BURO HAPPOLD

Dewsbury Riverside Gateway Development

Surface Water Drainage Strategy

0048206-BHE-XX-XX-RP-C-0001

0048206

24 September 2021

Revision P04

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Revision	Description	Issued by	Date	Checked
P01	Draft	FD	03/09/21	AH
P02	For Information	FD	10/09/21	AH
P03	For Information	FD	17/09/21	AH
P04	For Information	FD	24/09/21	AH

C:\Users\fdelriojuango\BuroHappold\P048206 P-Dewsbury Riverside - 08_Civils - Infrastructure\Reports\DRAINAGE STRATEGY\210913 FDR 0048206 Surface Water Drainage Strategy P03.docx

This report has been prepared for the sole benefit, use and information of Kirklees Council for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold Limited in respect of the information contained in the report will not extend to any third party.

author	**Fabiola del Rio**
date	**24/09/21**
approved	**Allan Hoodless**
signature	
date	**24/09/21**

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Contents

1 Introduction 5

1.1 Site Context 5

1.1.1 Statutory & Non-Statutory Policies Guidance 6

1.2 Scheme Proposals 7

1.3 Topography & Constraints 7

1.4 Existing Surface Water Drainage 8

1.5 Existing Discharge Rates 9

2 Surface Water Drainage Strategy 10

2.1 Design Codes & Standards 10

2.2 Proposed Drainage Requirements 10

2.3 Assessment of SuDS Viability 10

2.3.1 Drainage Hierarchy 10

2.4 Consultation 11

2.4.1 Metropolitan Borough of Kirklees (LLFA) 11

2.4.2 Yorkshire Water (YW) 11

2.5 Proposed Discharge Limit & Attenuation Requirements 12

2.6 Proposed Concept Drainage Design 12

2.6.1 Housing Masterplan - Northern Catchment Drainage Strategy 12

2.6.2 Housing Masterplan - Southern Catchment Drainage Strategy 12

2.6.3 Highways Detailed Drainage Design 13

2.7 Hydraulic Calculations 15

2.7.1 Housing Masterplan Calculations (Outline Planning) 15

2.7.2 Highways Calculations 16

2.8 Sustainable Drainage Systems (SuDS) 16

2.9 Climate Change 19

2.10 Pollution Control 19

2.11 Design for Exceedance 20

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2.12 Maintenance 20

Appendix A Proposed Masterplan

Appendix B Topographic Survey

Appendix C Communications

Appendix D Hydraulic Calculations

Appendix E SuDS Maintenance Plan

Table of Tables

Table 2-1 Gateway Development Northern and Southern Catchment Areas 15

Table 2-2 Proposed Attenuation Volumes 15

Table 2-3 Hydraulic Calculations Design Criteria 16

Table 2-4 SuDS Features - Assessment of Suitability 16

Table 2-5 Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) 19

Table 2-6 Mitigation indices of proposed SuDS components 19

Table 2-7 Pollution hazard indices of areas within the proposed development 19

Table of Figures

Figure 1-1 Existing Site Arrangement (Map data ©2015 Google). 5

Figure 1-2 Existing Contours and Fall Arrows (Map data ©2015 Google). 7

Figure 1-3 Existing surface water drainage features (Map data ©2015 Google). 8

Figure 2-1 Proposed Drainage Strategy (Map data ©2015 Google). 13

Figure 2-2 Typical Section Through Fill 14

Figure 2-3 Typical Section Through Cut 14

Figure 2-4 Proposed Highways Drainage 14

Figure 2-5 Example Detention Basin 18

Figure 2-6 Example Swale 18

Figure 2-7 Exceedance Routes 20

Copyright © 1976 - 2021 Buro Happold. All rights reserved

1 Introduction

This drainage strategy has been developed to demonstrate a viable solution for disposal of surface water from the Dewsbury Riverside Gateway Development site, meeting local and national planning policy and without increasing flood risk to others. The approving bodies for the scheme will be the Metropolitan Borough of Kirklees as the Local Lead Flood Authority (LLFA) and the Environment Agency (EA).

This drainage strategy has been developed to accompany the Hybrid Planning Application:

a) Application for full planning permission for engineering works, drainage and utilities connection for the provision of site access from Forge Lane and Ravensthorpe Road and associated works; and,

b) Application for outline planning permission for the erection of up to 350 dwellings and mixed use development (including community facilities) with associated works including the provision of internal estate roads and parking, landscape works (including provision of public open space, tree clearance/replacement/woodland management and ecological management) and sustainable urban drainage works drainage principles.

1.1 Site Context

The site is located off Raventhorpe Road, approximately 2.5 km southwest of Dewsbury town centre. The site comprises approximately 28.26 ha of land and is occupied by cropped farmland, woodland in the west (approximately 6.5 ha) and a school and allotment gardens (around 1.4 ha) in the east. The site is predominantly Greenfield, but Lady Wood (to the west) has been historically worked for coal.

An existing site arrangement is shown in Figure 1-1:

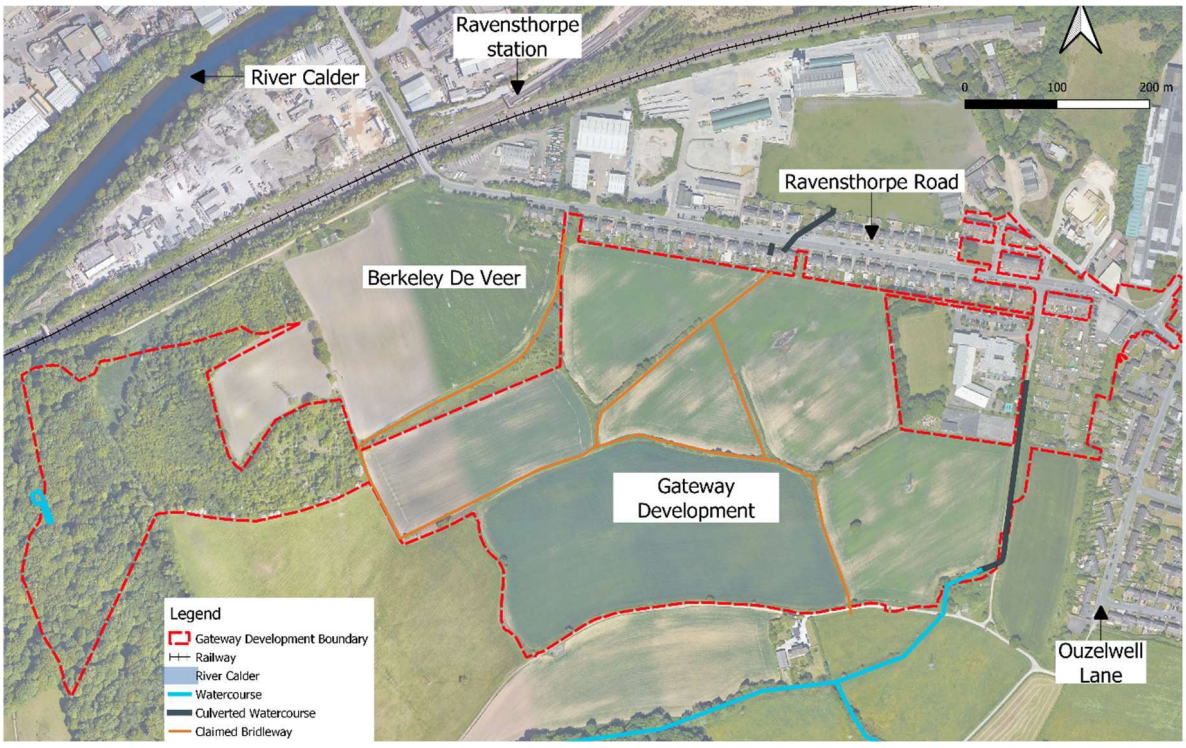


Figure 1-1 Existing Site Arrangement (Map data ©2015 Google).

Copyright © 1976 - 2021 Buro Happold. All rights reserved

The site's borders are defined by:

• North: (east) semi-detached residential dwellings with attached gardens, Ravensthorpe Road runs east to west immediately beyond. Railway line immediately beyond northwestern boundary.
• South: a bridleway that runs east to west along the southern boundary between Ouzlewell Lane (east) and Sands Lane (west).
• East: an un-named track with Ouzlewell Lane beyond.
• West: low dry stone walls which open out onto farmland.

1.1.1 Statutory & Non-Statutory Policies Guidance

National Policy

- The National Planning Policy Framework (NPPF) provides planning policy from central government. The document states that "…local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment…"
- The SuDS Manual (Department for Environment, Food and Rural Affairs, March 2015) provides guidance for the hydraulic performance of Sustainable Drainage Systems (SuDS) systems to reduce flood risk and improve water quality of water discharging from a development site. The document provides guidance on best practice and is not a statutory requirement for approval.

Local Policy

The Metropolitan Borough of Kirklees is the Local Lead Floor Authority (LLFA) for the area in which the development is situated. The Kirklees Local Plan Strategy and Policies (Feb 2019) gives guidance on the requirements for drainage (Policy LP28):

> *"The presumption is that Sustainable Drainage Systems (SuDS) will be used to assist in achieving the following on each site:*
>
> > *a. for proposals on greenfield sites, typical greenfield run-off rates should not be exceeded;*
> >
> > *b. for proposals on brownfield sites there should be a minimum 30% reduction in surface water run-off where previous positive surface water connections from the site can be proven. New connections will be subject to at least greenfield restrictions;*
> >
> > *c. No negative impact on local water quality and improvements in water quality where practicable;*
> >
> > *d. Consider whether proposed open spaces and green infrastructure within sites can contribute to the sustainable drainage of the site.*
>
> *Local conditions including the existence of critical drainage areas may require a lower run-off rate to be agreed to reflect volume control, local surface water risks, water course capacity and flood risk further downstream.*
>
> *There will be a general presumption against pumping surface water. It must also be demonstrated that the surface water management solution is designed to meet requirements over the lifetime of the development including evidence that management and maintenance arrangements have been secured to cover that period. This includes ensuring proposals to store water meet national standards and latest best practice.*

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Flow paths accommodating water from outside the site or due to an exceedance event should be designed to avoid buildings and curtilages.

Development will only be permitted if it can be demonstrated that the water supply and waste water infrastructure required is available or can be co-ordinated to meet the demand generated by the new development".

1.2 Scheme Proposals

The key features of the proposed scheme are shown in Appendix A. The proposed development consists of a new residential development of approximately 9.7 ha of new dwellings with its associated drives and gardens, approximately 1.05 ha of mixed use (residential or community use) and approximately 17.7 ha of green infrastructure. An allotments area will also be included in the development; however, the allotments drainage design is by others. A Land Use and Access Parameter Plan is included in Appendix A.

The site is split into 2 areas – Northern Catchment and Southern Catchment. This is also shown in Appendix A.

1.3 Topography & Constraints

Topography across the site and the wider area generally slopes down to the north and northeast. The steepest slopes reach gradients of about 1 in 6 in the centre-north, although the 'typical' gradient is 1 in 12. Contours and fall arrows are shown in Figure 1-2. The highest elevation is approximately 87 m AOD whilst the lowest elevation is 44.3 m AOD. The topographic survey is shown in Appendix B.

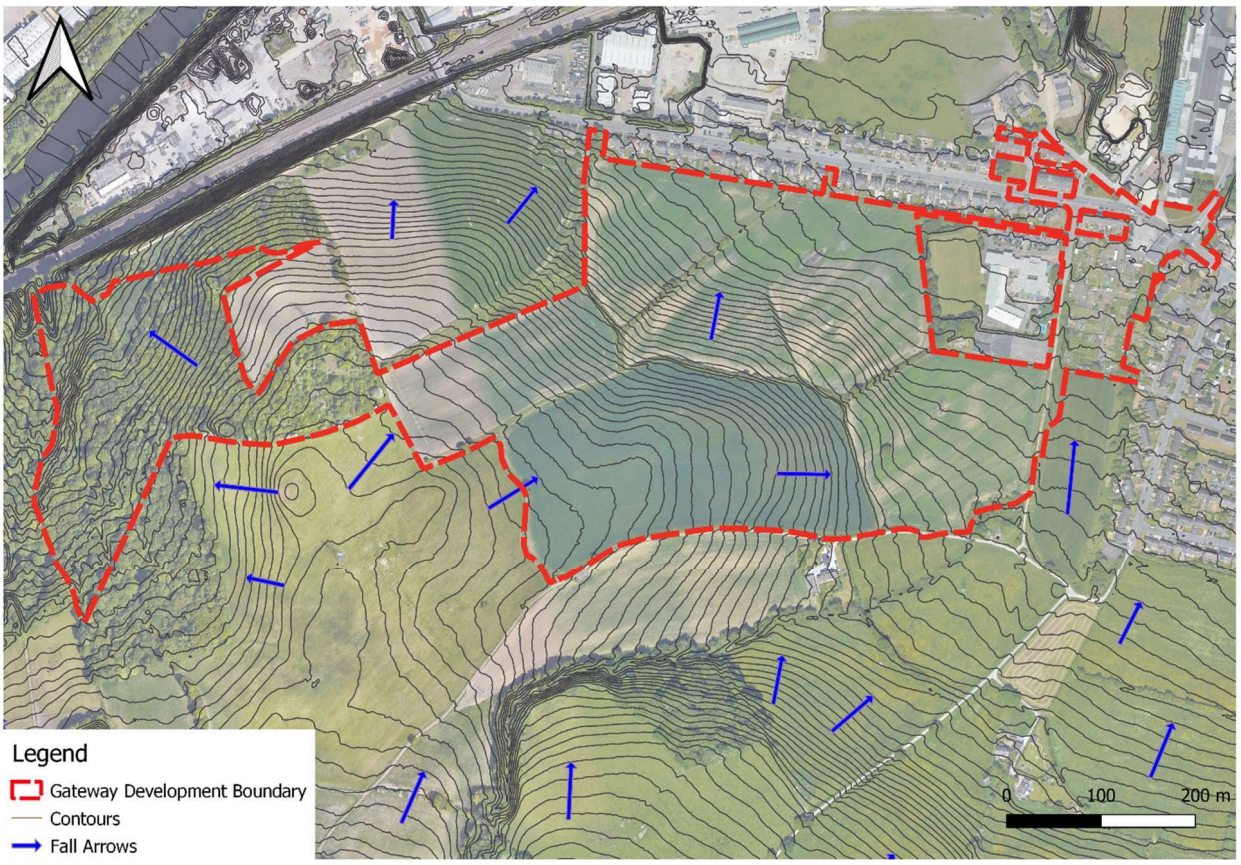


Figure 1-2 Existing Contours and Fall Arrows (Map data ©2015 Google).

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Some constraints to consider due to the existing levels on site:

- Significant regrade earthworks are anticipated.
- Underground mineworkings are highly likely to require consolidation prior to construction.
- Underground and overhead utilities present a potential development constraint unless they can be relocated.
- The former colliery gas main may require excavation and removal. The groundworker should take care when excavating the pipe in case any residual gasses or liquors remain in the pipeline.
- Three electricity utilities run north to south across the site; one in the east (on wooden poles along the western edge of Ravensthorpe School and over the cropped field); and, two in the west (steel pylons, over the immature woodland).
- A regional high pressure gas pipeline runs north to south across the centre of the site. The line of the gas main is shown by marker posts in field boundaries.

1.4 Existing Surface Water Drainage

The existing surface water drainage located within, and in close proximity, to the site is shown in Figure 1-3:

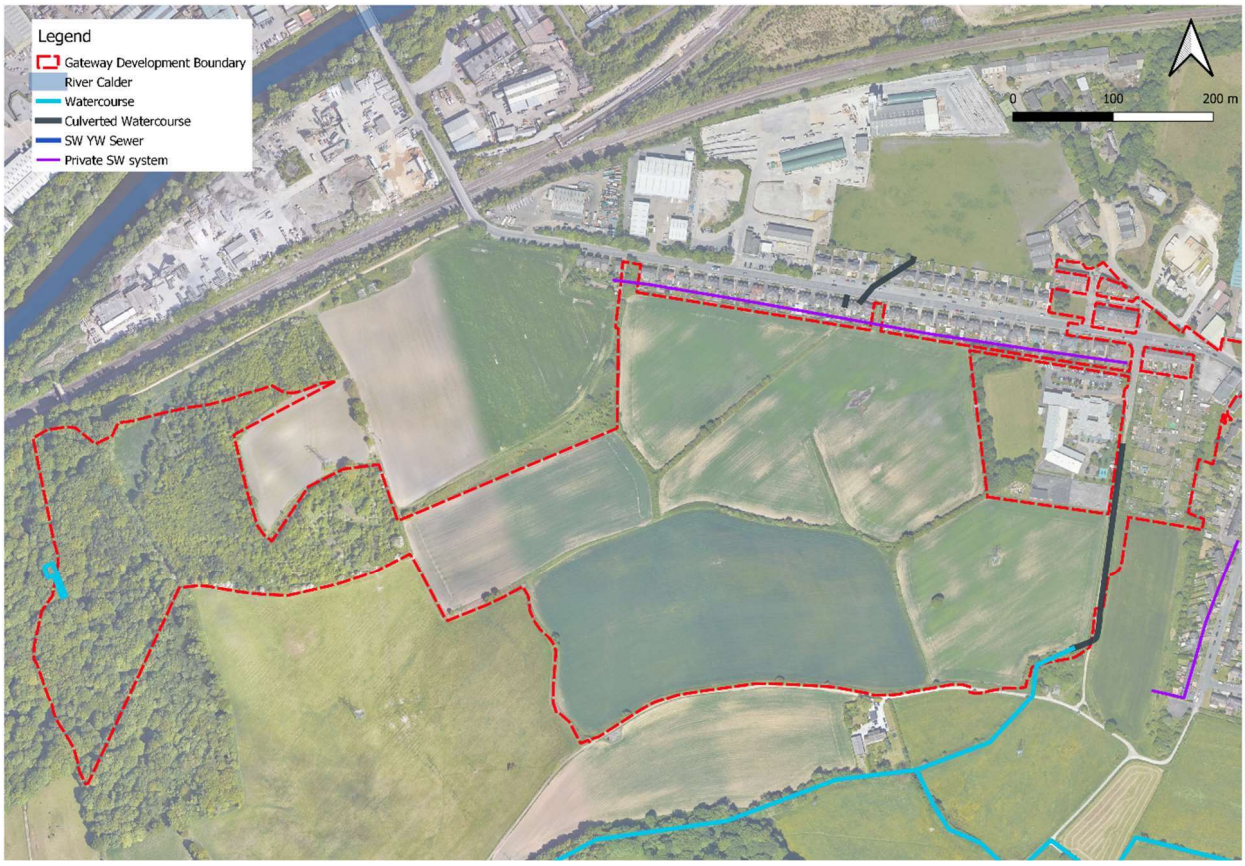


Figure 1-3 Existing surface water drainage features (Map data ©2015 Google).

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Existing drainage features comprise:

- River Calder beyond the railway tracks to the north.
- 200 mm diameter vitrified clay SW sewer in Ravensthorpe Road that connects to a 1080mm diameter concrete pipe before the junction with Lees Hall Road.
- Open watercourse through Priest Royd Wood to the south of the site and through to the rear of Ravenshall School where it becomes enclosed.
- Private system at the rear of the dwellings located off Ravensthorpe Road.

1.5 Existing Discharge Rates

The site is predominantly greenfield, and therefore, even though there has been some historical mining on the site it is assumed that it's a greenfield site from a hydraulics perspective.

Due consideration has been given to the surrounding levels for the run-off calculations. Existing levels outside the site boundary fall from south to north towards the Gateway Development. For this reason, an assessment of the existing levels and their most likely discharge points has been made and areas likely to discharge to our site have been included in the run-off calculations.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2 Surface Water Drainage Strategy

The drainage strategy presented within this document is in concept form. The future detailed design should ensure that the surface water drainage system meets the following criteria:

- Protect against flooding;
- Collect and convey surface water away from developed areas in a safe and controlled manner;
- Provide measures to improve the quality of runoff prior to discharge;
- Be sustainable and maintainable;
- Be appropriate for and compliment a developed, urban space;
- Ensure structural integrity over the duration of the development design life,

2.1 Design Codes & Standards

The future detailed design of the surface water drainage system network will be designed in accordance with the following Codes and Standards (or subsequent updates), as appropriate:

- BS EN 752 (2008), 'Drains and Sewer Systems Outside of Buildings';
- CIRIA C753 (2015), 'The SuDS Manual';
- CIRIA C635 (2006), 'Designing for Exceedance in Urban Drainage – Good Practice';
- The Kirklees Local Plan Strategy and Policies.

