>8.000</td><td>4.3</td></tr><tr><td>0.400</td><td>1.5</td><td>1.800</td><td>2.2</td><td>4.500</td><td>3.3</td><td>8.500</td><td>4.5</td></tr><tr><td>0.500</td><td>1.4</td><td>2.000</td><td>2.3</td><td>5.000</td><td>3.5</td><td>9.000</td><td>4.6</td></tr><tr><td>0.600</td><td>1.3</td><td>2.200</td><td>2.4</td><td>5.500</td><td>3.6</td><td>9.500</td><td>4.7</td></tr><tr><td>0.800</td><td>1.5</td><td>2.400</td><td>2.5</td><td>6.000</td><td>3.8</td><td></td><td></td></tr><tr><td>1.000</td><td>1.7</td><td>2.600</td><td>2.6</td><td>6.500</td><td>3.9</td><td></td><td></td></tr></table>			Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	2.0	Flush-Flo™	0.269	1.6	Kick-Flo®	0.545	1.3	Mean Flow over Head Range	-	1.5	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.1	0.200	1.5	1.400	1.9	3.500	3.0	7.500	4.2	0.300	1.6	1.600	2.1	4.000	3.1	8.000	4.3	0.400	1.5	1.800	2.2	4.500	3.3	8.500	4.5	0.500	1.4	2.000	2.3	5.000	3.5	9.000	4.6	0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7	0.800	1.5	2.400	2.5	6.000	3.8			1.000	1.7	2.600	2.6	6.500	3.9		
Control Points	Head (m)	Flow (l/s)																																																																																							
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0.200	1.5	1.400	1.9	3.500	3.0	7.500	4.2																																																																																		
0.300	1.6	1.600	2.1	4.000	3.1	8.000	4.3																																																																																		
0.400	1.5	1.800	2.2	4.500	3.3	8.500	4.5																																																																																		
0.500	1.4	2.000	2.3	5.000	3.5	9.000	4.6																																																																																		
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7																																																																																		
0.800	1.5	2.400	2.5	6.000	3.8																																																																																				
1.000	1.7	2.600	2.6	6.500	3.9																																																																																				
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Innovyze	Network 2020.1.3																																																																									
Storage Structures for Storm Cellular Storage Manhole: STree Pit 1, DS/PN: S1.005 Invert Level (m) 10.768 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>20.0</td><td>0.0</td><td>1.001</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>20.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: SCourtyard L00, DS/PN: S2.000 Invert Level (m) 11.000 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>143.0</td><td>0.0</td><td>0.901</td><td>0.0</td><td>0.0</td></tr><tr><td>0.900</td><td>143.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: SBlue Roof 1, DS/PN: S3.000 Invert Level (m) 19.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>56.0</td><td>0.0</td><td>0.151</td><td>0.0</td><td>0.0</td></tr><tr><td>0.150</td><td>56.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: SBlue Roof 2, DS/PN: S4.000 Invert Level (m) 19.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>44.0</td><td>0.0</td><td>0.151</td><td>0.0</td><td>0.0</td></tr><tr><td>0.150</td><td>44.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: STree Pit 2, DS/PN: S1.007 Invert Level (m) 10.502 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	20.0	0.0	1.001	0.0	0.0	1.000	20.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	143.0	0.0	0.901	0.0	0.0	0.900	143.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	56.0	0.0	0.151	0.0	0.0	0.150	56.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	44.0	0.0	0.151	0.0	0.0	0.150	44.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	20.0	0.0	1.001	0.0	0.0																																																																					
1.000	20.0	0.0																																																																								
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	143.0	0.0	0.901	0.0	0.0																																																																					
0.900	143.0	0.0																																																																								
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	56.0	0.0	0.151	0.0	0.0																																																																					
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Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	44.0	0.0	0.151	0.0	0.0																																																																					
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Innovyze	Network 2020.1.3																																																																																											
<u>Cellular Storage Manhole: STree Pit 2, DS/PN: S1.007</u> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>20.0</td><td>0.0</td><td>1.001</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>20.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: SBlue Roof 3, DS/PN: S5.000</u> Invert Level (m) 19.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>73.5</td><td>0.0</td><td>0.151</td><td>0.0</td><td>0.0</td></tr><tr><td>0.150</td><td>73.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: SBlue Roof 4, DS/PN: S6.000</u> Invert Level (m) 19.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>73.5</td><td>0.0</td><td>0.151</td><td>0.0</td><td>0.0</td></tr><tr><td>0.150</td><td>73.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: SCourtyard 2 L00, DS/PN: S5.002</u> Invert Level (m) 11.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>115.0</td><td>0.0</td><td>0.901</td><td>0.0</td><td>0.0</td></tr><tr><td>0.900</td><td>115.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: SBlue Roof 5, DS/PN: S7.000</u> Invert Level (m) 19.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>46.0</td><td>0.0</td><td>0.151</td><td>0.0</td><td>0.0</td></tr><tr><td>0.150</td><td>46.0</td><td>0.0</td><td></td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	20.0	0.0	1.001	0.0	0.0	1.000	20.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	73.5	0.0	0.151	0.0	0.0	0.150	73.5	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	73.5	0.0	0.151	0.0	0.0	0.150	73.5	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	115.0	0.0	0.901	0.0	0.0	0.900	115.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	46.0	0.0	0.151	0.0	0.0	0.150	46.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																																							
0.000	20.0	0.0	1.001	0.0	0.0																																																																																							
1.000	20.0	0.0																																																																																										
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0.000	73.5	0.0	0.151	0.0	0.0																																																																																							
0.150	73.5	0.0																																																																																										
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																																							
0.000	73.5	0.0	0.151	0.0	0.0																																																																																							
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Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																																							
0.000	115.0	0.0	0.901	0.0	0.0																																																																																							
0.900	115.0	0.0																																																																																										
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																																							
0.000	46.0	0.0	0.151	0.0	0.0																																																																																							
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)

