OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

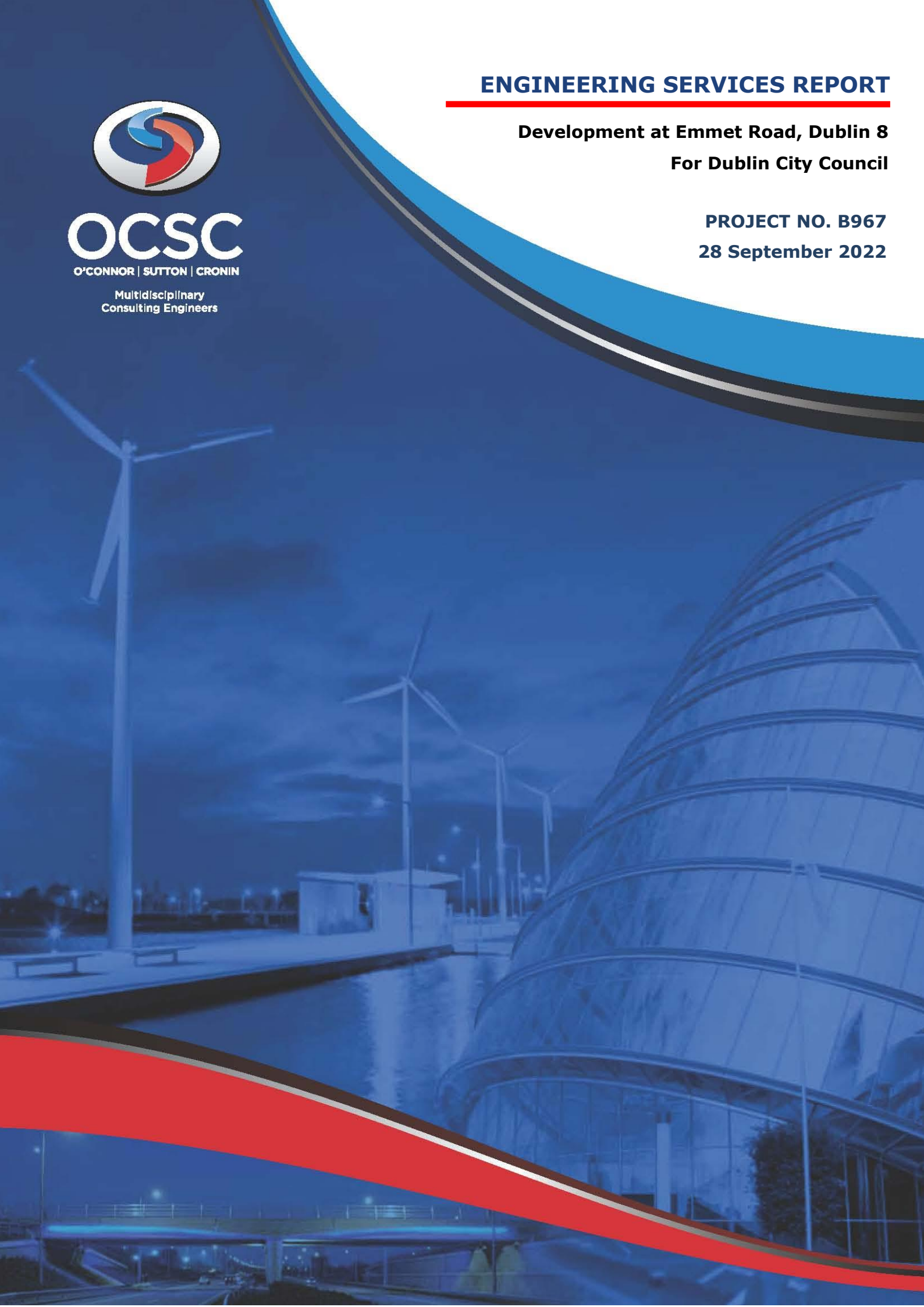
# ENGINEERING SERVICES REPORT

**Development at Emmet Road, Dublin 8**

**For Dublin City Council**

**PROJECT NO. B967**

**28 September 2022**



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# NOTICE



## DOCUMENT CONTROL & HISTORY

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| P01 | S3 | RP | MK | AH | 12.03.2021 |

# ENGINEERING SERVICES REPORT

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## APPENDICES

# 1 INTRODUCTION

## 1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Dublin City Council* to carry out the design of the Civil Engineering services (surface water, wastewater drainage and watermain) associated with the development proposed comprising c.578nr. residential units, along with supporting community facilities, retail, and a neighbourhood (supermarket) centre at Emmet Road, Inchicore, Dublin 8.

## 1.2 Administrative Jurisdiction

The proposed development is located in the jurisdiction of Dublin City Council (DCC), and therefore the engineering services design was carried out with reference to the following:

- Dublin City Council Development Plan (2016 – 2022);
- Dublin City Council Draft Development Plan (2022 – 2028);
- Greater Dublin Strategic Drainage Study (GDSDS);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009 (Department of Environment, Heritage and Local Government and the Office of Public Works).

## 1.3 Site Location

The subject site is located at Emmet Road, in the heart of Inchicore, Dublin 8, as shown in *Figure 1.1 – Site Location*.

Inchicore is a suburb of Dublin located approximately 5km to the west of Dublin city centre. Inchicore is primarily a residential area comprising predominantly of 2 storey early to mid-20$^{th}$ century housing stock with some medium rise apartments developments of both social and private built in more recent decades.