2.2 Proposed Drainage Requirements

Levels of Protection Provided

The proposed surface water drainage network will provide the following levels of protection:

- All return periods up to and including 1 in 30 + 40% Climate Change – no above ground flooding.
- All return periods up to and including 1 in 100 + 40% Climate Change – above ground surface ponding allowed; provided flood water does not leave the site, flood water is not a hazard, building plots are not flooded, and any key infrastructure is not flooded.

Water Quality

To ensure that the quality of water discharged from site meets good practice requirements as set out in the SuDS Manual.

2.3 Assessment of SuDS Viability

2.3.1 Drainage Hierarchy

The detailed design for the proposed surface water drainage strategy for the site will be designed with the CIRIA SUDS manual, particularly the hierarchy for surface water drainage discharge in mind. The hierarchy is as follows:

Discharge via Infiltration

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Infiltration testing was carried out on site and proved to be unsuccessful. Ground investigation results indicate the clay soils are the predominant sub soil, therefore, discharge via infiltration cannot be used.

For more ground information and soakaway test results refer to Geoenvironmental Appraisal Land at Dewsbury Riverside Gateway Report No 3901/2 by Lithos Consulting Ltd.

Discharge to a Watercourse or the Sea

River Calder is located to the north of the Dewsbury Riverside Gateway Development, beyond the railway tracks. Discharging to the river will imply crossing the railway tracks as well as third party land. Levels on site fall to the northeast and therefore it is assessed that some parts of the site won't be able to discharge to the river by gravity. It is currently envisaged that the River Calder will not be used for surface water discharge.

There is an existing open watercourse located to the south of the site, through Priest Royd Wood, and through to the rear of Ravenshall School where it becomes a culverted watercourse. It is envisaged that this culverted watercourse will be used for discharge of the southern catchment.

The watercourse connects to the Yorkshire Water network, therefore, a discharge rate to this culverted watercourse has been agreed with Yorkshire Water. Refer to Appendix C for more information on the agreed discharge rates.

Discharge to Existing Surface Water Infrastructure

This method is achievable for the Gateway Development as there is an existing surface water sewer located in Ravensthorpe Road. This sewer is 200mm diameter and connects to a 1080mm diameter concrete pipe close to the junction with Lees Hall Road.

Communications with Yorkshire Water (see Appendix C) were undertaken to agree a discharge rate according to the existing sewer capacity for the existing sewer in Ravensthorpe Road and for the private system at the rear of the dwellings located off Ravensthorpe Road.

A SuDS suitability assessment has been carried out, see Table 2-4. Numerous types of SuDS have been assessed, including SuDS which are primarily: conduits (convey water from one location to another), attenuation (stores water) and source control (collects water at source).

2.4 Consultation

2.4.1 Metropolitan Borough of Kirklees (LLFA)

Communications with the LLFA were included in the Flood Risk Assessment at Ravensthorpe Road by ARP Associates (November 2016). They have been included in Appendix C of this report. A pre-development enquiry was submitted but no feedback was received.

2.4.2 Yorkshire Water (YW)

Initial consultation has been held with Yorkshire Water. Yorkshire Water have agreed to a discharge rates for Catchments 1 and 2 to the existing YW sewers. A response was received the 15th July 2021 indicating an allowed discharge rate of 3.5 l/s for the Northern Site (Catchment 1) and a discharge rate of 5 l/s for the Southern Site (Catchment 2). These discharge rates result in a significant betterment on greenfield rates. The rates of 3.5 and 5.0 l/s have been used for attenuation sizing, however it is advised that during the detailed design for the development further negotiation is held with Yorkshire Water to agree higher discharge rates and potentially offsite reinforcement of existing infrastructure.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Correspondence with Yorkshire Water is included in Appendix C.

2.5 Proposed Discharge Limit & Attenuation Requirements

Preliminary surface water attenuation volume calculation has been carried out using MicroDrainage. Storage sizing is based on a 1 in 100-year return period with 40% Climate Change allowance.

MicroDrainage calculations are included in Appendix D. Storage volumes are summarised in Table 2-1.

2.6 Proposed Concept Drainage Design

This project will be delivered via a hybrid planning application. The highways for the site will be delivered via a detailed planning application and the remainder of the site (the housing masterplan) will be for outline planning.

An outline for the proposed drainage strategy is in Figure 2-1.

It is proposed that the drainage strategy of Gateway Development will be divided in 2 catchments. Catchment 1 will include the northern area of the site and catchment 2 will include the rest of the site. These catchments are shown in Appendix A.

2.6.1 Housing Masterplan - Northern Catchment Drainage Strategy

The northern site runoff will be conveyed by gravity via a swales and other drainage routes, such as sewers, towards the northern end of the site where detention basins will be used to provide attenuation and water quality treatment. The detention basins will discharge to the sewer located under Ravensthorpe Road.

As stated on Table 2-4 SuDS methods like porous paving, green and blue roofs, swales, filter strips and detention basins can be used on site to help the runoff conveyance and improve the drainage system.

An estimate of the volume of storage required in the detention basins has been calculated in Table 2-1. It should be noted that the existing levels on site are very steep, and therefore, it has been considered that only the 70% of the available area for SuDS will be able to be used for storage.

As stated above the attenuation has been sized based on the discharge rates agreed with Yorkshire Water. Whilst the attenuation size can be accommodated within the masterplan, the basin drain down times of the basins becomes longer than typically advised, this is why it is advised that prior to detailed planning submittal further negotiation is held with Yorkshire Water to agree higher discharge rates and potentially offsite reinforcement of existing infrastructure.

2.6.2 Housing Masterplan - Southern Catchment Drainage Strategy

The southern site runoff will be conveyed by gravity via a swales and other drainage routes, such as sewers, towards the east of the site where detention basins will be used to provide attenuation and water quality treatment before discharging to the existing culverted watercourse.

As stated on Table 2-4 SuDS methods like porous paving, green and blue roofs, swales, filter strips and detention basins can be used on site to help the runoff conveyance and improve the drainage system.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

An estimate of the volume of storage required in the detention basins has been calculated in Table 2-2. It should be noted that the existing levels on site are very steep, and therefore, it has been considered that only the 70% of the available area for SuDS will be able to be used for storage.

As stated above the attenuation has been sized based on the discharge rates agreed with Yorkshire Water. Whilst the attenuation size can be accommodated within the masterplan, the basin drain down times of the basins becomes longer than typically advised, this is why it is advised that prior to detailed planning submittal further negotiation is held with Yorkshire Water to agree higher discharge rates and potentially offsite reinforcement of existing infrastructure.

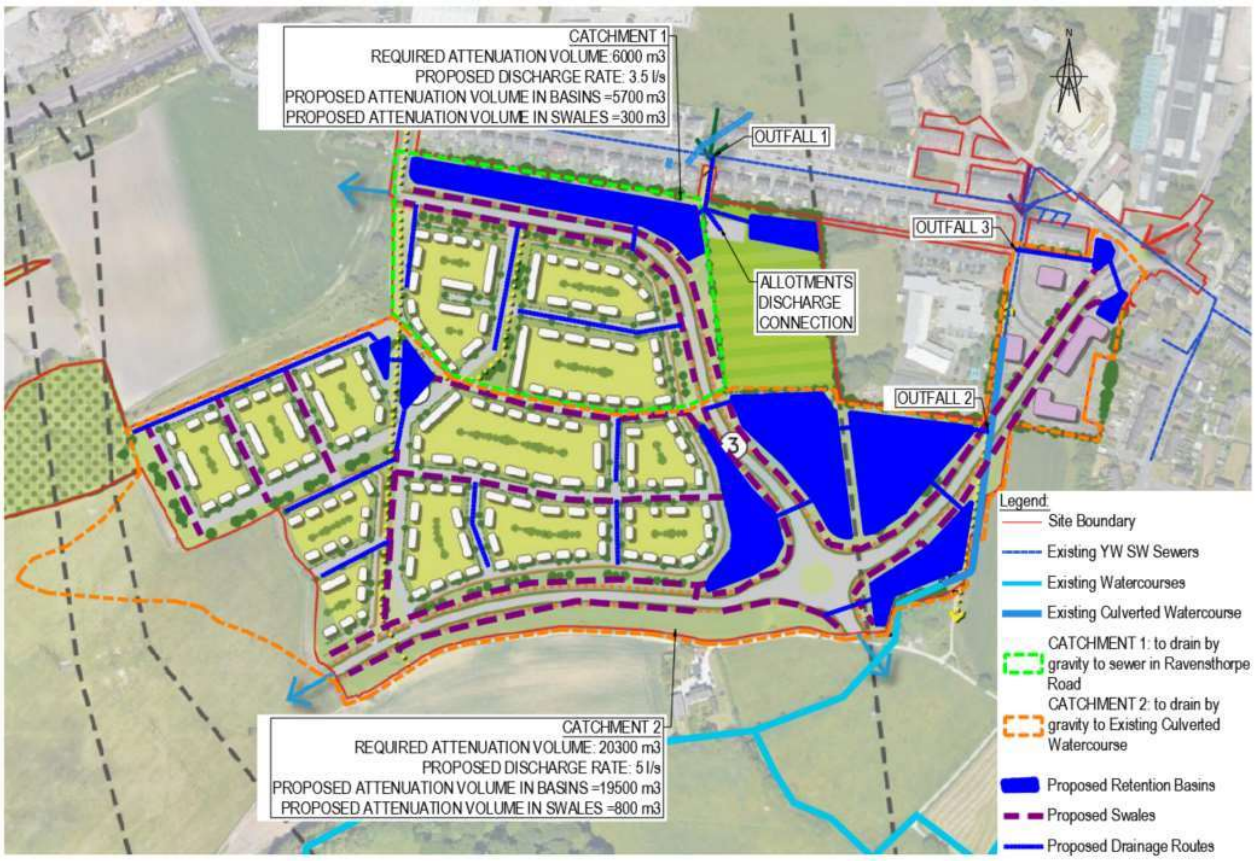


Figure 2-1 Proposed Drainage Strategy (Map data ©2015 Google).

2.6.3 Highways Detailed Drainage Design

Swales will be located at either side of the highways. These will drain the highways and convey flows to detention basins which will act as attenuation. Flow controls will limit the discharge from the detention basins. The detention basins will ultimately discharge to the Yorkshire water sewer or the culverted water course. Figure 2-4, below, shows the highways drainage arrangement, and Figure 2-2 and Figure 2-3 show the typical cross section.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

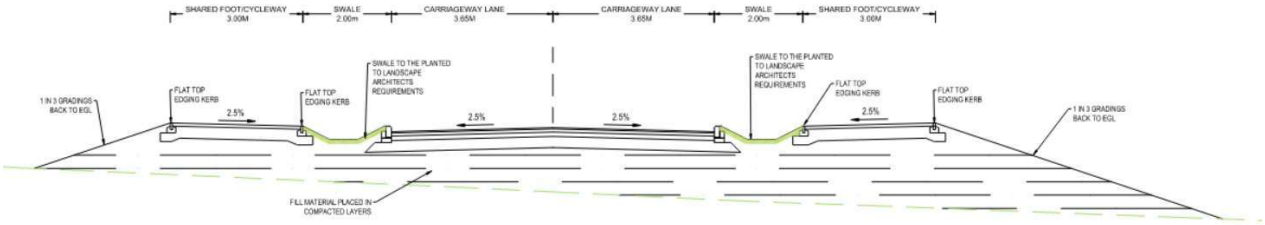


Figure 2-2 Typical Section Through Fill

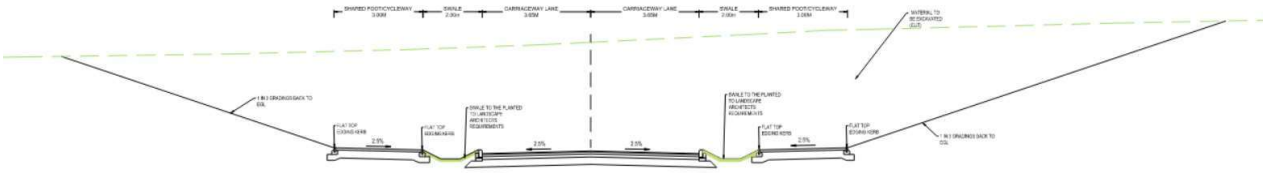


Figure 2-3 Typical Section Through Cut

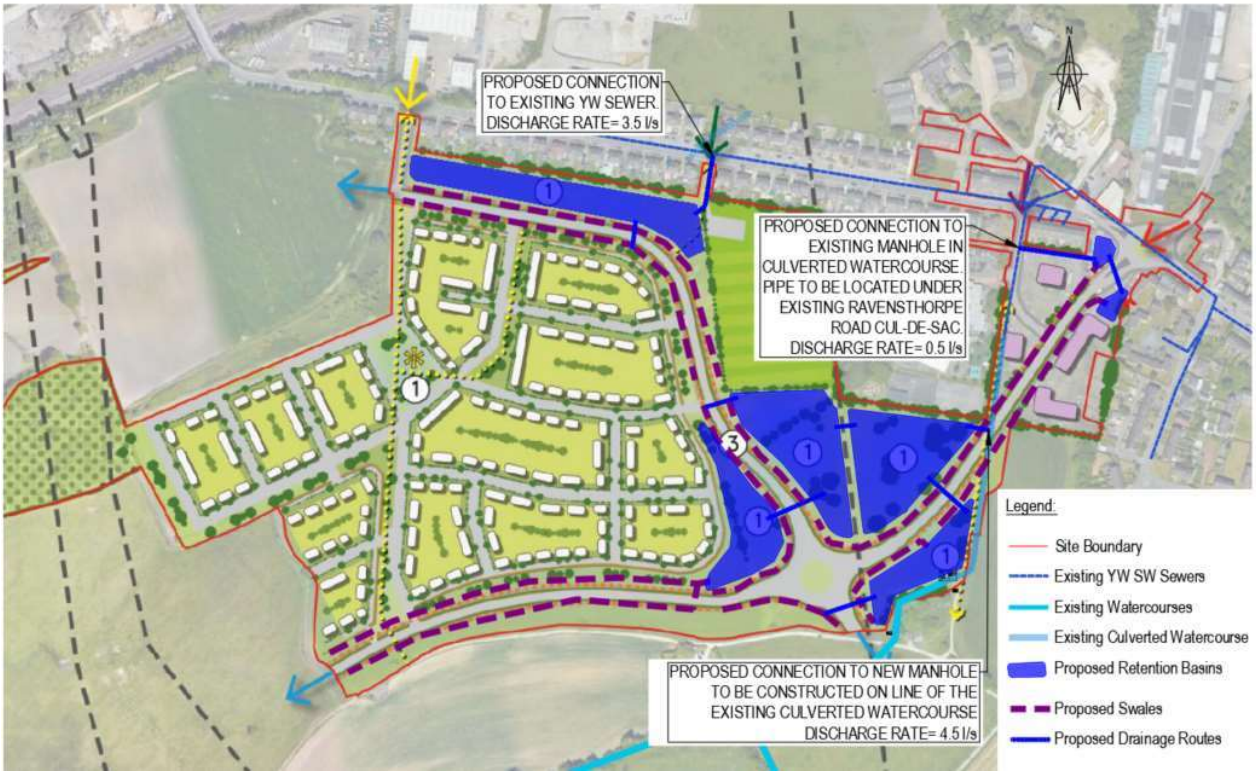


Figure 2-4 Proposed Highways Drainage

The highways drainage has been modelled using MicroDrainage. The calculations are included in the Appendix D of this report. Please refer to Buro Happold Highways Drainage drawings for more details about the Highways Drainage General Arrangement.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2.7 Hydraulic Calculations

2.7.1 Housing Masterplan Calculations (Outline Planning)

This section includes the calculations of the outline drainage strategy for the masterplan outline planning proposal.

The site comprises 28.26 ha of land however, some areas (approximately 7.46 ha) are to be maintained as per existing and therefore they have not been considered for the calculations: the woodland in the west and the existing areas around Ravensthorpe Road. The allotments area to the east (approximately 1.4 ha) is not included in the calculations either.

Conversely, it is assessed that approximately 1.8 ha to the south east of the site will keep draining to our site following the existing levels, and therefore this area has been included in the calculations. Due to this reason the area considered for the runoff calculations is 4.7 ha for Catchment 1 and 16.5 ha for Catchment 2.

The areas considered, impermeability factor and estimated impermeable areas are shown in Table 2-1.

Table 2-1 Gateway Development Northern and Southern Catchment Areas

	AREA* (ha)			IMPERMEABLE AREA (ha)	
	NORTHERN CATCHMENT	SOUTHERN CATCHMENT	IMPERMEABILITY FACTOR	NORTHERN CATCHMENT	SOUTHERN CATCHMENT
RESIDENTIAL USE	2.9	6.8	85%	2.5	5.8
MIXED USE	0.0	0.96	85%	0.0	0.8
ROADS	0.7	2.2	85%	0.6	1.9
SUDS AREAS	0.6	2.3	85%	0.5	2.0
GREEN AREAS	0.5	2.4	15%	0.1	0.4
EXTERNAL AREA DRAINING TO THE SITE	0.0	1.8	15%	0.0	0.3
TOTAL	**4.7**	**16.5**		**3.6**	**11.1**

*The areas do not include the Allotments (1.4 ha) and the 8.8 ha of areas to be maintained as per existing and include the 1.8ha of area external to the site draining towards the site.

Storage sizing based on a 1 in 100-year return period with 40% Climate Change allowance has been calculated using MicroDrainage. The discharge rates for each catchment are as agreed with Yorkshire Water 3.5 l/s for the northern catchment and 5 l/s for the southern catchment. The attenuation volume required is 6000 m^3 for the northern catchment and 20300 m^3 for the southern catchment. The proposed attenuation volumes stored in the proposed basins and swales are shown in Table 2-2. MicroDrainage calculations are included in Appendix D.

Table 2-2 Proposed Attenuation Volumes

	PROPOSED VOLUMES	
	NORTHERN CATCHMENT	SOUTHERN CATCHMENT
ATTENUATION BASINS	5700	19500
SWALES	300	800
TOTAL	6000	20300

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2.7.2 Highways Calculations

Calculations for the detailed highways drainage have been done using MicroDrainage. Refer to Append D for detailed hydraulic calculations results.

Key design criteria and results are tabulated below.

Table 2-3 Hydraulic Calculations Design Criteria

DESIGN CRITERIA	**Return Period (years)**	100
	M5-60 (mm)	17.000
	Ratio R	0.300
	Climate Change (%)	40

The calculations include results for the 1 in 1 year event, the 1 in 30 year event including 40% Climate Change and the 1 in 100 year event including 40 % Climate Change with no flooding present in any of the storm events.

2.8 Sustainable Drainage Systems (SuDS)

Sustainable Urban Drainage Systems are used to reduce the impact of surface water from storm events on the existing environment mimicking the natural run-off characteristics of the site and removing pollutants from the urban run-off at source. There are various solutions which are described in the SuDS Manual (CIRIA C753) and include ground level features including swales and ponds, below ground systems (such as tanks, and infiltration techniques like soakaways). In addition, there are above ground solutions such as green roofs.

The Proposed Development considers the use of sustainable drainage techniques in accordance with local policy. The CIRIA SuDS Manual contains a hierarchy of sustainable methods of capturing and storing rainwater in a descending order: from drainage into the ground to recharging water resources. Since infiltration is not possible, surface water will be stored on site in open water features and then released at a controlled rate.