for Storm

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coeffiecient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Online Controls 8

Number of Offline Controls 0

Number of Storage Structures 9

Number of Time/Area Diagrams 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 533705 191591 TQ 33705 91591

Data Type Point

Cv (Summer) 0.950

Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status OFF

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 2, 10, 30, 100

Climate Change (%) 0, 0, 0, 0

PN

US/MH Name

Storm

Return Period

Climate Change

First (X) Surge

First (Y) Flood

First (Z) Overflow

S1.000

S1

15 Summer

2

+0%

S1.001

S2

15 Summer

2

+0%

S1.002

S3

15 Summer

2

+0%

100/180 Summer

S1.003

S4

15 Summer

2

+0%

30/180 Summer

S1.004

S5

15 Summer

2

+0%

30/120 Summer

S1.005

STree Pit 1

15 Summer

2

+0%

10/240 Summer

S2.000

SCourtyard L00

360 Winter

2

+0%

30/120 Summer

S2.001

S8

360 Winter

2

+0%

10/60 Winter

S3.000

SBlue Roof 1

240 Summer

2

+0%

S3.001

S9

240 Summer

2

+0%

S2.002

S10

360 Winter

2

+0%

2/15 Summer

S1.006

S6

360 Summer

2

+0%

10/60 Summer

S4.000

SBlue Roof 2

240 Summer

2

+0%

S4.001

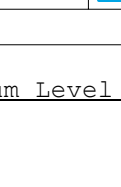
S11

240 Summer

2

+0%

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10 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 * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	8	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

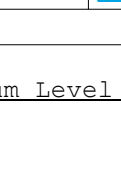
Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Cv (Summer)	0.950
Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 10, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow
S1.000		S1 15 Summer	10	+0%			
S1.001		S2 15 Summer	10	+0%			
S1.002		S3 15 Summer	10	+0%	100/180 Summer		
S1.003		S4 360 Winter	10	+0%	30/180 Summer		
S1.004		S5 360 Winter	10	+0%	30/120 Summer		
S1.005	S	Tree Pit 1 360 Winter	10	+0%	10/240 Summer		
S2.000	S	Courtyard L00 360 Winter	10	+0%	30/120 Summer		
S2.001		S8 360 Winter	10	+0%	10/60 Winter		
S3.000	S	Blue Roof 1 180 Winter	10	+0%			
S3.001		S9 180 Winter	10	+0%			
S2.002		S10 360 Winter	10	+0%	2/15 Summer		
S1.006		S6 360 Winter	10	+0%	10/60 Summer		
S4.000	S	Blue Roof 2 180 Winter	10	+0%			
S4.001		S11 180 Winter	10	+0%			