Non-infiltration SuDS features will not reduce the amount of surface water discharged; however, it will significantly delay and mitigate the peak flood flows from the Site. The hierarchy of SuDS techniques is shown below:

Table 2-4 SuDS Features - Assessment of Suitability

SuDS Device	SuDS Type	Suitable on Site	Comments
Permeable Pavement	Source Control	Yes	Viable - Suitable for draining private roads and driveways. Little infiltration likely, but filtration will still improve water quality.
Infiltration Trench	Conduit	No	Not viable - Infiltration not considered viable.
Infiltration Basin	Attenuation	No	Not viable - Infiltration not considered viable.
Soakaway	Conduit	No	Not viable - Infiltration not considered viable.
Filter strips	Conduit	Yes	Viable – Suitable for conveying water from roads provided space is available.
Filter Trench	Conduit	Yes	Viable – Suitable for draining roads and conveying water to attenuation features.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Enhanced Dry Swale	Conduit	Yes	Viable – Suitable for draining roads and conveying water to attenuation features.
Enhanced Wet Swale	Conduit	Yes	Viable – Suitable for draining roads and conveying water to attenuation features.
Shallow Wetland	Attenuation	Yes	Viable – Suitable for storing water from small catchments
Wetland	Attenuation	Yes	Viable – Suitable for storing water from large catchments
Wetland Channel	Conduit	Yes	Viable – Suitable for conveying water from roads provided space is available.
Retention Pond	Attenuation	Yes	Viable – Suitable for storing water from large catchments
Conveyance Swale	Conduit	Yes	Viable – Suitable for conveying water from roads provided space is available.
Detention Basin	Attenuation	Yes	Viable – Suitable for storing water from large catchments
Sub-Surface Storage	Attenuation	Yes	Viable – Suitable for storing water from large catchments. This option is not as favoured as other attenuation methods
Rainwater Harvesting	Source Control	Yes	Viable - Rainwater re-use feasible for building plots. Harvested water can be used for irrigation, façade washing, car washing, etc
Green/Blue Roofs/ Roof Planters	Source Control	Yes	Viable – However dependant on Architects proposals.

Based on the SuDS assessment above the following is currently proposed:

- Green and blue roofs should be used where possible for future buildings.
- Water butts / rainwater harvesting should be used for future buildings.
- Linear features such as filter strips and swales should be used to drain water from roads. The swales can also convey flows from building plots. The swales will connect to the attenuation. Piped crossings will be required at road crossings.
- Detention basins are proposed for attenuation wherever possible.

The SuDS features included in the design for this site are listed below, with their location shown in Figure 2-1.

Detention Basins

The detention basins are proposed to be landscaped depressions that are normally dry except during and immediately following storm events. To provide additional storage each basin is proposed to have a granular storage layer below the basin. An allowance for topsoil/planting medium, between the surface and the granular material, will be provided similar to a bio-retention system. The potential amenity/ecological use of the detention basin system allows this space to be flexible and provide multiple benefits to the development.

Detention basins allow sedimentation and pollutant removal of the run-off. They will also provide the main source of attenuation across the site and deliver a reduction in discharge volumes due to evapotranspiration.

Copyright © 1976 - 2021 Buro Happold. All rights reserved



Figure 2-5 Example Detention Basin

Swales

Swales are linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.

In the Gateway Development there will be a series of swales to create green routes that will receive the water from the closer plots and convey it to the different proposed attenuation basins.

The swales across the site are proposed to have a filter trench below to provide additional attenuation and water treatment capacity.



Figure 2-6 Example Swale

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2.9 Climate Change

The climate change allowances are based on the Table 2 Peak Rainfall Intensity Allowance in Small and Urban Catchments (use 1961 to 1990 baseline), produced by the Environment Agency (EA).

For the Proposed Development, the site is considered at 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%.

Table 2-5 Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Allowance category	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

2.10 Pollution Control

The appropriateness of proposed SuDS for the proposed development has been evaluated based on the CIRIA Report C753 Simple Index Approach. This is based on a simple index system, in which SuDS components and types of sites are assigned an index value for pollutant mitigation/hazard levels. To deliver adequate treatment, the SuDS component should have a total pollution mitigation index equal to or larger than the pollution hazard index. The following table summarises the mitigation indices of the proposed SuDS.

Table 2-6 Mitigation indices of proposed SuDS components

Mitigation indices			
Type of SuDS	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Detention basin	0.5	0.5	0.6

These values are then compared to the pollution hazard levels of each type of area within the site to evaluate the adequacy of proposed SuDS.

Table 2-7 Pollution hazard indices of areas within the proposed development

Land use	Pollution hazard level	Total suspended solids	Metals	Hydrocarbons	Proposed mitigation measure	Adequacy
Residential roofs	Very low	0.2	0.2	0.05	Swales/basins	√
Low traffic roads, residential car parks	Low	0.5	0.4	0.4	Swales and basins	√
Main access road	Medium	0.7	0.6	0.7	Swales and basins	√

Due to the multiple levels of treatment the proposed the SuDS are deemed sufficient for treating the various land use types.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2.11 Design for Exceedance

The proposed site levels are mimicking the existing site levels, which means that any exceedance events will follow the existing flow paths to the existing points of discharge. The main roads and the green routes created with swales will act as the flow paths and divert flow away from development plots. Blue arrows in Figure 2-7 below indicate the exceedance routes for the proposed masterplan. These routes are illustrative only based on an illustrative scheme and shows the principles of drainage for a future detailed scheme.



Figure 2-7 Exceedance Routes

2.12 Maintenance

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

An agreed maintenance programme will be prepared in accordance with CIRIA guidance and supervised by either the development's facilities manager or an appointed property management company. This will be included within the Building Manual for the development on completion. An outline maintenance plan is shown in Appendix E.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

2.11 Design for Exceedance

The proposed site levels are mimicking the existing site levels, which means that any exceedance events will follow the existing flow paths to the existing points of discharge. The main roads and the green routes created with swales will act as the flow paths and divert flow away from development plots. Blue arrows in Figure 2-7 below indicate the exceedance routes for the proposed masterplan. These routes are illustrative only based on an illustrative scheme and shows the principles of drainage for a future detailed scheme.



Figure 2-7 Exceedance Routes

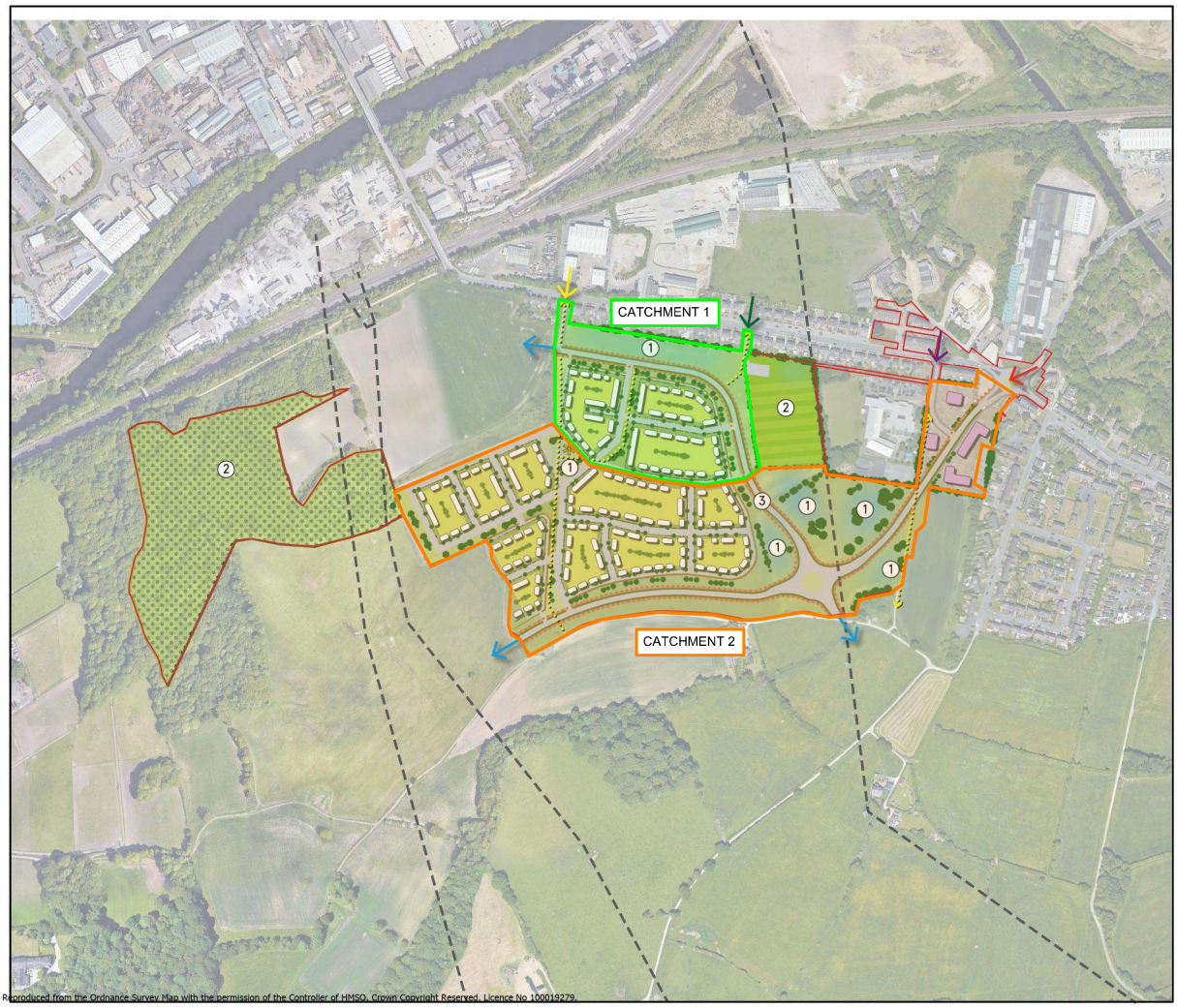
2.12 Maintenance

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

An agreed maintenance programme will be prepared in accordance with CIRIA guidance and supervised by either the development's facilities manager or an appointed property management company. This will be included within the Building Manual for the development on completion. An outline maintenance plan is shown in Appendix E.

Copyright © 1976 - 2021 Buro Happold. All rights reserved

Appendix A Proposed Masterplan



Reproduced from the Ordnance Survey Map with the permission of the Controller of HMSO. Crown Copyright Reserved. Licence No 100019279.

The scaling of this drawing cannot be assured

Revision	Date	Drn	Ckd
-	-	-	-

- Site Boundary (c.28.26ha)
- Proposed 3m shared pedestrian/ cycle path (alongside Spine Road)
- Indicative active travel connections
- Indicative residential development
- Indicative residential or community use
- (1) Indicative SuDS
- (2) Allotments (planing ref: 2021/62/90552/E) granted on 3rd June 2021.
- (3) Proposed spine road
- (4) Lady Wood
- Proposed primary vehicle access
- Existing school access/ Proposed alternative/ secondary access
- Proposed vehicle access to third party land
- Approved allotment access/ pedestrian access (Planning Ref: 2021/62/90552/E)
- Proposed active travel access
- HV Pylon
- Indicative public open space (to include retained landscape features, SuDS, new planting and ecological enhancements)
- Indicative planting
- Potential play area

Notes:

Development Capacity: Up to 350 Homes

Project:
Dewsbury Riverside

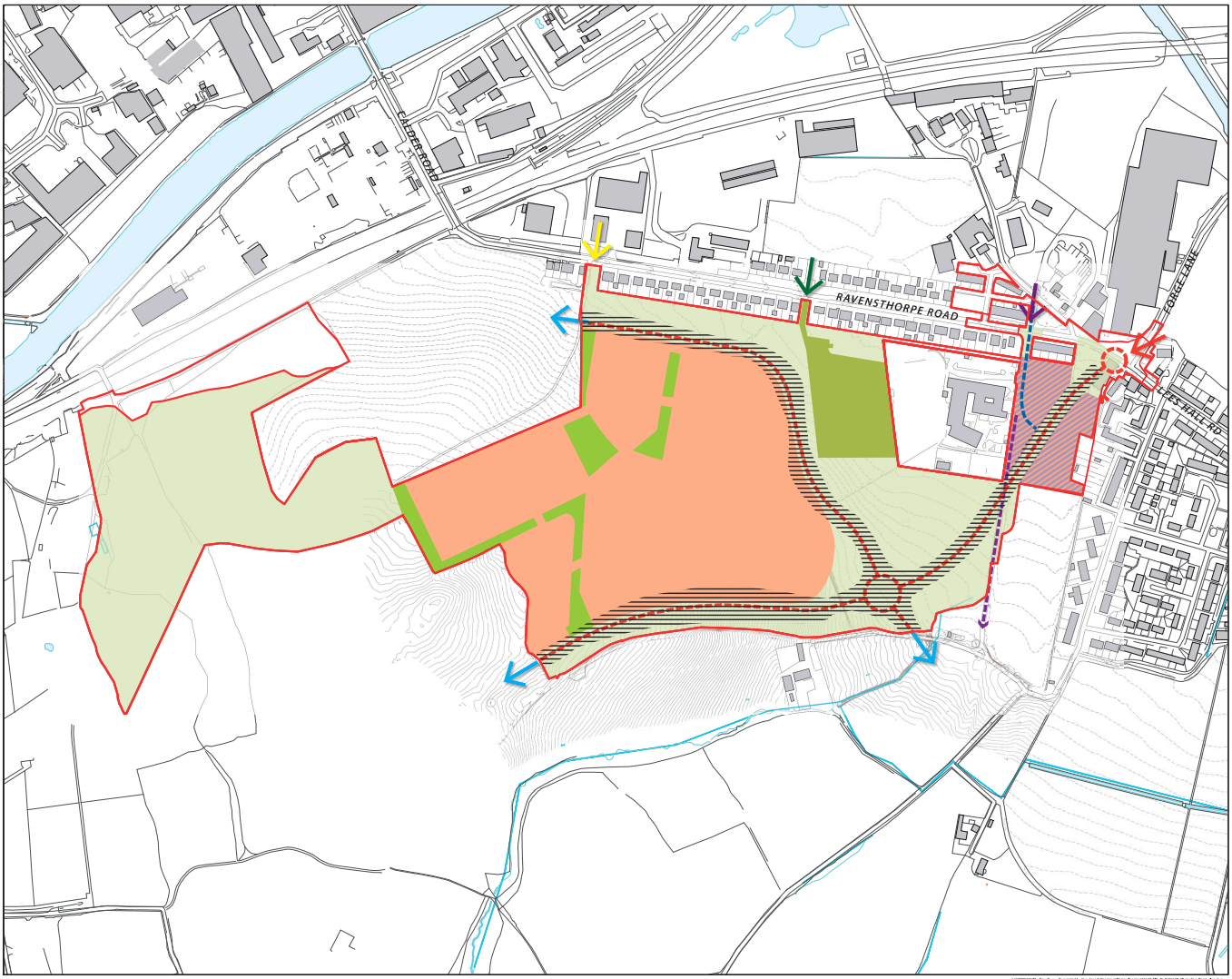
Drawing Title
Illustrative Masterplan

Date	Scale	Drawn by	Check by
23.09.21	1:5000	SW	SW

Project No	Drawing No	Revision
32147	18	C

DRAFT

BARTON WILLMORE
Town Planning • Master Planning & Urban Design • Architecture • Landscape Planning & Design • Infrastructure & Environmental Planning • Heritage • Graphic Communication • Communications & Engagement • Development Economics
bartonwillmore.co.uk
Offices at Birmingham Bristol Cambridge Cardiff Edinburgh Glasgow Leeds London Manchester Newcastle Reading Southampton



The scaling of this drawing cannot be assured

Revision	Date	Drn	Chd
-	-	-	-

N

LEGEND

- Site boundary (c.28.26ha)
- Residential (c.9.7ha)
  To include: Incidental areas of POS and road infrastructure
- Residential or Community Use (c.0.96Ha)
  (Incl. land for proposed initial/ secondary vehicle access
- Green Infrastructure (c.16.51ha)
  Including POS, Lees Wood, retained landscape features, active travel routes, proposed planting, swale, highway infrastructure, areas of ecology and ecological enhancement, HV cable easement
- Indicative Extents of Green Infrastructure with the Development Area (c.1.08ha)
  Including proposed planting
- Proposed Alignment of the Spine Road
- Indicative Alignment of Initial / Secondary Access Route
- Proposed Active Travel Access
- Proposed Primary Vehicle Access
- Proposed Vehicle Access to Third Party Land
- Approved Allotment Access (Planning Ref: 2021/62/90552/E
- Existing School Access / Proposed Initial / Secondary Vehicle Access
- Approved Allotments (Planning Ref: 2021/62/90552/E)
- Approximate Extent of Primary Road and Associated Earthworks
- Existing Bridleway

Project
Dewsbury Riverside

Drawing Title
Land Use and Access Parameter Plan

Date	Scale	Drawn by	Check by
23.09.21	1:2000 @A1	LF	SW
Project No	Drawing No		Revision
32147	A116		E