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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 Coeffiecient	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	8	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Cv (Summer)	0.950
Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 10, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow
S1.000		S1 15 Summer	30	+0%			
S1.001		S2 15 Summer	30	+0%			
S1.002		S3 15 Summer	30	+0%	100/180 Summer		
S1.003		S4 360 Winter	30	+0%	30/180 Summer		
S1.004		S5 360 Winter	30	+0%	30/120 Summer		
S1.005	S	Tree Pit 1 360 Winter	30	+0%	10/240 Summer		
S2.000	S	Courtyard L00 360 Winter	30	+0%	30/120 Summer		
S2.001		S8 360 Winter	30	+0%	10/60 Winter		
S3.000	S	Blue Roof 1 180 Winter	30	+0%			
S3.001		S9 120 Summer	30	+0%			
S2.002		S10 360 Winter	30	+0%	2/15 Summer		
S1.006		S6 360 Winter	30	+0%	10/60 Summer		
S4.000	S	Blue Roof 2 180 Winter	30	+0%			
S4.001		S11 180 Winter	30	+0%			

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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 8 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 FEH Rainfall Version 2013
 Site Location GB 533705 191591 TQ 33705 91591
 Data Type Point
 Cv (Summer) 0.950
 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440, 2160, 2880, 4320, 5760,
 7200, 8640, 10080
 Return Period(s) (years) 100
 Climate Change (%) 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.000		S1 480 Winter	100	+40%	100/15 Summer		
S1.001		S2 480 Winter	100	+40%	100/120 Summer		
S1.002		S3 480 Winter	100	+40%	100/60 Summer		
S1.003		S4 480 Winter	100	+40%	100/15 Summer		
S1.004		S5 480 Winter	100	+40%	100/15 Summer		
S1.005	STree Pit 1	480 Winter	100	+40%	100/15 Summer		
S2.000	SCourtyard L00	600 Winter	100	+40%	100/15 Summer		
S2.001		S8 600 Winter	100	+40%	100/15 Summer		
S3.000	SBlue Roof 1	360 Winter	100	+40%			
S3.001		S9 15 Summer	100	+40%			
S2.002		S10 600 Winter	100	+40%	100/15 Summer		

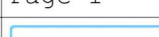
100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for Storm

PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)
	Name	Storm	Period	Change	Surcharge	Flood	Overflow	
S1.006	S6	480 Winter	100	+40%	100/15	Summer		
S4.000	SBlue Roof 2	360 Winter	100	+40%				
S4.001	S11	960 Winter	100	+40%				
S1.007	STree Pit 2	480 Winter	100	+40%	100/15	Summer		
S5.000	SBlue Roof 3	360 Winter	100	+40%				
S5.001	S14	15 Summer	100	+40%				
S6.000	SBlue Roof 4	360 Winter	100	+40%				
S6.001	S16	15 Summer	100	+40%				
S5.002	SCourtyard 2 L00	1440 Winter	100	+40%	100/60	Summer		
S7.000	SBlue Roof 5	240 Winter	100	+40%				
S7.001	S16	15 Summer	100	+40%				
S5.003	S10	1440 Winter	100	+40%	100/30	Summer		
S1.008	S7	480 Winter	100	+40%	100/15	Summer		
S1.009	S8	480 Winter	100	+40%	100/15	Summer		

			Water	Surcharged	Flooded		Half Drain
PN	US/MH Name	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s) Time (mins)
S1.006		S6	11.870	1.015	0.000	0.04	
S4.000	SBlue Roof 2		19.625	-0.025	0.000	0.01	
S4.001		S11	19.582	0.000	0.000	0.00	
S1.007	S	Tree Pit 2	11.869	1.120	0.000	0.05	
S5.000	SBlue Roof 3		19.624	-0.026	0.000	0.01	
S5.001		S14	19.466	0.000	0.000	0.00	
S6.000	SBlue Roof 4		19.596	-0.054	0.000	0.01	
S6.001		S16	19.518	0.000	0.000	0.00	
S5.002	S	Courtyard 2 L00	12.210	0.410	0.000	0.01	
S7.000	SBlue Roof 5		19.604	-0.046	0.000	0.01	
S7.001		S16	19.545	0.000	0.000	0.00	
S5.003		S10	12.212	0.470	0.000	0.01	
S1.008		S7	11.867	1.275	0.000	0.05	
S1.009		S8	11.866	1.336	0.000	0.03	

PN	US/MH Name	Pipe Flow (1/s)	Status	Level Exceeded
S1.006	S6	3.0	SURCHARGED	
S4.000	SBlue Roof 2	0.1	OK*	
S4.001	S11	0.1	SURCHARGED*	
S1.007	STree Pit 2	3.8	SURCHARGED	
S5.000	SBlue Roof 3	0.2	OK*	
S5.001	S14	0.1	SURCHARGED*	
S6.000	SBlue Roof 4	0.2	OK*	
S6.001	S16	0.1	SURCHARGED*	

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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>				
PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S5.002	SCourtyard 2 L00	0.4	SURCHARGED	
S7.000	SBlue Roof 5	0.2	OK*	
S7.001		S16 0.1	SURCHARGED*	
S5.003		S10 0.4	SURCHARGED	
S1.008		S7 3.1	SURCHARGED	
S1.009		S8 2.1	FLOOD RISK	
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FOUL SEWERAGE DESIGN

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	6.839	0.046	148.7	0.000	0	2.2	1.500	o	229	Pipe/Conduit
2.000	12.499	0.156	80.1	0.000	0	2.2	1.500	o	150	Pipe/Conduit
3.000	54.379	0.363	149.8	0.000	0	2.2	1.500	o	150	Pipe/Conduit
2.001	26.174	0.174	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit
2.002	25.593	0.171	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit
2.003	6.820	0.045	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit
1.001	23.508	0.118	200.0	0.000	0	0.0	1.500	o	229	Pipe/Conduit
4.000	4.789	0.060	79.8	0.000	0	2.2	1.500	o	100	Pipe/Conduit
4.001	15.533	0.194	80.0	0.000	0	0.0	1.500	o	100	Pipe/Conduit

PN	US/IL (m)	E Area (ha)	E Base Flow (l/s)	E Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	10.995	0.000	2.2	0	0.0	37	0.51	0.95	39.2	2.2
2.000	11.650	0.000	2.2	0	0.0	36	0.67	0.98	17.3	2.2
3.000	11.650	0.000	2.2	0	0.0	42	0.53	0.71	12.6	2.2
2.001	11.287	0.000	4.4	0	0.0	61	0.65	0.71	12.6	4.4
2.002	11.113	0.000	4.4	0	0.0	61	0.65	0.71	12.6	4.4
2.003	10.942	0.000	4.4	0	0.0	61	0.65	0.71	12.6	4.4
1.001	10.817	0.000	6.6	0	0.0	69	0.64	0.82	33.8	6.6
4.000	11.700	0.000	2.2	0	0.0	43	0.69	0.74	5.8	2.2
4.001	11.640	0.000	2.2	0	0.0	43	0.69	0.74	5.8	2.2