DRAFT

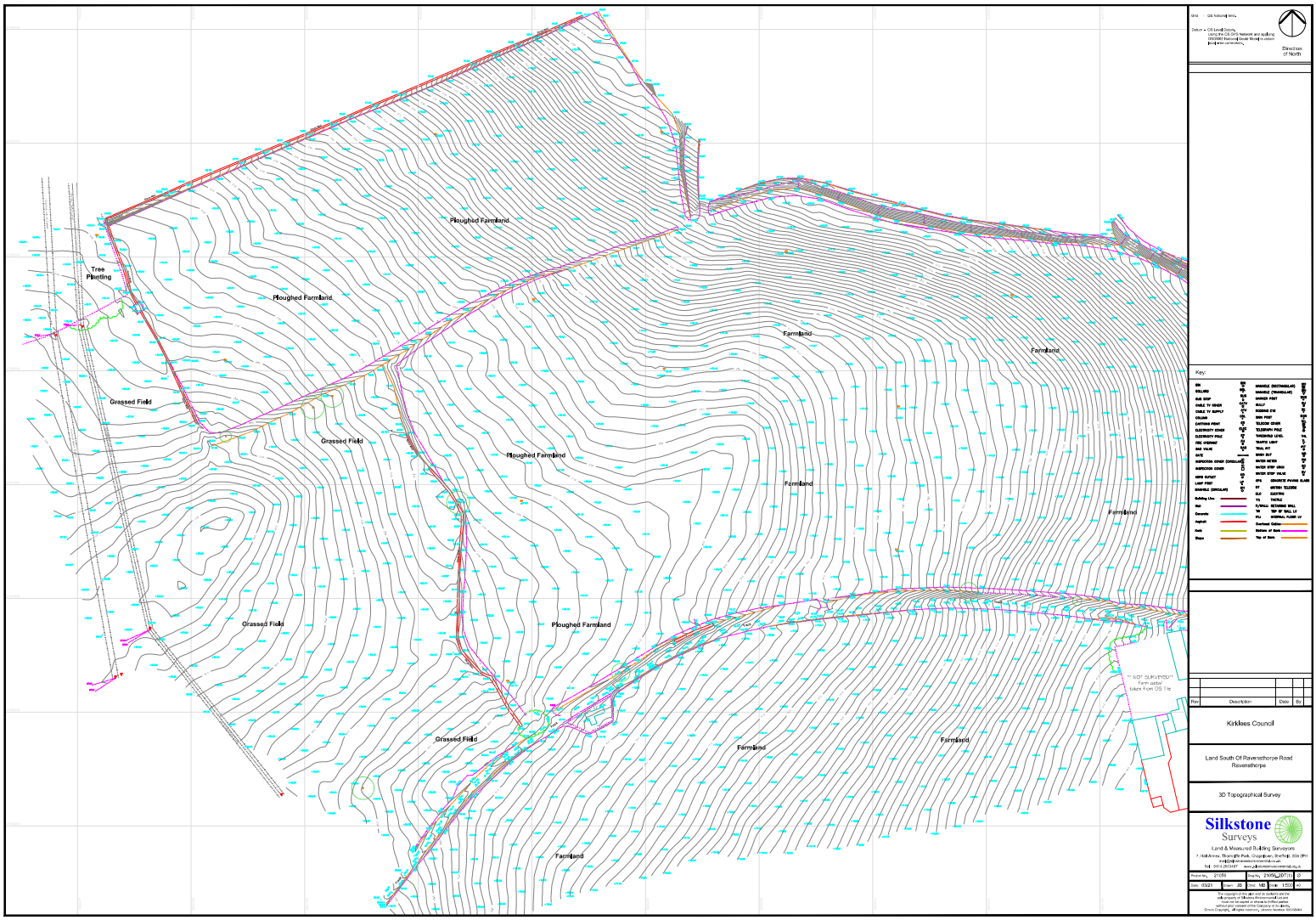
BARTON WILLMORE

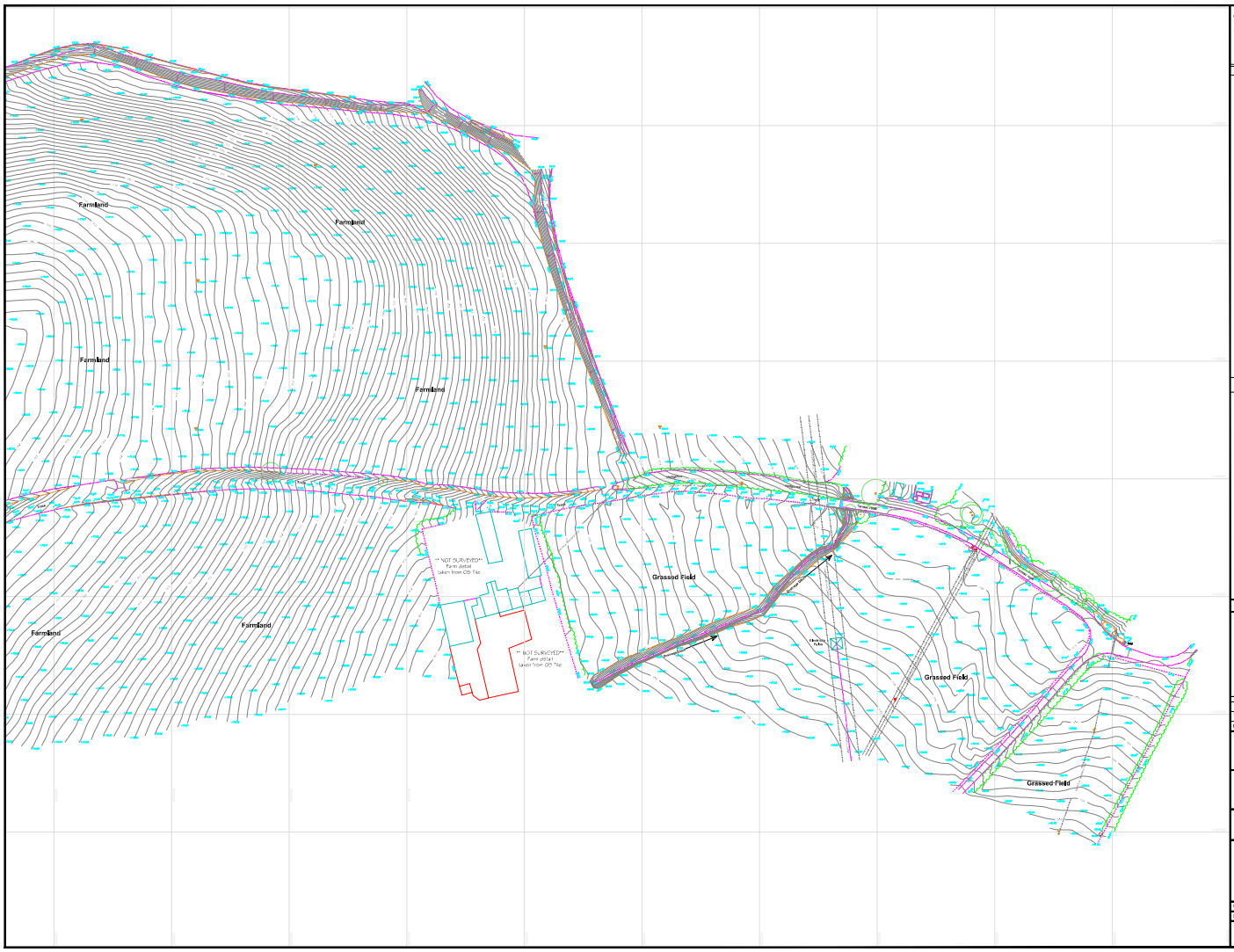
Town Planning • Master Planning & Urban Design • Architecture • Landscape Planning & Design • Infrastructure & Environmental Planning • Heritage • Graphic Communication • Communications & Engagement • Development Economics

bartonwillmore.co.uk

Offices at Birmingham Bristol Cambridge Cardiff Edinburgh Glasgow Leeds London Manchester Newcastle Reading Southampton

Appendix B Topographic Survey


Tree Planting
Ploughed Farmland
Ploughed Farmland
Grassed Field
Grassed Field
Ploughed Farmland
Farmland
Farmland
Farmland
Farmland
Grassed Field
Ploughed Farmland
Grassed Field
Farmland
Farmland
Farmland
Key:
Direction of North
Rev
Description
Date
By
Kirklees Council
Land South Of Ravensthorpe Road Ravensthorpe
3D Topographical Survey
Silkstone Surveys
Land & Measured Building Surveyors



Direction of North

Key:

MH	MH	MANHOLE (RECTANGULAR)	MH
DRAINS	DR	MANHOLE (TRIANGULAR)	MH
SUB STN	SUB	MARKER POST	MP
CABLE TV VENDR	CTV	BOLLY	BOL
CABLE TV SUPPLY	CTV	RODDING EYE	RE
CALVERT	CV	SIGN POST	SP
CAPTIONS POINT	CP	TELECOM COVER	TC
ELECTRICITY COVER	EC	TELEGRAPH POLE	TP
ELECTRICITY POLE	EP	THRESHOLD LEVEL	TH
FIRE HYDRANT	FH	TRAFFIC LIGHT	TL
GAS VALVE	GV	TRIAL PIT	TP
GATE		WASH OUT	WO
INSPECTION COVER (CIRCULAR)	IC	WATER METER	WM
INSPECTION COVER	IC	WATER STOP VENT	WV
KERB OUTLET	KO	WATER STOP VALVE	WV
LAMP POST	LP	BFA	BRICK/STONE FACING PLAIN
MANHOLE (CIRCULAR)	MH	BT	BRITISH TELECOM
Building Line		CLC	CLADDING
Fence		TS	TACTILE
Concrete		R.W.WALL	RETAINING WALL
Asphalt		TOE	TOP OF WALL (U
		FFL	INTERNAL FLOOR LE
		Overhead Cables	
Kerb		Bottom of Bank	
Slope		Top of Bank	

Rev	Description	Date	By

Kirklees Council

Land South Of Ravensthorpe Road
Ravensthorpe

3D Topographical Survey

Silkstone Surveys
Land & Measured Building Surveyors
7, Hall Arrow, Thoroughfare Park, Dodgeholes, Brighouse, West Yorkshire, HD6 3RH
Tel: 01274 872287 www.silkstonesurveys.co.uk

Projection: 27700 | Graphic: 2309L_207.dgn | D
Size: A3/21 | Grid: 20 | Unit: MD | Scale: 1:500 | Ver:

The copyright of this plan and all its contents are the property of Silkstone Environmental Ltd and may not be reproduced or used in any manner without prior consent of the Company or its clients.
Ordnance Survey data © Crown Copyright, all rights reserved. Licence Number 100019664

Appendix C Communications

C.1 YORKSHIRE WATER

YorkshireWater

Ms F Del Rio
Buro Happold
3 Wellington Place
Leeds
LS1 4AP

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

Your Ref:
Our Ref: X004167

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

15th July 2021

Dear Ms Del Rio,

Ravensthorpe Road, Dewsbury, WF12 9EG - Pre-Planning Sewerage Enquiry U178824 (RESIDENTIAL)

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul Water

Subject to a robust build rate profile and start date foul water domestic waste can discharge to the 375 mm diameter public combined sewer recorded in Ravensthorpe Road, at a point to the north of the site.

From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network. If sewage pumping is required foul water discharge must not exceed 8.5 (eight point five) litres per second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

Northern Site

As a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, curtilage surface water may discharge via the 600 mm private surface water drain that in turn drains to the 1080 mm diameter public surface water sewer recorded in Revensthorpe Road, at a point to the east of the

site.

The surface water discharge from the site to be restricted to not greater than 3.5 (three point five) litres/second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Southern Site

Due to the fall of the site not much appears to find its way into the watercourse to the south east. Approximately 2.5 hectares.

As a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, curtilage surface water may discharge via the watercourse or 600 mm private surface water drain that in turn drains to the 1080 mm diameter public surface water sewer recorded in Revensthorpe Road, at a point to the east of the site.

The surface water discharge from the site to be restricted to not greater than 5 (five) litres/second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

YorkshireWater

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the Codes for Adoption as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.

The site is within an area that may be affected by river, coastal or estuarine flooding. We would advise you to contact the Environment Agency for details.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.

YorkshireWater

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

Chris Roberts
Development Services Technician

INVESTING IN VOLUNTEERS FOR EMPLOYERS
CUSTOMER SERVICE EXCELLENCE CSE

Appendix D Hydraulic Calculations

D.1 HOUSING MASTERPLAN CALCULATIONS (OUTLINE PLANNING)

D.2 HIGHWAYS DETAILED CALCULATIONS

HOUSING MASTERPLAN CALCULATIONS (OUTLINE PLANNING)

CATCHMENT 1

CATCHMENT 1	AREAS	IMPERMEABILITY FACTOR	IMPERMEABLE AREAS
RESIDENTIAL USE	2.9	0.85	2.5
MIXED USE	0	0.85	0.0
ROADS	0.7	0.85	0.6
SUDS AREAS	0.6	0.85	0.5
GREEN AREAS	0.5	0.15	0.1
EXTERNAL AREA DRAINING TO SITE	0	0.15	0.0
TOTAL	**4.7**		**3.6**

Storage sizing based on a 1 in 100-year return period with 40% Climate Change allowance was calculated using MicroDrainage. The discharge rate agreed with Yorkshire Water for Catchment 1 is 3.5 l/s and the design criteria for hydraulic calculations used is:

DESIGN CRITERIA	**Return Period (years)**	100
	M5-60 (mm)	17.000
	Ratio R	0.300
	Climate Change (%)	40

MicroDrainage results indicate that for Catchment 1 it is required a storage of between 5071 m^3 and 6456 m^3. Therefore the **required approximate attenuation volume =5071 + 2/3 (6456-5071) = 5994 m^3 ~ 6000 m^3**

CATCHMENT 2

CATCHMENT 2	AREAS	IMPERMEABILITY FACTOR	IMPERMEABLE AREAS
RESIDENTIAL USE	6.8	0.85	5.8
MIXED USE	1.05	0.85	0.9
ROADS	2.2	0.85	1.9
SUDS AREAS	2.3	0.85	2.0
GREEN AREAS	2.35	0.15	0.4
EXTERNAL AREA DRAINING TO SITE	1.8	0.15	0.3
TOTAL	**16.5**		**11.1**

Storage sizing based on a 1 in 100-year return period with 40% Climate Change allowance was calculated using MicroDrainage. The discharge rate agreed with Yorkshire Water for Catchment 2 is 5 l/s and the design criteria for hydraulic calculations used is:

DESIGN CRITERIA	**Return Period (years)**	100
	M5-60 (mm)	17.000
	Ratio R	0.300
	Climate Change (%)	40

MicroDrainage results indicate that for Catchment 2 it is required a storage of between 18876 m^3 and 20962 m^3.
Therefore the **required approximate attenuation volume = 18876 + 2/3 (20962-18876) = 20267 m^3 ~ 20300 m^3**

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.000	Add Flow / Climate Change (%)	40
Ratio R	0.300	Minimum Backdrop Height (m)	0.225
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.225
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	191.990	8.050	23.8	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S2.000	51.105	2.400	21.3	0.033	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S2.001	21.988	1.200	18.3	0.046	0.00	0.0		0.035	o	225	Pipe/Conduit	
S2.002	14.759	0.800	18.4	0.022	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S2.003	16.540	0.800	20.7	0.011	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S2.004	17.406	0.800	21.8	0.012	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S2.005	15.058	0.200	75.3	0.013	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S3.000	69.892	3.200	21.8	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S3.001	20.600	0.800	25.8	0.052	0.00	0.0		0.035	o	150	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	7.49	55.575	0.000	0.0	0.0	0.0	1.29	212.4	0.0
S2.000	50.00	5.63	53.775	0.033	0.0	0.0	1.8	1.36	224.8	6.3
S2.001	50.00	6.00	51.375	0.079	0.0	0.0	4.3	0.98	39.0	15.0
S2.002	50.00	6.17	50.175	0.101	0.0	0.0	5.5	1.46	241.5	19.1
S2.003	50.00	6.37	49.375	0.112	0.0	0.0	6.1	1.38	228.1	21.2
S2.004	50.00	6.58	48.575	0.124	0.0	0.0	6.7	1.35	222.4	23.5
S2.005	50.00	6.93	47.775	0.137	0.0	0.0	7.4	0.72	119.5	26.0
S3.000	50.00	5.87	55.575	0.000	0.0	0.0	0.0	1.35	222.0	0.0
S3.001	50.00	6.41	52.375	0.052	0.0	0.0	2.8	0.63	11.1	9.9

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.002	85.660	3.800	22.5	0.021	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S3.003	14.646	0.200	73.2	0.063	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S2.006	9.657	0.050	193.1	0.016	0.00	0.0		0.035	o	450	Pipe/Conduit	
S4.000	18.965	1.000	19.0	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S4.001	73.181	3.600	20.3	0.019	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S4.002	16.397	0.800	20.5	0.054	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S4.003	18.051	0.800	22.6	0.012	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S4.004	21.377	0.800	26.7	0.013	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S4.005	18.032	0.250	72.1	0.016	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S1.001	7.913	0.025	316.5	0.155	0.00	0.0	0.600		o	450	Pipe/Conduit	
S1.002	52.066	1.375	37.9	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
S1.003	10.705	2.244	4.8	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S5.000	10.975	0.800	13.7	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.001	19.237	1.200	16.0	0.018	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.002	6.422	0.300	21.4	0.021	0.00	0.0		0.035	o	150	Pipe/Conduit	
S5.003	13.547	0.300	45.2	0.016	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.004	14.088	0.200	70.4	0.011	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.005	4.618	0.200	23.1	0.012	0.00	0.0		0.035	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.002	50.00	7.49	51.575	0.073	0.0	0.0	4.0	1.32	218.5	13.8
S3.003	50.00	7.82	47.775	0.136	0.0	0.0	7.4	0.73	121.2	25.8
S2.006	50.00	8.16	46.450	0.289	0.0	0.0	15.7	0.48	76.2	54.8
S4.000	50.00	5.22	54.775	0.000	0.0	0.0	0.0	1.44	238.2	0.0
S4.001	50.00	6.09	53.775	0.019	0.0	0.0	1.0	1.39	230.1	3.6
S4.002	50.00	6.29	50.175	0.073	0.0	0.0	4.0	1.39	229.1	13.8
S4.003	50.00	6.52	49.375	0.085	0.0	0.0	4.6	1.32	218.4	16.1
S4.004	50.00	6.81	48.575	0.098	0.0	0.0	5.3	1.22	200.7	18.6
S4.005	50.00	7.22	47.775	0.114	0.0	0.0	6.2	0.74	122.1	21.6
S1.001	50.00	8.27	46.400	0.558	0.0	0.0	30.2	1.14	180.9	105.8
S1.002	50.00	8.53	46.375	0.558	0.0	0.0	30.2	3.31	526.8	105.8
S1.003	50.00	8.56	45.000	0.558	0.0	0.0	30.2	6.03	239.8	105.8
S5.000	50.00	5.11	60.975	0.000	0.0	0.0	0.0	1.70	280.0	0.0
S5.001	50.00	5.31	60.175	0.018	0.0	0.0	1.0	1.57	259.1	3.4
S5.002	50.00	5.47	58.975	0.039	0.0	0.0	2.1	0.69	12.2	7.4
S5.003	50.00	5.71	58.675	0.055	0.0	0.0	3.0	0.94	154.4	10.4
S5.004	50.00	6.02	58.375	0.066	0.0	0.0	3.6	0.75	123.6	12.5
S5.005	50.00	6.11	58.175	0.078	0.0	0.0	4.2	0.87	34.7	14.8

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.006	8.488	0.200	42.4	0.014	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.007	19.783	0.200	98.9	0.008	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.008	14.370	0.050	287.4	0.017	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.009	16.855	0.300	56.2	0.013	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.010	34.752	0.450	77.2	0.016	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.011	21.102	0.800	26.4	0.042	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.012	20.678	1.000	20.7	0.032	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.013	9.452	0.050	189.0	0.040	0.00	0.0		0.035	o	450	Pipe/Conduit	
S6.000	16.889	0.100	168.9	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S6.001	16.953	0.050	339.1	0.018	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S6.002	22.184	0.050	443.7	0.016	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S6.003	18.869	0.300	62.9	0.019	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S6.004	31.624	0.500	63.2	0.014	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S6.005	21.060	0.800	26.3	0.035	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S6.006	19.676	1.100	17.9	0.019	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S5.014	16.039	0.050	320.8	0.021	0.00	0.0	0.600		o	375	Pipe/Conduit	
S5.015	187.418	5.325	35.2	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit	
S7.000	13.181	0.400	33.0	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S7.001	14.266	0.600	23.8	0.053	0.00	0.0		0.035	3 \=/	650	1:3 Swale	

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)
S5.006	50.00	6.26	57.975	0.092	0.0	0.0	5.0	0.96	159.2	17.4
S5.007	50.00	6.78	57.775	0.100	0.0	0.0	5.4	0.63	104.3	19.0
S5.008	50.00	7.42	57.575	0.117	0.0	0.0	6.3	0.37	61.2	22.2
S5.009	50.00	7.76	57.525	0.130	0.0	0.0	7.0	0.84	138.4	24.6
S5.010	50.00	8.57	57.225	0.146	0.0	0.0	7.9	0.72	118.0	27.7
S5.011	50.00	8.86	56.775	0.188	0.0	0.0	10.2	1.22	202.0	35.6
S5.012	50.00	9.10	55.975	0.220	0.0	0.0	11.9	1.38	228.1	41.7
S5.013	50.00	9.43	53.850	0.260	0.0	0.0	14.1	0.48	77.0	49.3
S6.000	50.00	5.58	57.775	0.000	0.0	0.0	0.0	0.48	79.8	0.0
S6.001	50.00	6.41	57.675	0.018	0.0	0.0	1.0	0.34	56.3	3.4
S6.002	50.00	7.65	57.625	0.034	0.0	0.0	1.8	0.30	49.2	6.4
S6.003	50.00	8.05	57.575	0.053	0.0	0.0	2.9	0.79	130.8	10.0
S6.004	50.00	8.71	57.275	0.067	0.0	0.0	3.6	0.79	130.4	12.7
S6.005	50.00	9.00	56.775	0.102	0.0	0.0	5.5	1.23	202.2	19.3
S6.006	50.00	9.22	55.975	0.121	0.0	0.0	6.6	1.49	245.3	22.9
S5.014	50.00	9.70	53.875	0.402	0.0	0.0	21.8	1.01	111.1	76.2
S5.015	50.00	10.46	53.825	0.402	0.0	0.0	21.8	4.11	1163.2	76.2
S7.000	50.00	5.20	57.775	0.000	0.0	0.0	0.0	1.10	180.7	0.0
S7.001	50.00	5.39	57.375	0.053	0.0	0.0	2.9	1.29	212.7	10.0

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.002	21.327	1.000	21.3	0.180	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S7.003	30.983	1.600	19.4	0.160	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S7.004	23.387	1.200	19.5	0.028	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S7.005	23.386	1.200	19.5	0.013	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S7.006	34.513	2.375	14.5	0.016	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S8.000	37.500	1.200	31.3	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S8.001	24.579	1.200	20.5	0.017	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S8.002	34.647	1.750	19.8	0.021	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S8.003	9.444	0.125	75.6	0.031	0.00	0.0	0.600		o	225	Pipe/Conduit	
S7.007	13.833	0.050	276.7	0.025	0.00	0.0	0.600		o	450	Pipe/Conduit	
S7.008	2.494	0.850	2.9	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
S9.000	16.938	0.400	42.3	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.001	31.163	1.400	22.3	0.012	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.002	21.709	1.400	15.5	0.023	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.003	26.943	1.800	15.0	0.019	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.004	35.527	2.400	14.8	0.029	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.005	37.517	2.600	14.4	0.045	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.006	24.594	1.600	15.4	0.056	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.007	22.300	1.600	13.9	0.041	0.00	0.0		0.035	3 \=/	650	1:3 Swale	

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)
S7.002	50.00	5.65	56.775	0.233	0.0	0.0	12.6	1.36	224.6	44.2
S7.003	50.00	6.01	55.775	0.393	0.0	0.0	21.3	1.43	235.7	74.5
S7.004	50.00	6.28	54.175	0.421	0.0	0.0	22.8	1.42	235.0	79.8
S7.005	50.00	6.56	52.975	0.434	0.0	0.0	23.5	1.42	235.0	82.3
S7.006	50.00	6.90	51.775	0.450	0.0	0.0	24.4	1.65	272.1	85.3
S8.000	50.00	5.56	54.175	0.000	0.0	0.0	0.0	1.12	185.6	0.0
S8.001	50.00	5.85	52.975	0.017	0.0	0.0	0.9	1.39	229.2	3.2
S8.002	50.00	6.26	51.775	0.038	0.0	0.0	2.1	1.41	233.1	7.2
S8.003	50.00	6.36	49.525	0.069	0.0	0.0	3.7	1.51	59.9	13.1
S7.007	50.00	7.09	49.400	0.544	0.0	0.0	29.5	1.22	193.6	103.1
S7.008	50.00	7.10	49.350	0.544	0.0	0.0	29.5	11.93	1897.6	103.1
S9.000	50.00	5.29	82.775	0.000	0.0	0.0	0.0	0.97	159.4	0.0
S9.001	50.00	5.68	82.375	0.012	0.0	0.0	0.6	1.33	219.9	2.3
S9.002	50.00	5.91	80.975	0.035	0.0	0.0	1.9	1.60	263.4	6.6
S9.003	50.00	6.19	79.575	0.054	0.0	0.0	2.9	1.62	268.1	10.2
S9.004	50.00	6.55	77.775	0.083	0.0	0.0	4.5	1.63	269.6	15.7
S9.005	50.00	6.93	75.375	0.128	0.0	0.0	6.9	1.65	273.1	24.3
S9.006	50.00	7.18	72.775	0.184	0.0	0.0	10.0	1.60	264.6	34.9
S9.007	50.00	7.40	71.175	0.225	0.0	0.0	12.2	1.68	277.8	42.7

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.008	17.424	1.150	15.2	0.038	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.009	94.204	6.250	15.1	0.028	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.010	15.788	0.800	19.7	0.137	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.011	9.260	0.050	185.2	0.200	0.00	0.0		0.035	o	600	Pipe/Conduit	
S10.000	42.196	1.400	30.1	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.001	18.307	1.050	17.4	0.031	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.002	20.407	1.350	15.1	0.015	0.00	0.0		0.035	o	150	Pipe/Conduit	
S10.003	18.842	1.200	15.7	0.026	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.004	36.056	2.400	15.0	0.024	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.005	39.917	2.600	15.4	0.057	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.006	23.973	1.600	15.0	0.069	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.007	21.885	1.400	15.6	0.042	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.008	20.288	1.400	14.5	0.041	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.009	90.829	7.000	13.0	0.039	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S10.010	14.839	0.200	74.2	0.151	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S9.012	13.246	0.025	529.8	0.017	0.00	0.0		0.035	o	900	Pipe/Conduit	
S9.013	49.726	3.025	16.4	0.000	0.00	0.0		0.035	o	900	Pipe/Conduit	
S9.014	11.414	0.500	22.8	0.000	0.00	0.0		0.035	o	900	Pipe/Conduit	
S9.015	22.829	0.050	456.6	0.000	0.00	0.0		0.035	o	900	Pipe/Conduit	
S9.016	11.414	1.450	7.9	0.000	0.00	0.0		0.035	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S9.008	50.00	7.58	69.575	0.263	0.0	0.0	14.2	1.62	266.5	49.9
S9.009	50.00	8.55	68.425	0.291	0.0	0.0	15.8	1.62	267.2	55.2
S9.010	50.00	8.74	62.175	0.428	0.0	0.0	23.2	1.42	233.5	81.1
S9.011	50.00	9.00	60.100	0.628	0.0	0.0	34.0	0.59	167.6	119.1
S10.000	50.00	5.61	82.775	0.000	0.0	0.0	0.0	1.15	188.9	0.0
S10.001	50.00	5.82	81.375	0.031	0.0	0.0	1.7	1.51	248.4	5.9
S10.002	50.00	6.23	80.325	0.046	0.0	0.0	2.5	0.82	14.5	8.7
S10.003	50.00	6.43	78.975	0.072	0.0	0.0	3.9	1.59	261.8	13.6
S10.004	50.00	6.80	77.775	0.096	0.0	0.0	5.2	1.62	267.6	18.2
S10.005	50.00	7.21	75.375	0.153	0.0	0.0	8.3	1.60	264.7	29.0
S10.006	50.00	7.46	72.775	0.222	0.0	0.0	12.0	1.62	268.0	42.1
S10.007	50.00	7.69	71.175	0.264	0.0	0.0	14.3	1.59	262.4	50.0
S10.008	50.00	7.89	69.775	0.305	0.0	0.0	16.5	1.65	272.5	57.8
S10.009	50.00	8.76	68.375	0.344	0.0	0.0	18.6	1.75	288.0	65.2
S10.010	50.00	9.10	61.375	0.495	0.0	0.0	26.8	0.73	120.4	93.8
S9.012	50.00	9.58	60.050	1.140	0.0	0.0	61.7	0.46	292.1	216.1
S9.013	50.00	9.90	60.025	1.140	0.0	0.0	61.7	2.61	1658.4	216.1
S9.014	50.00	9.98	57.000	1.140	0.0	0.0	61.7	2.21	1407.3	216.1
S9.015	50.00	10.75	56.500	1.140	0.0	0.0	61.7	0.49	314.7	216.1
S9.016	50.00	10.80	56.450	1.140	0.0	0.0	61.7	3.77	2396.5	216.1

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.017	126.927	6.500	19.5	0.000	0.00	0.0		0.035	o	900	Pipe/Conduit	
S11.000	10.236	0.150	68.2	0.020	5.00	0.0		0.035	o	150	Pipe/Conduit	
S11.001	9.302	0.200	46.5	0.019	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S11.002	6.126	0.200	30.6	0.048	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S11.003	8.915	0.200	44.6	0.028	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S11.004	6.520	0.400	16.3	0.011	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S11.005	17.438	0.800	21.8	0.031	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S11.006	21.981	1.000	22.0	0.000	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S11.007	13.707	0.700	19.6	0.029	0.00	0.0	0.600		o	300	Pipe/Conduit	
S11.008	26.439	1.200	22.0	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit	
S12.000	23.687	0.100	236.9	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.000	18.762	1.200	15.6	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.001	10.584	0.400	26.5	0.031	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.002	7.225	0.300	24.1	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
S13.003	21.999	0.700	31.4	0.023	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.004	10.001	0.200	50.0	0.032	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.005	8.123	0.150	54.2	0.015	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.006	15.488	0.050	309.8	0.017	0.00	0.0		0.035	3 \=/	650	1:3 Swale	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S9.017	50.00	11.69	55.000	1.140	0.0	0.0	61.7	2.39	1521.6	216.1
S11.000	50.00	5.44	57.975	0.020	0.0	0.0	1.1	0.39	6.8	3.8
S11.001	50.00	5.61	57.825	0.039	0.0	0.0	2.1	0.92	152.1	7.4
S11.002	50.00	5.70	57.625	0.087	0.0	0.0	4.7	1.14	187.4	16.5
S11.003	50.00	5.86	57.425	0.115	0.0	0.0	6.2	0.94	155.4	21.8
S11.004	50.00	5.93	57.225	0.126	0.0	0.0	6.8	1.56	256.9	23.9
S11.005	50.00	6.14	56.825	0.157	0.0	0.0	8.5	1.35	222.2	29.8
S11.006	50.00	6.42	56.025	0.157	0.0	0.0	8.5	1.34	221.2	29.8
S11.007	50.00	6.48	54.400	0.186	0.0	0.0	10.1	3.57	252.3	35.3
S11.008	50.00	6.56	53.700	0.186	0.0	0.0	10.1	5.20	1471.1	35.3
S12.000	50.00	5.97	57.975	0.000	0.0	0.0	0.0	0.41	67.4	0.0
S13.000	50.00	5.20	60.975	0.000	0.0	0.0	0.0	1.59	262.3	0.0
S13.001	50.00	5.34	59.775	0.031	0.0	0.0	1.7	1.22	201.7	5.9
S13.002	50.00	5.40	59.375	0.031	0.0	0.0	1.7	2.06	36.4	5.9
S13.003	50.00	5.73	59.075	0.054	0.0	0.0	2.9	1.12	185.0	10.2
S13.004	50.00	5.91	58.375	0.086	0.0	0.0	4.7	0.89	146.7	16.3
S13.005	50.00	6.07	58.175	0.101	0.0	0.0	5.5	0.85	141.0	19.1
S13.006	50.00	6.80	58.025	0.118	0.0	0.0	6.4	0.36	58.9	22.4

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S14.000	21.190	0.050	423.8	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S13.007	14.004	0.050	280.1	0.039	0.00	0.0	0.600		o	375	Pipe/Conduit	
S12.001	14.880	0.050	297.6	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S12.002	81.510	4.325	18.8	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S11.009	10.435	0.050	208.7	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S11.010	33.471	0.050	669.4	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S11.011	67.948	3.900	17.4	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit	
S5.016	32.810	0.762	43.1	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S15.000	41.112	1.800	22.8	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S15.001	12.054	0.600	20.1	0.029	0.00	0.0		0.035	o	150	Pipe/Conduit	
S15.002	44.692	1.200	37.2	0.014	0.00	0.0		0.035	3 \=/	600	1:3 Swale	
S15.003	16.306	0.400	40.8	0.000	0.00	0.0		0.035	o	150	Pipe/Conduit	
S15.004	10.892	0.200	54.5	0.000	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S15.005	33.682	1.275	26.4	0.050	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S15.006	36.102	1.150	31.4	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
S15.007	11.602	0.050	232.0	0.140	0.00	0.0	0.600		o	600	Pipe/Conduit	
S15.008	5.478	0.300	18.3	0.000	0.00	0.0	0.600		o	600	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)
S14.000	50.00	6.16	58.025	0.000	0.0	0.0	0.0	0.31	50.4	0.0
S13.007	50.00	7.01	56.925	0.157	0.0	0.0	8.5	1.08	119.0	29.8
S12.001	50.00	7.25	56.875	0.157	0.0	0.0	8.5	1.05	115.4	29.8
S12.002	50.00	7.57	56.825	0.157	0.0	0.0	8.5	4.19	462.8	29.8
S11.009	50.00	7.77	52.500	0.343	0.0	0.0	18.6	0.90	35.8«	65.0
S11.010	50.00	8.89	52.450	0.343	0.0	0.0	18.6	0.50	19.8«	65.0
S11.011	50.00	9.08	52.400	0.343	0.0	0.0	18.6	5.85	1654.8	65.0
S5.016	50.00	11.96	48.500	2.429	0.0	0.0	131.6	2.00	79.5«	460.5
S15.000	50.00	5.52	49.975	0.000	0.0	0.0	0.0	1.32	217.0	0.0
S15.001	50.00	5.80	48.175	0.029	0.0	0.0	1.6	0.71	12.6	5.5
S15.002	50.00	6.53	47.575	0.043	0.0	0.0	2.3	1.02	160.7	8.2
S15.003	50.00	7.07	46.375	0.043	0.0	0.0	2.3	0.50	8.9	8.2
S15.004	50.00	7.29	45.975	0.043	0.0	0.0	2.3	0.85	140.6	8.2
S15.005	50.00	7.75	45.775	0.093	0.0	0.0	5.0	1.22	201.8	17.6
S15.006	50.00	8.08	44.500	0.093	0.0	0.0	5.0	1.80	31.9	17.6
S15.007	50.00	8.20	43.350	0.233	0.0	0.0	12.6	1.59	450.8	44.2
S15.008	50.00	8.22	43.300	0.233	0.0	0.0	12.6	5.72	1616.4	44.2

©1982-2020 Innovyze

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S16.000	41.008	1.800	22.8	0.000	5.00	0.0		0.035	3 \=/	650	1:3 Swale	
S16.001	12.314	0.600	20.5	0.037	0.00	0.0		0.035	o	150	Pipe/Conduit	
S16.002	71.344	1.800	39.6	0.011	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S16.003	32.035	0.800	40.0	0.050	0.00	0.0		0.035	3 \=/	650	1:3 Swale	
S16.004	10.680	0.050	213.6	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
S16.005	9.434	0.200	47.2	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
S16.006	29.256	0.700	41.8	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S16.007	9.457	0.300	31.5	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
S15.009	67.515	0.310	217.8	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S16.000	50.00	5.52	49.975	0.000	0.0	0.0	0.0	1.32	217.3	0.0
S16.001	50.00	5.81	48.175	0.037	0.0	0.0	2.0	0.71	12.5	7.0
S16.002	50.00	7.00	47.575	0.048	0.0	0.0	2.6	1.00	164.8	9.1
S16.003	50.00	7.54	45.775	0.098	0.0	0.0	5.3	0.99	163.9	18.6
S16.004	50.00	7.67	44.250	0.098	0.0	0.0	5.3	1.39	220.6	18.6
S16.005	50.00	7.72	44.425	0.098	0.0	0.0	5.3	2.97	471.7	18.6
S16.006	50.00	7.96	44.000	0.098	0.0	0.0	5.3	2.03	80.7	18.6
S16.007	50.00	8.00	43.300	0.098	0.0	0.0	5.3	3.63	577.5	18.6
S15.009	50.00	9.49	43.000	0.331	0.0	0.0	17.9	0.88	35.1«	62.8

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	45.500	42.756	0.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S5.016	S	49.300	47.738	0.000	0	0

©1982-2020 Innovyze

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S15.009	S	44.465	42.690	0.000	0	0

©1982-2020 Innovyze

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S21, DS/PN: S1.003, Volume (m³): 9.6

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	45.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0
Flush-Flo™	0.297	3.0
Kick-Flo®	0.623	2.4
Mean Flow over Head Range	-	2.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	3.3	3.000	5.0	7.000	7.4
0.200	2.9	1.400	3.5	3.500	5.4	7.500	7.7
0.300	3.0	1.600	3.7	4.000	5.7	8.000	7.9
0.400	2.9	1.800	3.9	4.500	6.0	8.500	8.2
0.500	2.8	2.000	4.1	5.000	6.3	9.000	8.4
0.600	2.5	2.200	4.3	5.500	6.6	9.500	8.6
0.800	2.7	2.400	4.5	6.000	6.9		
1.000	3.0	2.600	4.7	6.500	7.2		

Hydro-Brake® Optimum Manhole: S99, DS/PN: S9.014, Volume (m³): 33.6

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)	57.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

©1982-2020 Innovyze

Hydro-Brake® Optimum Manhole: S99, DS/PN: S9.014, Volume (m³): 33.6

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: S101, DS/PN: S11.009, Volume (m³): 18.0

Unit Reference	MD-SHE-0036-6000-1000-6000
Design Head (m)	1.000
Design Flow (l/s)	0.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	36
Invert Level (m)	52.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.6
Flush-Flo™	0.156	0.4
Kick-Flo®	0.317	0.4
Mean Flow over Head Range	-	0.5

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	0.4	0.300	0.4	0.500	0.4	0.800	0.5
0.200	0.4	0.400	0.4	0.600	0.5	1.000	0.6

©1982-2020 Innovyze

Hydro-Brake® Optimum Manhole: S101, DS/PN: S11.009, Volume (m³): 18.0

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	0.6	2.400	0.9	5.000	1.2	8.000	1.5
1.400	0.7	2.600	0.9	5.500	1.3	8.500	1.6
1.600	0.7	3.000	1.0	6.000	1.3	9.000	1.6
1.800	0.8	3.500	1.0	6.500	1.4	9.500	1.7
2.000	0.8	4.000	1.1	7.000	1.4		
2.200	0.9	4.500	1.2	7.500	1.5		

Hydro-Brake® Optimum Manhole: S67, DS/PN: S5.016, Volume (m³): 154.7

Unit Reference	MD-SHE-0100-4500-1000-4500
Design Head (m)	1.000
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	48.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.5
Flush-Flo™	0.292	4.5
Kick-Flo®	0.630	3.6
Mean Flow over Head Range	-	3.9

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	3.3	1.200	4.9	3.000	7.5	7.000	11.2
0.200	4.4	1.400	5.3	3.500	8.1	7.500	11.6
0.300	4.5	1.600	5.6	4.000	8.6	8.000	12.0
0.400	4.4	1.800	5.9	4.500	9.1	8.500	12.3
0.500	4.2	2.000	6.2	5.000	9.6	9.000	12.7
0.600	3.8	2.200	6.5	5.500	10.0	9.500	13.0
0.800	4.1	2.400	6.8	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.8		

Hydro-Brake® Optimum Manhole: S116, DS/PN: S16.006, Volume (m³): 2.8

Unit Reference	MD-SHE-0024-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	0.3
Flush-Flo™	Calculated

©1982-2020 Innovyze

Hydro-Brake® Optimum Manhole: S116, DS/PN: S16.006, Volume (m³): 2.8

Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	24
Invert Level (m)	44.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.3
Flush-Flo™	0.106	0.2
Kick-Flo®	0.218	0.2
Mean Flow over Head Range	-	0.2

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	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.3	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.5	8.000	0.7
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		

Hydro-Brake® Optimum Manhole: S117, DS/PN: S15.009, Volume (m³): 4.5

Unit Reference	MD-SHE-0032-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	32
Invert Level (m)	43.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.5
Flush-Flo™	0.143	0.3
Kick-Flo®	0.288	0.3
Mean Flow over Head Range	-	0.4

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

©1982-2020 Innovyze

Hydro-Brake® Optimum Manhole: S117, DS/PN: S15.009, Volume (m³): 4.5

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	0.3	1.200	0.5	3.000	0.8	7.000	1.2
0.200	0.3	1.400	0.6	3.500	0.9	7.500	1.2
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.3
0.400	0.3	1.800	0.6	4.500	1.0	8.500	1.3
0.500	0.4	2.000	0.7	5.000	1.0	9.000	1.3
0.600	0.4	2.200	0.7	5.500	1.1	9.500	1.4
0.800	0.5	2.400	0.7	6.000	1.1		
1.000	0.5	2.600	0.8	6.500	1.2		

©1982-2020 Innovyze

Storage Structures for Storm

Tank or Pond Manhole: S21, DS/PN: S1.003

Invert Level (m) 45.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3938.0	1.000	3938.0	1.001	0.0

Tank or Pond Manhole: S99, DS/PN: S9.014

Invert Level (m) 57.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2330.0	1.000	2330.0	1.001	0.0

Tank or Pond Manhole: S101, DS/PN: S11.009

Invert Level (m) 52.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1469.0	1.000	1469.0	1.001	0.0

Tank or Pond Manhole: S67, DS/PN: S5.016

Invert Level (m) 48.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8504.0	1.000	8504.0	1.001	0.0

Tank or Pond Manhole: S116, DS/PN: S16.006

Invert Level (m) 44.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	68.0	1.000	68.0	1.001	0.0

Tank or Pond Manhole: S117, DS/PN: S15.009

Invert Level (m) 43.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	110.0	1.000	110.0	1.001	0.0

©1982-2020 Innovyze

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	6
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	5	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	17.000	Cv (Winter)	1.000

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

Profile(s)	Summer and Winter
Duration(s) (mins)	30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S29	30 Summer	1	+0%					55.575
S2.000	S35	30 Summer	1	+0%					53.791
S2.001	S36	30 Summer	1	+0%					51.450
S2.002	S37	30 Summer	1	+0%					50.203
S2.003	S38	30 Summer	1	+0%					49.405
S2.004	S39	30 Summer	1	+0%					48.607
S2.005	S40	30 Summer	1	+0%					47.824
S3.000	S25	30 Summer	1	+0%					55.575
S3.001	S26	30 Summer	1	+0%			1/30 Summer	108	52.392
S3.002	S27	30 Summer	1	+0%					51.588
S3.003	S28	30 Summer	1	+0%					47.812
S2.006	S41	30 Summer	1	+0%	30/30 Summer				46.647
S4.000	S42	30 Summer	1	+0%					54.775
S4.001	S43	30 Summer	1	+0%					53.786
S4.002	S44	30 Summer	1	+0%					50.198
S4.003	S45	30 Summer	1	+0%					49.401
S4.004	S46	30 Summer	1	+0%					48.605
S4.005	S47	30 Summer	1	+0%					47.818
S1.001	S30	30 Summer	1	+0%	30/30 Summer				46.620