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Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
MH7505	13.250	2.255	Open Manhole	1200	1.000	10.995	229				
New MH	12.750	1.100	Open Manhole	1200	2.000	11.650	150				
3	12.500	0.850	Open Manhole	1200	3.000	11.650	150				
3	12.775	1.488	Open Manhole	1200	2.001	11.287	150	2.000	11.494	150	207
								3.000	11.287	150	
5	12.800	1.687	Open Manhole	1200	2.002	11.113	150	2.001	11.113	150	
MH8407	13.000	2.058	Open Manhole	1200	2.003	10.942	150	2.002	10.942	150	
2	13.065	2.248	Open Manhole	1200	1.001	10.817	229	1.000	10.949	229	132
								2.003	10.896	150	
8	13.000	1.300	Open Manhole	1200	4.000	11.700	100				
9	13.000	1.360	Open Manhole	1200	4.001	11.640	100	4.000	11.640	100	
8	12.973	2.273	Open Manhole	1200	1.002	10.700	229	1.001	10.700	229	
								4.001	11.446	100	617
MH8507	12.880	2.230	Open Manhole	1200	1.003	10.650	229	1.002	10.650	229	
12	13.000	1.300	Open Manhole	1200	5.000	11.700	100				
10	12.205	1.655	Open Manhole	1200	1.004	10.550	229	1.003	10.550	229	
								5.000	11.557	100	878
MH8517	11.530	1.065	Open Manhole	1200		OUTFALL		1.004	10.465	229	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
MH7505	533786.988	191534.710	533786.988	191534.710	Required	
New MH	533800.769	191464.021	533800.769	191464.021	Required	
3	533852.340	191485.798	533852.340	191485.798	Required	
3	533798.786	191476.361	533798.786	191476.361	Required	
5	533794.746	191502.221	533794.746	191502.221	Required	
MH8407	533790.972	191527.535	533790.972	191527.535	Required	

Manhole Schedules for Foul - Main

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
	2 533793.761	191533.758	533793.761	191533.758	Required	
	8 533814.992	191510.455	533814.992	191510.455	Required	
	9 533814.205	191515.179	533814.205	191515.179	Required	
	8 533817.035	191530.452	533817.035	191530.452	Required	
MH8507	533829.455	191528.872	533829.455	191528.872	Required	
	12 533853.100	191513.762	533853.100	191513.762	Required	
	10 533854.157	191525.133	533854.157	191525.133	Required	
MH8517	533875.112	191522.326			No Entry	

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PIPELINE SCHEDULES for Foul - Main

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)
1.000	o	229	MH7505	13.250	10.995	2.026	Open Manhole	1200
2.000	o	150	New MH	12.750	11.650	0.950	Open Manhole	1200
3.000	o	150	3	12.500	11.650	0.700	Open Manhole	1200
2.001	o	150	3	12.775	11.287	1.338	Open Manhole	1200
2.002	o	150	5	12.800	11.113	1.537	Open Manhole	1200
2.003	o	150	MH8407	13.000	10.942	1.908	Open Manhole	1200
1.001	o	229	2	13.065	10.817	2.019	Open Manhole	1200
4.000	o	100	8	13.000	11.700	1.200	Open Manhole	1200
4.001	o	100	9	13.000	11.640	1.260	Open Manhole	1200
1.002	o	229	8	12.973	10.700	2.044	Open Manhole	1200
1.003	o	229	MH8507	12.880	10.650	2.001	Open Manhole	1200
5.000	o	100	12	13.000	11.700	1.200	Open Manhole	1200
1.004	o	229	10	12.205	10.550	1.426	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)
1.000	6.839	148.7	2	13.065	10.949	1.887	Open Manhole	1200
2.000	12.499	80.1	3	12.775	11.494	1.131	Open Manhole	1200
3.000	54.379	149.8	3	12.775	11.287	1.338	Open Manhole	1200
2.001	26.174	150.0	5	12.800	11.113	1.537	Open Manhole	1200
2.002	25.593	150.0	MH8407	13.000	10.942	1.908	Open Manhole	1200
2.003	6.820	150.0	2	13.065	10.896	2.019	Open Manhole	1200
1.001	23.508	200.0	8	12.973	10.700	2.044	Open Manhole	1200
4.000	4.789	79.8	9	13.000	11.640	1.260	Open Manhole	1200
4.001	15.533	80.0	8	12.973	11.446	1.427	Open Manhole	1200
1.002	12.520	250.0	MH8507	12.880	10.650	2.001	Open Manhole	1200
1.003	24.983	250.0	10	12.205	10.550	1.426	Open Manhole	1200
5.000	11.421	79.9	10	12.205	11.557	0.548	Open Manhole	1200
1.004	21.143	250.0	MH8517	11.530	10.465	0.836	Open Manhole	1200