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S29	-0.225	0.000	0.00			0.0	OK	
S2.000	S35	-0.209	0.000	0.01			4.2	FLOOD RISK*	
S2.001	S36	-0.150	0.000	0.24			9.2	FLOOD RISK	
S2.002	S37	-0.197	0.000	0.02			11.6	FLOOD RISK	
S2.003	S38	-0.195	0.000	0.02			12.8	FLOOD RISK*	
S2.004	S39	-0.193	0.000	0.03			14.1	FLOOD RISK*	
S2.005	S40	-0.176	0.000	0.06			15.4	FLOOD RISK*	
S3.000	S25	-0.225	0.000	0.00			0.0	OK	
S3.001	S26	-0.133	0.000	0.03	5.4		0.3	FLOOD RISK	
S3.002	S27	-0.212	0.000	0.01			2.6	FLOOD RISK	
S3.003	S28	-0.188	0.000	0.03			9.5	FLOOD RISK*	
S2.006	S41	-0.253	0.000	0.37			26.5	OK	
S4.000	S42	-0.225	0.000	0.00			0.0	OK	
S4.001	S43	-0.214	0.000	0.00			2.1	FLOOD RISK*	
S4.002	S44	-0.202	0.000	0.02			8.1	FLOOD RISK*	
S4.003	S45	-0.199	0.000	0.02			9.4	FLOOD RISK*	
S4.004	S46	-0.195	0.000	0.02			10.8	FLOOD RISK*	
S4.005	S47	-0.182	0.000	0.05			12.6	FLOOD RISK*	
S1.001	S30	-0.230	0.000	0.48			55.4	OK	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.002	S20	30 Summer	1	+0%					46.472
S1.003	S21	8640 Summer	1	+0%					45.047
S5.000	S26	30 Summer	1	+0%					60.975
S5.001	S27	30 Summer	1	+0%					60.185
S5.002	S28	30 Summer	1	+0%	30/30 Summer				59.038
S5.003	S29	30 Summer	1	+0%					58.700
S5.004	S30	30 Summer	1	+0%					58.406
S5.005	S31	30 Summer	1	+0%					58.253
S5.006	S32	30 Summer	1	+0%					58.008
S5.007	S33	30 Summer	1	+0%					57.819
S5.008	S34	30 Summer	1	+0%					57.639
S5.009	S30	30 Summer	1	+0%					57.567
S5.010	S31	30 Summer	1	+0%					57.274
S5.011	S32	30 Summer	1	+0%					56.816
S5.012	S33	30 Summer	1	+0%					56.016
S5.013	S34	30 Summer	1	+0%	30/30 Summer				54.062
S6.000	S58	30 Summer	1	+0%					57.775
S6.001	S59	30 Summer	1	+0%					57.698
S6.002	S60	30 Summer	1	+0%					57.659
S6.003	S43	30 Summer	1	+0%					57.599
S6.004	S44	30 Summer	1	+0%					57.303
S6.005	S45	30 Summer	1	+0%					56.802
S6.006	S46	30 Summer	1	+0%					56.002
S5.014	S47	30 Summer	1	+0%	30/30 Summer				54.044
S5.015	S66	30 Summer	1	+0%					53.895
S7.000	S66	30 Summer	1	+0%					57.775
S7.001	S67	30 Summer	1	+0%					57.395
S7.002	S68	30 Summer	1	+0%					56.821
S7.003	S69	30 Summer	1	+0%					55.836
S7.004	S54	30 Summer	1	+0%					54.238
S7.005	S55	30 Summer	1	+0%					53.039
S7.006	S56	30 Summer	1	+0%					51.835
S8.000	S57	30 Summer	1	+0%					54.175
S8.001	S58	30 Summer	1	+0%					52.985
S8.002	S59	30 Summer	1	+0%					51.791
S8.003	S60	30 Summer	1	+0%	30/30 Summer				49.610
S7.007	S57	30 Summer	1	+0%	30/30 Summer				49.600
S7.008	S79	30 Summer	1	+0%					49.451
S9.000	S1	30 Summer	1	+0%					82.775
S9.001	S2	30 Summer	1	+0%					82.383
S9.002	S3	30 Summer	1	+0%					80.989
S9.003	S4	30 Summer	1	+0%					79.593
S9.004	S5	30 Summer	1	+0%					77.798
S9.005	S6	30 Summer	1	+0%					75.404
S9.006	S8	30 Summer	1	+0%					72.811
S9.007	S9	30 Summer	1	+0%					71.215
S9.008	S10	30 Summer	1	+0%					69.620
S9.009	S11	30 Summer	1	+0%					68.472

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	S20	-0.353	0.000	0.10			55.2	OK*	
S1.003	S21	-0.178	0.000	0.00			0.9	OK	
S5.000	S26	-0.225	0.000	0.00			0.0	OK	
S5.001	S27	-0.215	0.000	0.00			2.0	FLOOD RISK*	
S5.002	S28	-0.087	0.000	0.36			4.3	FLOOD RISK	
S5.003	S29	-0.200	0.000	0.02			6.1	FLOOD RISK	
S5.004	S30	-0.194	0.000	0.03			7.3	FLOOD RISK*	
S5.005	S31	-0.147	0.000	0.26			8.6	FLOOD RISK	
S5.006	S32	-0.192	0.000	0.03			10.1	FLOOD RISK	
S5.007	S33	-0.181	0.000	0.05			10.8	FLOOD RISK*	
S5.008	S34	-0.161	0.000	0.09			12.5	FLOOD RISK*	
S5.009	S30	-0.183	0.000	0.04			13.6	FLOOD RISK*	
S5.010	S31	-0.176	0.000	0.06			14.9	FLOOD RISK*	
S5.011	S32	-0.184	0.000	0.04			18.5	FLOOD RISK*	
S5.012	S33	-0.184	0.000	0.04			21.2	FLOOD RISK*	
S5.013	S34	-0.238	0.000	0.34			24.7	OK	
S6.000	S58	-0.225	0.000	0.00			0.0	OK	
S6.001	S59	-0.202	0.000	0.01			1.9	FLOOD RISK*	
S6.002	S60	-0.191	0.000	0.03			3.3	FLOOD RISK*	
S6.003	S43	-0.201	0.000	0.02			5.0	FLOOD RISK*	
S6.004	S44	-0.197	0.000	0.02			6.3	FLOOD RISK*	
S6.005	S45	-0.198	0.000	0.02			9.5	FLOOD RISK*	
S6.006	S46	-0.198	0.000	0.02			11.3	FLOOD RISK*	
S5.014	S47	-0.206	0.000	0.42			37.7	OK	
S5.015	S66	-0.530	0.000	0.03			37.6	OK*	
S7.000	S66	-0.225	0.000	0.00			0.0	OK	
S7.001	S67	-0.205	0.000	0.01			5.9	FLOOD RISK*	
S7.002	S68	-0.179	0.000	0.05			25.8	FLOOD RISK*	
S7.003	S69	-0.164	0.000	0.08			43.2	FLOOD RISK*	
S7.004	S54	-0.162	0.000	0.09			46.5	FLOOD RISK*	
S7.005	S55	-0.161	0.000	0.09			48.1	FLOOD RISK*	
S7.006	S56	-0.165	0.000	0.08			49.8	FLOOD RISK*	
S8.000	S57	-0.225	0.000	0.00			0.0	OK	
S8.001	S58	-0.215	0.000	0.00			1.9	FLOOD RISK*	
S8.002	S59	-0.209	0.000	0.01			4.2	FLOOD RISK*	
S8.003	S60	-0.140	0.000	0.15			7.4	OK	
S7.007	S57	-0.250	0.000	0.41			59.6	OK	
S7.008	S79	-0.349	0.000	0.11			59.4	OK*	
S9.000	S1	-0.225	0.000	0.00			0.0	OK	
S9.001	S2	-0.217	0.000	0.00			1.3	FLOOD RISK*	
S9.002	S3	-0.211	0.000	0.01			3.9	FLOOD RISK*	
S9.003	S4	-0.207	0.000	0.01			6.0	FLOOD RISK*	
S9.004	S5	-0.202	0.000	0.02			9.2	FLOOD RISK*	
S9.005	S6	-0.196	0.000	0.02			14.1	FLOOD RISK*	
S9.006	S8	-0.189	0.000	0.03			20.2	FLOOD RISK*	
S9.007	S9	-0.185	0.000	0.04			24.7	FLOOD RISK*	
S9.008	S10	-0.180	0.000	0.05			28.9	FLOOD RISK*	

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S9.009	S11	-0.178	0.000	0.05			31.2	FLOOD RISK*	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.010	S13	30 Summer	1	+0%				
S9.011	S12	30 Summer	1	+0%	30/30 Summer			
S10.000	S13	30 Summer	1	+0%				
S10.001	S14	30 Summer	1	+0%				
S10.002	S15	30 Summer	1	+0%			1/30 Summer	108
S10.003	S16	30 Summer	1	+0%				
S10.004	S17	30 Summer	1	+0%				
S10.005	S18	30 Summer	1	+0%				
S10.006	S19	30 Summer	1	+0%				
S10.007	S20	30 Summer	1	+0%				
S10.008	S21	30 Summer	1	+0%				
S10.009	S22	30 Summer	1	+0%				
S10.010	S23	30 Summer	1	+0%				
S9.012	S24	30 Summer	1	+0%	30/30 Summer			
S9.013	S98	30 Summer	1	+0%				
S9.014	S99	10080 Summer	1	+0%				
S9.015	S84	10080 Summer	1	+0%				
S9.016	S85	10080 Summer	1	+0%				
S9.017	S84	8640 Winter	1	+0%				
S11.000	S93	30 Summer	1	+0%	30/30 Summer			
S11.001	S94	30 Summer	1	+0%				
S11.002	S95	30 Summer	1	+0%				
S11.003	S96	30 Summer	1	+0%				
S11.004	S97	30 Summer	1	+0%				
S11.005	S98	30 Summer	1	+0%				
S11.006	S101	30 Summer	1	+0%				
S11.007	S99	30 Summer	1	+0%				
S11.008	S96	30 Summer	1	+0%				
S12.000	S94	30 Summer	1	+0%				
S13.000	S86	30 Summer	1	+0%				
S13.001	S87	30 Summer	1	+0%				
S13.002	S87	30 Summer	1	+0%				
S13.003	S88	30 Summer	1	+0%				
S13.004	S89	30 Summer	1	+0%				
S13.005	S90	30 Summer	1	+0%				
S13.006	S91	30 Summer	1	+0%				
S14.000	S92	30 Summer	1	+0%				
S13.007	S92	30 Summer	1	+0%				
S12.001	S106	30 Summer	1	+0%				
S12.002	S107	30 Summer	1	+0%				
S11.009	S101	8640 Summer	1	+0%	30/2160 Summer			
S11.010	S109	8640 Summer	1	+0%				
S11.011	S103	2160 Summer	1	+0%				
S5.016	S67	10080 Winter	1	+0%				
S15.000	S62	30 Summer	1	+0%				
S15.001	S63	30 Summer	1	+0%	100/30 Summer			
S15.002	S64	30 Summer	1	+0%				
S15.003	S110	30 Summer	1	+0%			1/30 Summer	108

©1982-2020 Innovyze

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.010	S13	62.237	-0.163	0.000	0.09			45.2	FLOOD RISK*
S9.011	S12	60.561	-0.139	0.000	0.42			64.8	OK
S10.000	S13	82.775	-0.225	0.000	0.00			0.0	OK
S10.001	S14	81.388	-0.212	0.000	0.01			3.5	FLOOD RISK*
S10.002	S15	80.367	-0.108	0.000	0.17	2.6		2.5	FLOOD RISK
S10.003	S16	78.992	-0.208	0.000	0.01			5.3	FLOOD RISK
S10.004	S17	77.796	-0.204	0.000	0.01			7.9	FLOOD RISK*
S10.005	S18	75.405	-0.195	0.000	0.02			14.1	FLOOD RISK*
S10.006	S19	72.813	-0.187	0.000	0.04			21.6	FLOOD RISK*
S10.007	S20	71.218	-0.182	0.000	0.04			26.1	FLOOD RISK*
S10.008	S21	69.821	-0.179	0.000	0.05			30.5	FLOOD RISK*
S10.009	S22	68.422	-0.178	0.000	0.05			34.1	FLOOD RISK*
S10.010	S23	61.469	-0.131	0.000	0.18			49.4	FLOOD RISK*
S9.012	S24	60.544	-0.406	0.000	0.58			116.0	OK
S9.013	S98	60.180	-0.745	0.000	0.07			115.4	OK*
S9.014	S99	57.197	-0.703	0.000	0.00			0.8	OK
S9.015	S84	56.513	-0.887	0.000	0.00			0.8	OK
S9.016	S85	56.452	-0.898	0.000	0.00			0.8	OK
S9.017	S84	55.002	-0.898	0.000	0.00			0.8	OK*
S11.000	S93	58.038	-0.087	0.000	0.37			2.5	FLOOD RISK
S11.001	S94	57.846	-0.154	0.000	0.02			4.5	FLOOD RISK
S11.002	S95	57.654	-0.146	0.000	0.04			9.8	FLOOD RISK*
S11.003	S96	57.463	-0.137	0.000	0.06			12.9	FLOOD RISK*
S11.004	S97	57.255	-0.145	0.000	0.04			14.1	FLOOD RISK
S11.005	S98	56.862	-0.138	0.000	0.06			17.4	FLOOD RISK
S11.006	S101	56.062	-0.138	0.000	0.06			17.4	FLOOD RISK*
S11.007	S99	54.463	-0.237	0.000	0.10			20.5	OK
S11.008	S96	53.753	-0.547	0.000	0.02			20.4	OK*
S12.000	S94	57.975	-0.225	0.000	0.00			0.0	OK
S13.000	S86	60.975	-0.225	0.000	0.00			0.0	OK
S13.001	S87	59.790	-0.210	0.000	0.01			3.5	FLOOD RISK*
S13.002	S87	59.408	-0.117	0.000	0.11			3.4	FLOOD RISK
S13.003	S88	59.097	-0.203	0.000	0.01			6.0	FLOOD RISK
S13.004	S89	58.408	-0.192	0.000	0.03			9.5	FLOOD RISK*
S13.005	S90	58.212	-0.188	0.000	0.04			11.1	FLOOD RISK*
S13.006	S91	58.092	-0.158	0.000	0.10			13.0	FLOOD RISK
S14.000	S92	58.025	-0.225	0.000	0.00			0.0	OK
S13.007	S92	57.032	-0.268	0.000	0.18			17.1	OK
S12.001	S106	56.984	-0.266	0.000	0.18			17.0	OK
S12.002	S107	56.871	-0.329	0.000	0.04			17.0	OK*
S11.009	S101	52.593	-0.132	0.000	0.01			0.3	OK
S11.010	S109	52.468	-0.207	0.000	0.02			0.3	OK*
S11.011	S103	52.401	-0.599	0.000	0.00			0.3	OK*
S5.016	S67	48.566	-0.159	0.000	0.03			1.9	OK
S15.000	S62	49.975	-0.225	0.000	0.00			0.0	OK
S15.001	S63	48.226	-0.099	0.000	0.25			3.2	FLOOD RISK
S15.002	S64	47.596	-0.204	0.000	0.01			4.7	FLOOD RISK

©1982-2020 Innovyze

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S15.003	S110	46.400	-0.125	0.000	0.06	4.1		0.6	FLOOD RISK

PN	US/MH Name	Level Exceeded
S9.010	S13	
S9.011	S12	
S10.000	S13	
S10.001	S14	
S10.002	S15	
S10.003	S16	
S10.004	S17	
S10.005	S18	
S10.006	S19	
S10.007	S20	
S10.008	S21	
S10.009	S22	
S10.010	S23	
S9.012	S24	
S9.013	S98	
S9.014	S99	
S9.015	S84	
S9.016	S85	
S9.017	S84	
S11.000	S93	
S11.001	S94	
S11.002	S95	
S11.003	S96	
S11.004	S97	
S11.005	S98	
S11.006	S101	
S11.007	S99	
S11.008	S96	
S12.000	S94	
S13.000	S86	
S13.001	S87	
S13.002	S87	
S13.003	S88	
S13.004	S89	
S13.005	S90	
S13.006	S91	
S14.000	S92	
S13.007	S92	
S12.001	S106	
S12.002	S107	
S11.009	S101	

©1982-2020 Innovyze

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

PN	US/MH Name	Level Exceeded
S11.010	S109	
S11.011	S103	
S5.016	S67	
S15.000	S62	
S15.001	S63	
S15.002	S64	
S15.003	S110	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S15.004	S111	30 Summer	1	+0%				
S15.005	S65	30 Summer	1	+0%				
S15.006	S118	30 Summer	1	+0%	100/30 Summer			
S15.007	S66	30 Summer	1	+0%				
S15.008	S108	30 Summer	1	+0%				
S16.000	S68	30 Summer	1	+0%				
S16.001	S69	30 Summer	1	+0%	30/30 Summer			
S16.002	S70	30 Summer	1	+0%				
S16.003	S71	30 Summer	1	+0%				
S16.004	S72	30 Summer	1	+0%				
S16.005	S115	30 Summer	1	+0%				
S16.006	S116	30 Summer	1	+0%			1/30 Summer	108
S16.007	S120	30 Summer	1	+0%				
S15.009	S117	30 Summer	1	+0%			1/30 Summer	108

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S15.004	S111	45.981	-0.219	0.000	0.00			0.6	FLOOD RISK
S15.005	S65	45.796	-0.204	0.000	0.01			6.0	FLOOD RISK*
S15.006	S118	44.545	-0.105	0.000	0.19			5.9	OK
S15.007	S66	43.456	-0.494	0.000	0.07			21.1	OK
S15.008	S108	43.376	-0.524	0.000	0.04			21.2	OK*
S16.000	S68	49.975	-0.225	0.000	0.00			0.0	OK
S16.001	S69	48.234	-0.091	0.000	0.32			4.0	FLOOD RISK
S16.002	S70	47.597	-0.203	0.000	0.01			5.0	FLOOD RISK
S16.003	S71	45.807	-0.193	0.000	0.03			10.2	FLOOD RISK*
S16.004	S72	44.486	-0.214	0.000	0.07			10.2	OK
S16.005	S115	44.483	-0.392	0.000	0.04			10.2	OK*
S16.006	S116	44.016	-0.209	0.000	0.00	9.3		0.1	OK
S16.007	S120	43.300	-0.450	0.000	0.00			0.1	OK*
S15.009	S117	43.027	-0.198	0.000	0.00	17.9		0.2	OK

PN	US/MH Name	Level Exceeded
S15.004	S111	
S15.005	S65	
S15.006	S118	
S15.007	S66	
S15.008	S108	
S16.000	S68	
S16.001	S69	
S16.002	S70	

©1982-2020 Innovyze

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

PN	US/MH Name	Level Exceeded
S16.003	S71	
S16.004	S72	
S16.005	S115	
S16.006	S116	
S16.007	S120	
S15.009	S117	

©1982-2020 Innovyze

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	6
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	5	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	17.000	Cv (Winter)	1.000

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

Profile(s)	Summer and Winter
Duration(s) (mins)	30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S29	30 Summer	30	+40%					55.575
S2.000	S35	30 Summer	30	+40%					53.808
S2.001	S36	30 Summer	30	+40%					51.543
S2.002	S37	30 Summer	30	+40%					50.236
S2.003	S38	30 Summer	30	+40%					49.441
S2.004	S39	30 Summer	30	+40%					48.646
S2.005	S40	30 Summer	30	+40%					47.880
S3.000	S25	30 Summer	30	+40%					55.575
S3.001	S26	30 Summer	30	+40%			1/30 Summer	108	52.437
S3.002	S27	30 Summer	30	+40%					51.607
S3.003	S28	30 Summer	30	+40%					47.861
S2.006	S41	30 Summer	30	+40%	30/30 Summer				47.085
S4.000	S42	30 Summer	30	+40%					54.775
S4.001	S43	30 Summer	30	+40%					53.800
S4.002	S44	30 Summer	30	+40%					50.228
S4.003	S45	30 Summer	30	+40%					49.435
S4.004	S46	30 Summer	30	+40%					48.643
S4.005	S47	30 Summer	30	+40%					47.872
S1.001	S30	30 Summer	30	+40%	30/30 Summer				46.972

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S29	-0.225	0.000	0.00			0.0	OK	
S2.000	S35	-0.192	0.000	0.03			14.4	FLOOD RISK*	
S2.001	S36	-0.057	0.000	0.90			34.8	FLOOD RISK	
S2.002	S37	-0.164	0.000	0.09			44.5	FLOOD RISK	
S2.003	S38	-0.159	0.000	0.10			49.3	FLOOD RISK*	
S2.004	S39	-0.154	0.000	0.11			54.4	FLOOD RISK*	
S2.005	S40	-0.120	0.000	0.22			59.8	FLOOD RISK*	
S3.000	S25	-0.225	0.000	0.00			0.0	OK	
S3.001	S26	-0.088	0.000	0.35	20.6		3.9	FLOOD RISK	
S3.002	S27	-0.193	0.000	0.03			13.2	FLOOD RISK	
S3.003	S28	-0.139	0.000	0.15			41.9	FLOOD RISK*	
S2.006	S41	0.185	0.000	1.50			108.4	SURCHARGED	
S4.000	S42	-0.225	0.000	0.00			0.0	OK	
S4.001	S43	-0.200	0.000	0.02			8.7	FLOOD RISK*	
S4.002	S44	-0.172	0.000	0.06			33.5	FLOOD RISK*	
S4.003	S45	-0.165	0.000	0.08			39.1	FLOOD RISK*	
S4.004	S46	-0.157	0.000	0.10			45.3	FLOOD RISK*	
S4.005	S47	-0.128	0.000	0.19			52.9	FLOOD RISK*	
S1.001	S30	0.122	0.000	2.01			230.6	SURCHARGED	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.002	S20	30 Summer	30	+40%					46.583
S1.003	S21	4320 Summer	30	+40%					45.107
S5.000	S26	30 Summer	30	+40%					60.975
S5.001	S27	30 Summer	30	+40%					60.197
S5.002	S28	30 Summer	30	+40%	30/30 Summer				59.196
S5.003	S29	30 Summer	30	+40%					58.726
S5.004	S30	30 Summer	30	+40%					58.440
S5.005	S31	30 Summer	30	+40%					58.345
S5.006	S32	30 Summer	30	+40%					58.045
S5.007	S33	30 Summer	30	+40%					57.866
S5.008	S34	30 Summer	30	+40%					57.705
S5.009	S30	30 Summer	30	+40%					57.613
S5.010	S31	30 Summer	30	+40%					57.327
S5.011	S32	30 Summer	30	+40%					56.861
S5.012	S33	30 Summer	30	+40%					56.064
S5.013	S34	30 Summer	30	+40%	30/30 Summer				54.440
S6.000	S58	30 Summer	30	+40%					57.775
S6.001	S59	30 Summer	30	+40%					57.734
S6.002	S60	30 Summer	30	+40%					57.704
S6.003	S43	30 Summer	30	+40%					57.633
S6.004	S44	30 Summer	30	+40%					57.341
S6.005	S45	30 Summer	30	+40%					56.840
S6.006	S46	30 Summer	30	+40%					56.039
S5.014	S47	30 Summer	30	+40%	30/30 Summer				54.345
S5.015	S66	30 Summer	30	+40%					53.970
S7.000	S66	30 Summer	30	+40%					57.775
S7.001	S67	30 Summer	30	+40%					57.422
S7.002	S68	30 Summer	30	+40%					56.878
S7.003	S69	30 Summer	30	+40%					55.908
S7.004	S54	30 Summer	30	+40%					54.313
S7.005	S55	30 Summer	30	+40%					53.115
S7.006	S56	30 Summer	30	+40%					51.906
S8.000	S57	30 Summer	30	+40%					54.175
S8.001	S58	30 Summer	30	+40%					52.998
S8.002	S59	30 Summer	30	+40%					51.811
S8.003	S60	30 Summer	30	+40%	30/30 Summer				50.029
S7.007	S57	30 Summer	30	+40%	30/30 Summer				49.978
S7.008	S79	30 Summer	30	+40%					49.572
S9.000	S1	30 Summer	30	+40%					82.775
S9.001	S2	30 Summer	30	+40%					82.394
S9.002	S3	30 Summer	30	+40%					81.007
S9.003	S4	30 Summer	30	+40%					79.616
S9.004	S5	30 Summer	30	+40%					77.828
S9.005	S6	30 Summer	30	+40%					75.442
S9.006	S8	30 Summer	30	+40%					72.858
S9.007	S9	30 Summer	30	+40%					71.265
S9.008	S10	30 Summer	30	+40%					69.675
S9.009	S11	30 Summer	30	+40%					68.529

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	S20	-0.242	0.000	0.44			229.7	OK*	
S1.003	S21	-0.118	0.000	0.01			2.5	OK	
S5.000	S26	-0.225	0.000	0.00			0.0	OK	
S5.001	S27	-0.203	0.000	0.01			8.4	FLOOD RISK*	
S5.002	S28	0.071	0.000	1.12			13.5	FLOOD RISK	
S5.003	S29	-0.174	0.000	0.06			20.7	FLOOD RISK	
S5.004	S30	-0.160	0.000	0.09			25.8	FLOOD RISK*	
S5.005	S31	-0.055	0.000	0.91			30.3	FLOOD RISK	
S5.006	S32	-0.155	0.000	0.11			36.2	FLOOD RISK	
S5.007	S33	-0.134	0.000	0.17			39.4	FLOOD RISK*	
S5.008	S34	-0.095	0.000	0.33			45.9	FLOOD RISK*	
S5.009	S30	-0.137	0.000	0.16			50.3	FLOOD RISK*	
S5.010	S31	-0.123	0.000	0.21			55.2	FLOOD RISK*	
S5.011	S32	-0.139	0.000	0.15			69.8	FLOOD RISK*	
S5.012	S33	-0.136	0.000	0.16			81.8	FLOOD RISK*	
S5.013	S34	0.140	0.000	1.34			97.8	SURCHARGED	
S6.000	S58	-0.225	0.000	0.00			0.0	OK	
S6.001	S59	-0.166	0.000	0.06			8.0	FLOOD RISK*	
S6.002	S60	-0.146	0.000	0.13			14.6	FLOOD RISK*	
S6.003	S43	-0.167	0.000	0.08			22.3	FLOOD RISK*	
S6.004	S44	-0.159	0.000	0.09			27.6	FLOOD RISK*	
S6.005	S45	-0.160	0.000	0.09			41.2	FLOOD RISK*	
S6.006	S46	-0.161	0.000	0.09			49.3	FLOOD RISK*	
S5.014	S47	0.095	0.000	1.73			155.8	SURCHARGED	
S5.015	S66	-0.455	0.000	0.13			154.9	OK*	
S7.000	S66	-0.225	0.000	0.00			0.0	OK	
S7.001	S67	-0.178	0.000	0.05			24.8	FLOOD RISK*	
S7.002	S68	-0.122	0.000	0.21			108.3	FLOOD RISK*	
S7.003	S69	-0.092	0.000	0.34			182.0	FLOOD RISK*	
S7.004	S54	-0.087	0.000	0.37			196.1	FLOOD RISK*	
S7.005	S55	-0.085	0.000	0.38			203.0	FLOOD RISK*	
S7.006	S56	-0.094	0.000	0.34			210.5	FLOOD RISK*	
S8.000	S57	-0.225	0.000	0.00			0.0	OK	
S8.001	S58	-0.202	0.000	0.02			8.0	FLOOD RISK*	
S8.002	S59	-0.189	0.000	0.03			17.6	FLOOD RISK*	
S8.003	S60	0.279	0.000	0.64			31.4	FLOOD RISK	
S7.007	S57	0.128	0.000	1.73			251.9	FLOOD RISK	
S7.008	S79	-0.228	0.000	0.48			249.6	OK*	
S9.000	S1	-0.225	0.000	0.00			0.0	OK	
S9.001	S2	-0.206	0.000	0.01			5.6	FLOOD RISK*	
S9.002	S3	-0.193	0.000	0.03			16.3	FLOOD RISK*	
S9.003	S4	-0.184	0.000	0.04			25.0	FLOOD RISK*	
S9.004	S5	-0.172	0.000	0.06			38.3	FLOOD RISK*	
S9.005	S6	-0.158	0.000	0.10			59.3	FLOOD RISK*	
S9.006	S8	-0.142	0.000	0.14			85.0	FLOOD RISK*	
S9.007	S9	-0.135	0.000	0.17			103.9	FLOOD RISK*	
S9.008	S10	-0.125	0.000	0.20			121.3	FLOOD RISK*	

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S9.009	S11	-0.121	0.000	0.21			128.9	FLOOD RISK*	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.010	S13	30 Summer	30	+40%				
S9.011	S12	30 Summer	30	+40%	30/30 Summer			
S10.000	S13	30 Summer	30	+40%				
S10.001	S14	30 Summer	30	+40%				
S10.002	S15	30 Summer	30	+40%			1/30 Summer	108
S10.003	S16	30 Summer	30	+40%				
S10.004	S17	30 Summer	30	+40%				
S10.005	S18	30 Summer	30	+40%				
S10.006	S19	30 Summer	30	+40%				
S10.007	S20	30 Summer	30	+40%				
S10.008	S21	30 Summer	30	+40%				
S10.009	S22	30 Summer	30	+40%				
S10.010	S23	30 Summer	30	+40%				
S9.012	S24	30 Summer	30	+40%	30/30 Summer			
S9.013	S98	30 Summer	30	+40%				
S9.014	S99	10080 Winter	30	+40%				
S9.015	S84	4320 Winter	30	+40%				
S9.016	S85	10080 Summer	30	+40%				
S9.017	S84	480 Winter	30	+40%				
S11.000	S93	30 Summer	30	+40%	30/30 Summer			
S11.001	S94	30 Summer	30	+40%				
S11.002	S95	30 Summer	30	+40%				
S11.003	S96	30 Summer	30	+40%				
S11.004	S97	30 Summer	30	+40%				
S11.005	S98	30 Summer	30	+40%				
S11.006	S101	30 Summer	30	+40%				
S11.007	S99	30 Summer	30	+40%				
S11.008	S96	30 Summer	30	+40%				
S12.000	S94	30 Summer	30	+40%				
S13.000	S86	30 Summer	30	+40%				
S13.001	S87	30 Summer	30	+40%				
S13.002	S87	30 Summer	30	+40%				
S13.003	S88	30 Summer	30	+40%				
S13.004	S89	30 Summer	30	+40%				
S13.005	S90	30 Summer	30	+40%				
S13.006	S91	30 Summer	30	+40%				
S14.000	S92	30 Summer	30	+40%				
S13.007	S92	30 Summer	30	+40%				
S12.001	S106	30 Summer	30	+40%				
S12.002	S107	30 Summer	30	+40%				
S11.009	S101	10080 Summer	30	+40%	30/2160 Summer			
S11.010	S109	720 Winter	30	+40%				
S11.011	S103	720 Summer	30	+40%				
S5.016	S67	10080 Summer	30	+40%				
S15.000	S62	30 Summer	30	+40%				
S15.001	S63	30 Summer	30	+40%	100/30 Summer			
S15.002	S64	30 Summer	30	+40%				
S15.003	S110	30 Summer	30	+40%			1/30 Summer	108

©1982-2020 Innovyze

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.010	S13	62.311	-0.089	0.000	0.36			188.5	FLOOD RISK*
S9.011	S12	61.135	0.435	0.000	1.79			276.6	SURCHARGED
S10.000	S13	82.775	-0.225	0.000	0.00			0.0	OK
S10.001	S14	81.406	-0.194	0.000	0.03			14.5	FLOOD RISK*
S10.002	S15	80.425	-0.050	0.000	0.71	15.1		10.3	FLOOD RISK
S10.003	S16	79.014	-0.186	0.000	0.04			22.1	FLOOD RISK
S10.004	S17	77.823	-0.177	0.000	0.06			33.4	FLOOD RISK*
S10.005	S18	75.443	-0.157	0.000	0.10			59.0	FLOOD RISK*
S10.006	S19	72.861	-0.139	0.000	0.15			90.8	FLOOD RISK*
S10.007	S20	71.271	-0.129	0.000	0.19			110.6	FLOOD RISK*
S10.008	S21	69.877	-0.123	0.000	0.21			129.9	FLOOD RISK*
S10.009	S22	68.481	-0.119	0.000	0.22			143.9	FLOOD RISK*
S10.010	S23	61.575	-0.025	0.000	0.77			208.8	FLOOD RISK*
S9.012	S24	60.969	0.019	0.000	2.44			486.0	SURCHARGED
S9.013	S98	60.360	-0.565	0.000	0.30			492.6	OK*
S9.014	S99	57.618	-0.282	0.000	0.00			0.8	OK
S9.015	S84	56.513	-0.887	0.000	0.00			0.8	OK
S9.016	S85	56.452	-0.898	0.000	0.00			0.8	OK
S9.017	S84	55.004	-0.896	0.000	0.00			0.8	OK*
S11.000	S93	58.166	0.041	0.000	1.14			7.7	FLOOD RISK
S11.001	S94	57.869	-0.131	0.000	0.08			15.9	FLOOD RISK
S11.002	S95	57.689	-0.111	0.000	0.15			37.9	FLOOD RISK*
S11.003	S96	57.509	-0.091	0.000	0.24			50.9	FLOOD RISK*
S11.004	S97	57.293	-0.107	0.000	0.18			56.2	FLOOD RISK
S11.005	S98	56.908	-0.092	0.000	0.24			70.5	FLOOD RISK
S11.006	S101	56.107	-0.093	0.000	0.24			70.7	FLOOD RISK*
S11.007	S99	54.532	-0.168	0.000	0.40			83.7	OK
S11.008	S96	53.809	-0.491	0.000	0.08			83.6	OK*
S12.000	S94	57.975	-0.225	0.000	0.00			0.0	OK
S13.000	S86	60.975	-0.225	0.000	0.00			0.0	OK
S13.001	S87	59.810	-0.190	0.000	0.03			14.5	FLOOD RISK*
S13.002	S87	59.448	-0.077	0.000	0.46			14.4	FLOOD RISK
S13.003	S88	59.126	-0.174	0.000	0.06			25.0	FLOOD RISK
S13.004	S89	58.450	-0.150	0.000	0.12			39.8	FLOOD RISK*
S13.005	S90	58.259	-0.141	0.000	0.15			46.9	FLOOD RISK*
S13.006	S91	58.172	-0.078	0.000	0.43			54.7	FLOOD RISK
S14.000	S92	58.025	-0.225	0.000	0.00			0.0	OK
S13.007	S92	57.173	-0.127	0.000	0.76			71.9	OK
S12.001	S106	57.126	-0.124	0.000	0.77			70.9	OK
S12.002	S107	56.923	-0.277	0.000	0.15			71.4	OK*
S11.009	S101	52.767	0.042	0.000	0.01			0.4	SURCHARGED
S11.010	S109	52.473	-0.202	0.000	0.02			0.4	OK*
S11.011	S103	52.401	-0.599	0.000	0.00			0.4	OK*
S5.016	S67	48.626	-0.099	0.000	0.05			4.0	OK
S15.000	S62	49.975	-0.225	0.000	0.00			0.0	OK
S15.001	S63	48.306	-0.019	0.000	1.00			12.5	FLOOD RISK
S15.002	S64	47.623	-0.177	0.000	0.05			18.7	FLOOD RISK

©1982-2020 Innovyze

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S15.003	S110	46.435	-0.090	0.000	0.34	15.7		3.0	FLOOD RISK

PN	US/MH Name	Level Exceeded
S9.010	S13	
S9.011	S12	
S10.000	S13	
S10.001	S14	
S10.002	S15	
S10.003	S16	
S10.004	S17	
S10.005	S18	
S10.006	S19	
S10.007	S20	
S10.008	S21	
S10.009	S22	
S10.010	S23	
S9.012	S24	
S9.013	S98	
S9.014	S99	
S9.015	S84	
S9.016	S85	
S9.017	S84	
S11.000	S93	
S11.001	S94	
S11.002	S95	
S11.003	S96	
S11.004	S97	
S11.005	S98	
S11.006	S101	
S11.007	S99	
S11.008	S96	
S12.000	S94	
S13.000	S86	
S13.001	S87	
S13.002	S87	
S13.003	S88	
S13.004	S89	
S13.005	S90	
S13.006	S91	
S14.000	S92	
S13.007	S92	
S12.001	S106	
S12.002	S107	
S11.009	S101	

©1982-2020 Innovyze

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

PN	US/MH Name	Level Exceeded
S11.010	S109	
S11.011	S103	
S5.016	S67	
S15.000	S62	
S15.001	S63	
S15.002	S64	
S15.003	S110	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S15.004	S111	30 Summer	30	+40%				
S15.005	S65	30 Summer	30	+40%				
S15.006	S118	30 Summer	30	+40%	100/30 Summer			
S15.007	S66	30 Summer	30	+40%				
S15.008	S108	30 Summer	30	+40%				
S16.000	S68	30 Summer	30	+40%				
S16.001	S69	30 Summer	30	+40%	30/30 Summer			
S16.002	S70	30 Summer	30	+40%				
S16.003	S71	30 Summer	30	+40%				
S16.004	S72	30 Summer	30	+40%				
S16.005	S115	30 Summer	30	+40%				
S16.006	S116	30 Summer	30	+40%			1/30 Summer	108
S16.007	S120	30 Summer	30	+40%				
S15.009	S117	30 Summer	30	+40%			1/30 Summer	108

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S15.004	S111	45.992	-0.208	0.000	0.01			3.0	FLOOD RISK
S15.005	S65	45.825	-0.175	0.000	0.06			25.8	FLOOD RISK*
S15.006	S118	44.606	-0.044	0.000	0.84			25.9	OK
S15.007	S66	43.578	-0.372	0.000	0.30			89.5	OK
S15.008	S108	43.463	-0.437	0.000	0.16			90.1	OK*
S16.000	S68	49.975	-0.225	0.000	0.00			0.0	OK
S16.001	S69	48.380	0.055	0.000	1.05			12.9	FLOOD RISK
S16.002	S70	47.620	-0.180	0.000	0.05			17.3	FLOOD RISK
S16.003	S71	45.846	-0.154	0.000	0.11			39.9	FLOOD RISK*
S16.004	S72	44.554	-0.146	0.000	0.26			39.9	OK
S16.005	S115	44.544	-0.331	0.000	0.16			39.7	OK*
S16.006	S116	44.060	-0.165	0.000	0.00	35.4		0.2	OK
S16.007	S120	43.301	-0.449	0.000	0.00			0.2	OK*
S15.009	S117	43.110	-0.115	0.000	0.01	71.8		0.3	OK

PN	US/MH Name	Level Exceeded
S15.004	S111	
S15.005	S65	
S15.006	S118	
S15.007	S66	
S15.008	S108	
S16.000	S68	
S16.001	S69	
S16.002	S70	

©1982-2020 Innovyze

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

PN	US/MH Name	Level Exceeded
S16.003	S71	
S16.004	S72	
S16.005	S115	
S16.006	S116	
S16.007	S120	
S15.009	S117	

©1982-2020 Innovyze

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 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	6
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	5	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	17.000	Cv (Winter)	1.000

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

Profile(s)	Summer and Winter
Duration(s) (mins)	30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S29	30 Summer	100	+40%					55.575
S2.000	S35	30 Summer	100	+40%					53.813
S2.001	S36	30 Summer	100	+40%					51.596
S2.002	S37	30 Summer	100	+40%					50.241
S2.003	S38	30 Summer	100	+40%					49.448
S2.004	S39	30 Summer	100	+40%					48.654
S2.005	S40	30 Summer	100	+40%					47.892
S3.000	S25	30 Summer	100	+40%					55.575
S3.001	S26	30 Summer	100	+40%			1/30 Summer	108	52.443
S3.002	S27	30 Summer	100	+40%					51.612
S3.003	S28	30 Summer	100	+40%					47.874
S2.006	S41	30 Summer	100	+40%	30/30 Summer				47.270
S4.000	S42	30 Summer	100	+40%					54.775
S4.001	S43	30 Summer	100	+40%					53.804
S4.002	S44	30 Summer	100	+40%					50.237
S4.003	S45	30 Summer	100	+40%					49.445
S4.004	S46	30 Summer	100	+40%					48.654
S4.005	S47	30 Summer	100	+40%					47.887
S1.001	S30	30 Summer	100	+40%	30/30 Summer				47.085