Appendix E SuDS Maintenance Plan

SUDS COMPONENT:	BIORETENTION	
MAINTENANCE	ACTION	FREQUENCY
REGULAR MAINTENANCE	- LITTER AND DEBRIS REMOVAL	MONTHLY
	- INSPECT AND CLEAR INLETS, OUTLETS AND OVERFLOWS	
	- PRUNING, TRIMMING AND GENERAL LANDSCAPE CARE	
OCCASIONAL TASKS	- REMOVAL OF SILT FROM PRE-TREATMENT STRUCTURE	AS REQUIRED
	- SURFACE REINSTATEMENT BY FORKING OR SCARIFYING	
	- REPLACEMENT OF MULCH WITH SHREDDED PRUNINGS FROM SITE OR COMPOSTED BARK	
REMEDIAL WORK	LEVEL REINSTATEMENT DUE TO EROSION OR DAMAGE	AS REQUIRED
	REPAIR OR REPLACE INLETS, OUTLETS OR OVERFLOW STRUCTURES	

SUDS COMPONENT:	GEOCELLS ATTENUATION TANKS	
MAINTENANCE	ACTION	FREQUENCY
REGULAR MAINTENANCE	- CHECK INLETS, OUTLETS, CONTROL STRUCTURES AND OVERFLOWS	MONTHLY OR ANNUALLY AS REQUIRED
OCCASIONAL TASKS	- JETTING AND SUCTION WHERE SILT HAS SETTLED	AS REQUIRED
REMEDIAL WORK	- REINSTATE	AS REQUIRED

SUDS COMPONENT:	PERMEABLE PAVING	
MAINTENANCE	ACTION	FREQUENCY
REGULAR MAINTENANCE	- SURFACE BRUSHING FOR APPEARANCE AND TO REDUCE SILT ACCUMULATION	MONTHLY
	- BRUSHING AND SUCTION SWEEP OR JET WASH AND SUCTION SWEEP PARTICULARLY FOR BLOCK PAVEMENT IN AUTUMN AFTER LEAF FALL	ANNUALLY
	- MOW GRASS EDGES TO PAVING AT 35-50mm AND REMOVE WEEDS AND LEAVES	AS REQUIRED
	- CHECK OUTLETS AND CONTROL STRUCTURES	MONTHLY DEPENDING ON DETAIL
OCCASIONAL TASKS	- JETTING AND SUCTION WHERE SILT HAS ACCUMULATED IN JOINTS OR VOIDS. REPLACE GRIT AND VIBRATE SURFACE TO LOCK FOR PERMEABLE BLOCK PAVING	AS REQUIRED
REMEDIAL WORK	- WHERE SINKAGE OR SURFACE DAMAGE OCCURS UPLIFT BLOCKS,	AS REQUIRED

	REMOVE GRIT BEDDING LAYER, GEOTEXTILE IF PRESENT AND REINSTATE TO DESIGN PROFILE	
	- REPAIR OR REPLACE INLETS, OUTLETS OR CONTROL STRUCTURES TO DESIGN DETAIL	AS REQUIRED

SUDS COMPONENT:	BLUE ROOFS	
MAINTENANCE	ACTION	FREQUENCY
REGULAR MAINTENANCE	- REMOVE DEBRIS AND LITTER TO PREVENT CLOGGING OF INLET DRAINS AND INTERFERENCE WITH PLANT GROWTH	BI-ANNUALLY AND AFTER SEVERE STORMS
	- INSPECT SOIL SUBSTRATE FOR EVIDENCE OF EROSION AND IDENTIFY SEDIMENT SOURCES	ANNUALLY AND AFTER SEVERE STORMS
	- INSPECT DRAIN INLETS TO ENSURE UNRESTRICTED RUNOFF FROM THE DRAINAGE LAYER TO THE ROOF DRAIN SYSTEM	ANNUALLY AND AFTER SEVERE STORMS
	- REMOVE NUISANCE AND INVASIVE VEGETATION SUCH AS WEEDS	BI-ANNUALLY OR AS REQUIRED
REMEDIAL WORK	- IF EROSION CHANNELS ARE EVIDENT, THESE SHOULD BE STABILISED WITH EXTRA SOIL SUBSTRATE SIMILAR TO ORIGINAL MATERIAL, AND ASOURCES OF EROSION DAMAGE ARE TO BE IDENTIFIED AND CONTROLLED	AS REQUIRED
	IF DRAIN INLET HAS SETTLED, CRACKED OR MOVED, INVESTIGATE AND REPAIR AS APPROPRIATE	AS REQUIRED