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S29	-0.225	0.000	0.00			0.0	OK	
S2.000	S35	-0.187	0.000	0.04			18.7	FLOOD RISK*	
S2.001	S36	-0.004	0.000	1.00			38.6	FLOOD RISK	
S2.002	S37	-0.159	0.000	0.10			51.5	FLOOD RISK	
S2.003	S38	-0.152	0.000	0.11			58.1	FLOOD RISK*	
S2.004	S39	-0.146	0.000	0.13			65.4	FLOOD RISK*	
S2.005	S40	-0.108	0.000	0.27			73.4	FLOOD RISK*	
S3.000	S25	-0.225	0.000	0.00			0.0	OK	
S3.001	S26	-0.082	0.000	0.42	27.2		4.7	FLOOD RISK	
S3.002	S27	-0.188	0.000	0.03			16.9	FLOOD RISK	
S3.003	S28	-0.126	0.000	0.20			54.2	FLOOD RISK*	
S2.006	S41	0.370	0.000	1.91			137.6	SURCHARGED	
S4.000	S42	-0.225	0.000	0.00			0.0	OK	
S4.001	S43	-0.196	0.000	0.02			11.3	FLOOD RISK*	
S4.002	S44	-0.163	0.000	0.08			43.6	FLOOD RISK*	
S4.003	S45	-0.155	0.000	0.10			50.8	FLOOD RISK*	
S4.004	S46	-0.146	0.000	0.13			58.8	FLOOD RISK*	
S4.005	S47	-0.113	0.000	0.25			68.8	FLOOD RISK*	
S1.001	S30	0.235	0.000	2.59			297.4	SURCHARGED	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.002	S20	30 Summer	100	+40%					46.617
S1.003	S21	4320 Summer	100	+40%					45.132
S5.000	S26	30 Summer	100	+40%					60.975
S5.001	S27	30 Summer	100	+40%					60.201
S5.002	S28	30 Summer	100	+40%	30/30 Summer				59.199
S5.003	S29	30 Summer	100	+40%					58.729
S5.004	S30	30 Summer	100	+40%					58.445
S5.005	S31	30 Summer	100	+40%					58.385
S5.006	S32	30 Summer	100	+40%					58.049
S5.007	S33	30 Summer	100	+40%					57.873
S5.008	S34	30 Summer	100	+40%					57.718
S5.009	S30	30 Summer	100	+40%					57.624
S5.010	S31	30 Summer	100	+40%					57.340
S5.011	S32	30 Summer	100	+40%					56.874
S5.012	S33	30 Summer	100	+40%					56.076
S5.013	S34	30 Summer	100	+40%	30/30 Summer				54.610
S6.000	S58	30 Summer	100	+40%					57.775
S6.001	S59	30 Summer	100	+40%					57.745
S6.002	S60	30 Summer	100	+40%					57.717
S6.003	S43	30 Summer	100	+40%					57.643
S6.004	S44	30 Summer	100	+40%					57.352
S6.005	S45	30 Summer	100	+40%					56.851
S6.006	S46	30 Summer	100	+40%					56.050
S5.014	S47	30 Summer	100	+40%	30/30 Summer				54.455
S5.015	S66	30 Summer	100	+40%					53.992
S7.000	S66	30 Summer	100	+40%					57.775
S7.001	S67	30 Summer	100	+40%					57.429
S7.002	S68	30 Summer	100	+40%					56.894
S7.003	S69	30 Summer	100	+40%					55.927
S7.004	S54	30 Summer	100	+40%					54.333
S7.005	S55	30 Summer	100	+40%					53.135
S7.006	S56	30 Summer	100	+40%					51.926
S8.000	S57	30 Summer	100	+40%					54.175
S8.001	S58	30 Summer	100	+40%					53.002
S8.002	S59	30 Summer	100	+40%					51.818
S8.003	S60	30 Summer	100	+40%	30/30 Summer				50.200
S7.007	S57	30 Summer	100	+40%	30/30 Summer				50.114
S7.008	S79	30 Summer	100	+40%					49.610
S9.000	S1	30 Summer	100	+40%					82.775
S9.001	S2	30 Summer	100	+40%					82.398
S9.002	S3	30 Summer	100	+40%					81.013
S9.003	S4	30 Summer	100	+40%					79.623
S9.004	S5	30 Summer	100	+40%					77.836
S9.005	S6	30 Summer	100	+40%					75.452
S9.006	S8	30 Summer	100	+40%					72.871
S9.007	S9	30 Summer	100	+40%					71.278
S9.008	S10	30 Summer	100	+40%					69.690
S9.009	S11	30 Summer	100	+40%					68.545

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	S20	-0.208	0.000	0.56			296.5	OK*	
S1.003	S21	-0.093	0.000	0.01			2.7	OK	
S5.000	S26	-0.225	0.000	0.00			0.0	OK	
S5.001	S27	-0.199	0.000	0.02			11.0	FLOOD RISK*	
S5.002	S28	0.074	0.000	1.13			13.5	FLOOD RISK	
S5.003	S29	-0.171	0.000	0.07			23.2	FLOOD RISK	
S5.004	S30	-0.155	0.000	0.11			29.8	FLOOD RISK*	
S5.005	S31	-0.015	0.000	1.00			33.1	FLOOD RISK	
S5.006	S32	-0.151	0.000	0.13			41.4	FLOOD RISK	
S5.007	S33	-0.127	0.000	0.20			46.0	FLOOD RISK*	
S5.008	S34	-0.082	0.000	0.40			54.8	FLOOD RISK*	
S5.009	S30	-0.126	0.000	0.20			61.8	FLOOD RISK*	
S5.010	S31	-0.110	0.000	0.26			68.4	FLOOD RISK*	
S5.011	S32	-0.126	0.000	0.19			88.6	FLOOD RISK*	
S5.012	S33	-0.124	0.000	0.20			104.4	FLOOD RISK*	
S5.013	S34	0.310	0.000	1.72			125.6	SURCHARGED	
S6.000	S58	-0.225	0.000	0.00			0.0	OK	
S6.001	S59	-0.155	0.000	0.08			10.5	FLOOD RISK*	
S6.002	S60	-0.133	0.000	0.17			19.1	FLOOD RISK*	
S6.003	S43	-0.157	0.000	0.10			29.2	FLOOD RISK*	
S6.004	S44	-0.148	0.000	0.12			36.4	FLOOD RISK*	
S6.005	S45	-0.149	0.000	0.12			54.5	FLOOD RISK*	
S6.006	S46	-0.150	0.000	0.12			65.1	FLOOD RISK*	
S5.014	S47	0.205	0.000	2.24			201.5	SURCHARGED	
S5.015	S66	-0.433	0.000	0.17			200.4	OK*	
S7.000	S66	-0.225	0.000	0.00			0.0	OK	
S7.001	S67	-0.171	0.000	0.07			32.2	FLOOD RISK*	
S7.002	S68	-0.106	0.000	0.28			141.0	FLOOD RISK*	
S7.003	S69	-0.073	0.000	0.44			236.2	FLOOD RISK*	
S7.004	S54	-0.067	0.000	0.48			254.7	FLOOD RISK*	
S7.005	S55	-0.065	0.000	0.50			263.8	FLOOD RISK*	
S7.006	S56	-0.074	0.000	0.45			273.8	FLOOD RISK*	
S8.000	S57	-0.225	0.000	0.00			0.0	OK	
S8.001	S58	-0.198	0.000	0.02			10.4	FLOOD RISK*	
S8.002	S59	-0.182	0.000	0.04			22.9	FLOOD RISK*	
S8.003	S60	0.450	0.000	0.82			40.5	FLOOD RISK	
S7.007	S57	0.264	0.000	2.23			324.3	FLOOD RISK	
S7.008	S79	-0.190	0.000	0.62			322.8	OK*	
S9.000	S1	-0.225	0.000	0.00			0.0	OK	
S9.001	S2	-0.202	0.000	0.01			7.2	FLOOD RISK*	
S9.002	S3	-0.187	0.000	0.04			21.2	FLOOD RISK*	
S9.003	S4	-0.177	0.000	0.05			32.5	FLOOD RISK*	
S9.004	S5	-0.164	0.000	0.08			49.8	FLOOD RISK*	
S9.005	S6	-0.148	0.000	0.13			77.0	FLOOD RISK*	
S9.006	S8	-0.129	0.000	0.19			110.4	FLOOD RISK*	
S9.007	S9	-0.122	0.000	0.22			135.0	FLOOD RISK*	
S9.008	S10	-0.110	0.000	0.26			157.8	FLOOD RISK*	

©1982-2020 Innovyze

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S9.009	S11	-0.105	0.000	0.28			167.6	FLOOD RISK*	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.010	S13	30 Summer	100	+40%				
S9.011	S12	30 Summer	100	+40%	30/30 Summer			
S10.000	S13	30 Summer	100	+40%				
S10.001	S14	30 Summer	100	+40%				
S10.002	S15	30 Summer	100	+40%			1/30 Summer	108
S10.003	S16	30 Summer	100	+40%				
S10.004	S17	30 Summer	100	+40%				
S10.005	S18	30 Summer	100	+40%				
S10.006	S19	30 Summer	100	+40%				
S10.007	S20	30 Summer	100	+40%				
S10.008	S21	30 Summer	100	+40%				
S10.009	S22	30 Summer	100	+40%				
S10.010	S23	30 Summer	100	+40%				
S9.012	S24	30 Summer	100	+40%	30/30 Summer			
S9.013	S98	30 Summer	100	+40%				
S9.014	S99	10080 Winter	100	+40%				
S9.015	S84	10080 Winter	100	+40%				
S9.016	S85	10080 Winter	100	+40%				
S9.017	S84	2160 Winter	100	+40%				
S11.000	S93	30 Summer	100	+40%	30/30 Summer			
S11.001	S94	30 Summer	100	+40%				
S11.002	S95	30 Summer	100	+40%				
S11.003	S96	30 Summer	100	+40%				
S11.004	S97	30 Summer	100	+40%				
S11.005	S98	30 Summer	100	+40%				
S11.006	S101	30 Summer	100	+40%				
S11.007	S99	30 Summer	100	+40%				
S11.008	S96	30 Summer	100	+40%				
S12.000	S94	30 Summer	100	+40%				
S13.000	S86	30 Summer	100	+40%				
S13.001	S87	30 Summer	100	+40%				
S13.002	S87	30 Summer	100	+40%				
S13.003	S88	30 Summer	100	+40%				
S13.004	S89	30 Summer	100	+40%				
S13.005	S90	30 Summer	100	+40%				
S13.006	S91	30 Summer	100	+40%				
S14.000	S92	30 Summer	100	+40%				
S13.007	S92	30 Summer	100	+40%				
S12.001	S106	30 Summer	100	+40%				
S12.002	S107	30 Summer	100	+40%				
S11.009	S101	8640 Winter	100	+40%	30/2160 Summer			
S11.010	S109	240 Winter	100	+40%				
S11.011	S103	360 Winter	100	+40%				
S5.016	S67	10080 Summer	100	+40%				
S15.000	S62	30 Summer	100	+40%				
S15.001	S63	30 Summer	100	+40%	100/30 Summer			
S15.002	S64	30 Summer	100	+40%				
S15.003	S110	30 Summer	100	+40%			1/30 Summer	108

©1982-2020 Innovyze

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.010	S13	62.331	-0.069	0.000	0.47			245.6	FLOOD RISK*
S9.011	S12	61.305	0.605	0.000	2.33			360.2	FLOOD RISK
S10.000	S13	82.775	-0.225	0.000	0.00			0.0	OK
S10.001	S14	81.411	-0.189	0.000	0.03			18.9	FLOOD RISK*
S10.002	S15	80.435	-0.040	0.000	0.87	15.2		12.6	FLOOD RISK
S10.003	S16	79.020	-0.180	0.000	0.05			27.9	FLOOD RISK
S10.004	S17	77.831	-0.169	0.000	0.07			42.2	FLOOD RISK*
S10.005	S18	75.453	-0.147	0.000	0.13			76.1	FLOOD RISK*
S10.006	S19	72.873	-0.127	0.000	0.19			117.0	FLOOD RISK*
S10.007	S20	71.285	-0.115	0.000	0.24			142.2	FLOOD RISK*
S10.008	S21	69.892	-0.108	0.000	0.27			166.7	FLOOD RISK*
S10.009	S22	68.496	-0.104	0.000	0.28			184.7	FLOOD RISK*
S10.010	S23	61.597	-0.003	0.000	0.97			263.0	FLOOD RISK*
S9.012	S24	61.024	0.074	0.000	3.13			624.9	SURCHARGED
S9.013	S98	60.409	-0.516	0.000	0.38			629.8	OK*
S9.014	S99	57.759	-0.141	0.000	0.00			0.9	FLOOD RISK
S9.015	S84	56.514	-0.886	0.000	0.00			0.9	OK
S9.016	S85	56.452	-0.898	0.000	0.00			0.9	OK
S9.017	S84	55.003	-0.897	0.000	0.00			0.8	OK*
S11.000	S93	58.196	0.071	0.000	1.23			8.3	FLOOD RISK
S11.001	S94	57.875	-0.125	0.000	0.10			19.6	FLOOD RISK
S11.002	S95	57.699	-0.101	0.000	0.19			48.2	FLOOD RISK*
S11.003	S96	57.521	-0.079	0.000	0.31			65.2	FLOOD RISK*
S11.004	S97	57.303	-0.097	0.000	0.23			72.1	FLOOD RISK
S11.005	S98	56.920	-0.080	0.000	0.31			90.6	FLOOD RISK
S11.006	S101	56.119	-0.081	0.000	0.30			90.8	FLOOD RISK*
S11.007	S99	54.554	-0.146	0.000	0.52			107.7	OK
S11.008	S96	53.825	-0.475	0.000	0.10			107.6	OK*
S12.000	S94	57.975	-0.225	0.000	0.00			0.0	OK
S13.000	S86	60.975	-0.225	0.000	0.00			0.0	OK
S13.001	S87	59.816	-0.184	0.000	0.04			18.9	FLOOD RISK*
S13.002	S87	59.460	-0.065	0.000	0.60			18.7	FLOOD RISK
S13.003	S88	59.135	-0.165	0.000	0.08			32.5	FLOOD RISK
S13.004	S89	58.462	-0.138	0.000	0.16			51.7	FLOOD RISK*
S13.005	S90	58.272	-0.128	0.000	0.19			60.9	FLOOD RISK*
S13.006	S91	58.193	-0.057	0.000	0.56			71.3	FLOOD RISK
S14.000	S92	58.025	-0.225	0.000	0.00			0.0	OK
S13.007	S92	57.234	-0.066	0.000	0.99			93.5	OK
S12.001	S106	57.185	-0.065	0.000	1.00			91.9	OK
S12.002	S107	56.938	-0.262	0.000	0.20			92.0	OK*
S11.009	S101	52.840	0.115	0.000	0.01			0.4	SURCHARGED
S11.010	S109	52.473	-0.202	0.000	0.02			0.4	OK*
S11.011	S103	52.401	-0.599	0.000	0.00			0.5	OK*
S5.016	S67	48.649	-0.076	0.000	0.06			4.2	OK
S15.000	S62	49.975	-0.225	0.000	0.00			0.0	OK
S15.001	S63	48.393	0.068	0.000	1.06			13.2	FLOOD RISK
S15.002	S64	47.626	-0.174	0.000	0.06			21.1	FLOOD RISK

©1982-2020 Innovyze

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S15.003	S110	46.439	-0.086	0.000	0.38	17.8		3.3	FLOOD RISK

PN	US/MH Name	Level Exceeded
S9.010	S13	
S9.011	S12	
S10.000	S13	
S10.001	S14	
S10.002	S15	
S10.003	S16	
S10.004	S17	
S10.005	S18	
S10.006	S19	
S10.007	S20	
S10.008	S21	
S10.009	S22	
S10.010	S23	
S9.012	S24	
S9.013	S98	
S9.014	S99	
S9.015	S84	
S9.016	S85	
S9.017	S84	
S11.000	S93	
S11.001	S94	
S11.002	S95	
S11.003	S96	
S11.004	S97	
S11.005	S98	
S11.006	S101	
S11.007	S99	
S11.008	S96	
S12.000	S94	
S13.000	S86	
S13.001	S87	
S13.002	S87	
S13.003	S88	
S13.004	S89	
S13.005	S90	
S13.006	S91	
S14.000	S92	
S13.007	S92	
S12.001	S106	
S12.002	S107	
S11.009	S101	

©1982-2020 Innovyze

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

PN	US/MH Name	Level Exceeded
S11.010	S109	
S11.011	S103	
S5.016	S67	
S15.000	S62	
S15.001	S63	
S15.002	S64	
S15.003	S110	

©1982-2020 Innovyze

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S15.004	S111	30 Summer	100	+40%				
S15.005	S65	30 Summer	100	+40%				
S15.006	S118	30 Summer	100	+40%	100/30 Summer			
S15.007	S66	30 Summer	100	+40%				
S15.008	S108	30 Summer	100	+40%				
S16.000	S68	30 Summer	100	+40%				
S16.001	S69	30 Summer	100	+40%	30/30 Summer			
S16.002	S70	30 Summer	100	+40%				
S16.003	S71	30 Summer	100	+40%				
S16.004	S72	30 Summer	100	+40%				
S16.005	S115	30 Summer	100	+40%				
S16.006	S116	30 Summer	100	+40%			1/30 Summer	108
S16.007	S120	30 Summer	100	+40%				
S15.009	S117	30 Summer	100	+40%			1/30 Summer	108

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S15.004	S111	45.994	-0.206	0.000	0.01			3.4	FLOOD RISK
S15.005	S65	45.832	-0.168	0.000	0.07			33.1	FLOOD RISK*
S15.006	S118	44.689	0.039	0.000	0.98			30.2	SURCHARGED
S15.007	S66	43.609	-0.341	0.000	0.38			113.6	OK
S15.008	S108	43.486	-0.414	0.000	0.21			113.2	OK*
S16.000	S68	49.975	-0.225	0.000	0.00			0.0	OK
S16.001	S69	48.397	0.072	0.000	1.06			13.2	FLOOD RISK
S16.002	S70	47.622	-0.178	0.000	0.05			19.3	FLOOD RISK
S16.003	S71	45.854	-0.146	0.000	0.13			49.1	FLOOD RISK*
S16.004	S72	44.572	-0.128	0.000	0.31			49.1	OK
S16.005	S115	44.559	-0.316	0.000	0.19			49.0	OK*
S16.006	S116	44.075	-0.150	0.000	0.00	43.8		0.2	OK
S16.007	S120	43.301	-0.449	0.000	0.00			0.2	OK*
S15.009	S117	43.140	-0.085	0.000	0.01	91.4		0.3	OK

PN	US/MH Name	Level Exceeded
S15.004	S111	
S15.005	S65	
S15.006	S118	
S15.007	S66	
S15.008	S108	
S16.000	S68	
S16.001	S69	
S16.002	S70	

©1982-2020 Innovyze

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

PN	US/MH Name	Level Exceeded
S16.003	S71	
S16.004	S72	
S16.005	S115	
S16.006	S116	
S16.007	S120	
S15.009	S117	

©1982-2020 Innovyze

Appendix E SuDS Maintenance Plan

The table below is based on the CIRIA C753 SuDs Manual, 2015.

SUDS COMPONENTS MAINTENANCE REQUIREMENTS		
SUDS COMPONENT	**Swale**	
MAINTENANCE	**ACTION**	**FREQUENCY**
Regular maintenance	Litter and debris removal	Monthly
	Amenity grass cutting at 35-50mm	As required
	Grass cut to ditch access and overflows 75-100mm not to exceed 150mm	Monthly or as required
	Inspect and clear ditch where required, inlets, outlets and overflows	Monthly
Occasional tasks	Remove leaf accumulation	As required
	Cut back overhanging branches to allow dense vegetation growth	As required
Remedial work	Repair erosion, level uneven surfaces or damage by re-turfing or seeding	As required
	Repair or replace inlets, outlets or check dams to design detail	As required
	Remove silt and spread locally, reinstate surface	As required
SUDS COMPONENT	**Detention basins**	
MAINTENANCE	**ACTION**	**FREQUENCY**
Regular maintenance	Remove litter and debris	Monthly
	Cut grass for spillways and access routes	Monthly or as required
	Cut grass – meadow grass in and around basin	Six monthly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect banksides, structures, pipework etc. for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Monthly during first year, then annually or as required
	Check any penstocks or other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually or as required
	Manage wetland plants in outlet pool where provided	Annually
Occasional tasks	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years or as required
	Remove sediments from inlets, outlet, forebay and main basin when required	Every 5 years or as required
Remedial work	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitate inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required
UDS COMPONENT	**Key design standards for adoption inlets, outlets and connections**	

MAINTENANCE	ACTION	FREQUENCY
Regular maintenance	Litter and debris removal	Monthly
	Grass cut 1m around structure 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	As required

Fabiola del Rio
Buro Happold Limited
3 Wellington Place
Leeds
LS1 4AP
UK

T: +44 (0)113 204 2200
F: +44 (0)870 787 4144
Email: fabiola.delrio@burohappold.com