SUDS COMPONENT:	KEY DESIGN STANDARDS FOR ADOPTION INLETS, OUTLETS AND CONNECTIONS	
MAINTENANCE	ACTION	FREQUENCY
REGULAR MAINTENANCE	- LITTER AND DEBRIS REMOVAL	MONTHLY
	- GRASS CUT AROUND STRUCTURE 1m AT 50mm WHERE NECESSARY	MONTHLY
	- REMOVE SILT FROM FOREBAYS, APRONS OR OTHER STRUCTURES IF PRESENT	MONTHLY OR AS REQUIRED
	- INSPECT AND CLEAR INLETS, OUTLETS, CONTROL STRUCTURES AND OVERFLOWS	MONTHLY OR AS REQUIRED
OCCASIONAL TASKS	- REMOVAL OF TREE OR SHRUB GROWTH WITHIN 5m OF POND EDGE	AS REQUIRED

Appendix F Haringey LLFA Pro-Forma

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	The Printworks
Address & post code	819-829 High Road, Tottenham, N17 8ER
OS Grid ref. (Easting, Northing)	E 533845 N 191504
LPA reference (if applicable)	
Brief description of proposed work	Former retail units to be demolished and redevelopment of a purpose built student accommodation (Sui Generis) and flexible commercial, business and services uses (Class E)
Total site Area	3598 m ²
Total existing impervious area	3598 m ²
Total proposed impervious area	2980 m ²
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	Local area defined as Critical Drainage Area (CDA)
Existing drainage connection type and location	Brownfield Site to Storm Sewer
Designer Name	Marc Jones
Designer Position	Senior Infrastructure Engineer
Designer Company	Buro Happold

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility		
Superficial geology classification	Border between Taplow Gravel Member and the Kempton Park Gravel Member	
Bedrock geology classification	London Clay Formation	
Site infiltration rate	m/s	
Depth to groundwater level	m below ground level	
Is infiltration feasible?	No	
2b. Drainage Hierarchy		
	Feasible (Y/N)	Proposed (Y/N)
1 store rainwater for later use	N	N
2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
3 attenuate rainwater in ponds or open water features for gradual release	Y	Y
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	N	N
6 discharge rainwater to a surface water sewer/drain	Y	Y
7 discharge rainwater to the combined sewer.	N	N
2c. Proposed Discharge Details		
Proposed discharge location	610mm TW Sewer High Road (MH8512)	
Has the owner/regulator of the discharge location been consulted?	Yes. Pre-planning application submitted	

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	Existing discharge rate (l/s)	Required storage for GF rate (m ³)	Proposed discharge rate (l/s)
Qbar	0.64			
1 in 1	0.54			2
1 in 30	1.54		143	2
1 in 100	2.03		181	2
1 in 100 + CC			273	2
Climate change allowance used		40%		

3b. Principal Method of Flow Control

Hydrobrake

3c. Proposed SuDS Measures

	Catchment area (m ²)	Plan area (m ²)	Storage vol. (m ³)
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	293	293	42
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	90	40	38
Pervious pavements	1930	258	221
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
Total	2313	591	301

4. Supporting Information

4a. Discharge & Drainage Strategy

Page/section of drainage report

Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results

Drainage hierarchy (2b)

Section 3.3

Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location

Thames Water Asset Map -
Appendix A

Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations

Microdrainage Model -
Appendix A

Proposed SuDS measures & specifications (3b)

Section 3.8

4b. Other Supporting Details

Page/section of drainage report

Detailed Development Layout

Appendix C

Detailed drainage design drawings, including exceedance flow routes

Sections 3.8, 3.10 & Appendix C

Detailed landscaping plans

Re-Form Landscape Architect

Maintenance strategy

Appendix E

Demonstration of how the proposed SuDS measures improve:

a) water quality of the runoff?

b) biodiversity?

c) amenity?

Marc Jones
Buro Happold Limited
17 Newman Street
London
W1T 1PD
UK

T: +44 (0)207 927 9700

F: +44 (0)870 787 4145

Email: marc.jones@burohappold.com