The proposed development site is immediately bound by:

- Emmet Road, to the north;
- Saint Michael's Estate and the pedestrian link to the Emmet Road next to Saint Michael's Catholic Church, to the east;
- Saint Vincent Street West, to the west;
- Goldenbridge cemetery, to the south.

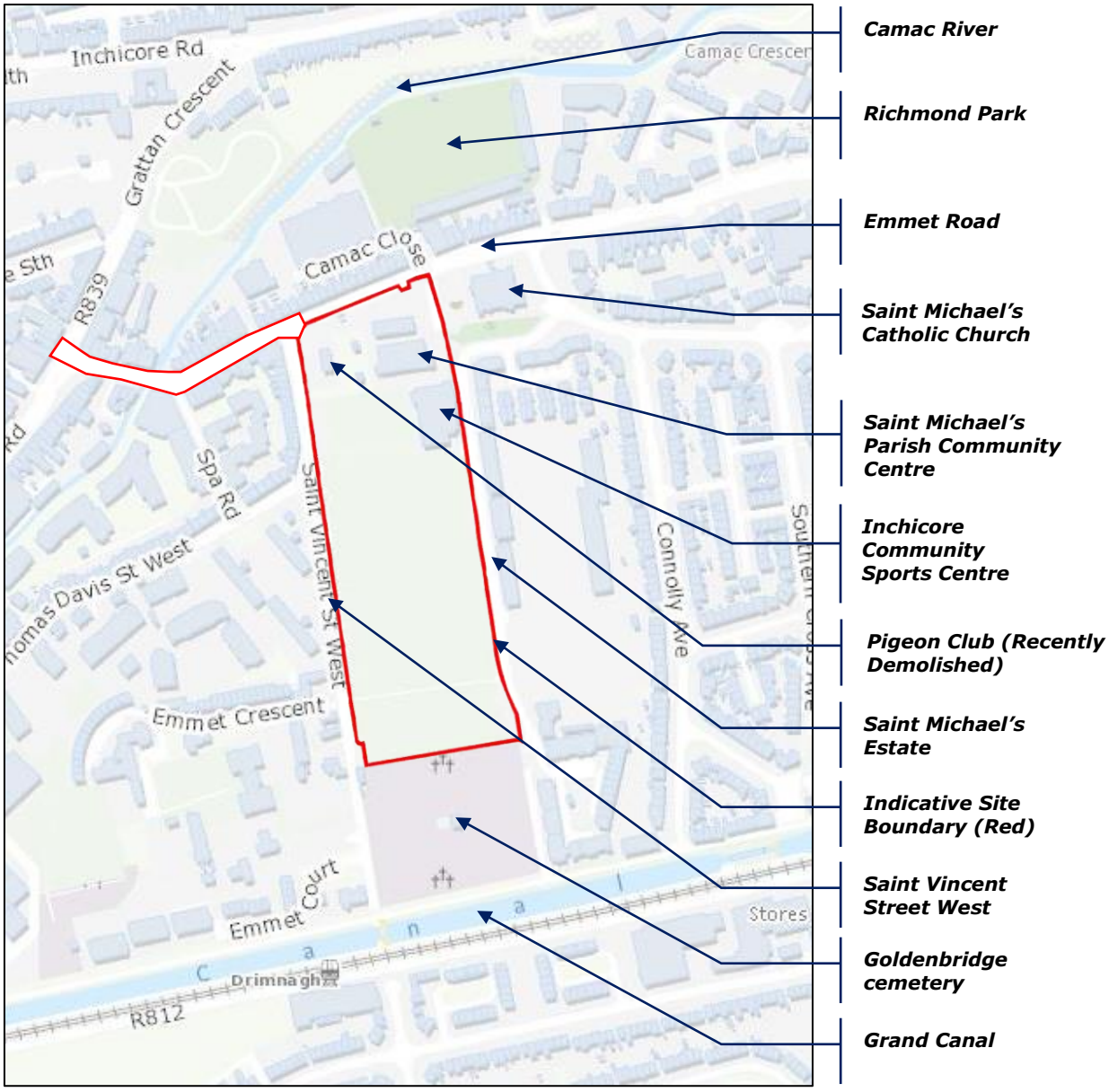



***Figure 1.1 - Site Location (www.myplan.ie)***

## 1.4 Existing Site Overview

The overall development site area is approximately **3.8-hectares** (9.4 acres) and is currently zoned by Dublin City Council for ***Z14, Strategic Development and Regeneration Areas***. This area does not include the section of Emmet Road associated with proposed watermain upgrade, as advised by Irish Water.

The site is graded naturally towards the northeast corner of the site. For context, the highest part of the site, located in the southwest corner of the site, has an existing level of approximately +27.5m AOD; with the lowest typical level being in the order of +22.2m AOD located in the northeast corner of the site.

The site currently comprises of a mixture of brownfield areas which previously housed the Saint Michael's Estate development together with the current existing buildings/structures:

- St Michael's Parish Community Centre (to be demolished);
- Eve Tuiscint Health Centre (to be demolished);
- Inchicore Community Sports Centre (to be retained);
- Boundary wall to the north western corner of the site (to be retained).

There are a number of existing structures outside of the site that are of importance. These include:

- Inchicore Primary Care Centre to the east of the site;
- Inchicore Community Centre;
- Richmond Barracks to the east of the site.

The locations of the above building relative to the site are shown in *Figure 1.2* over.

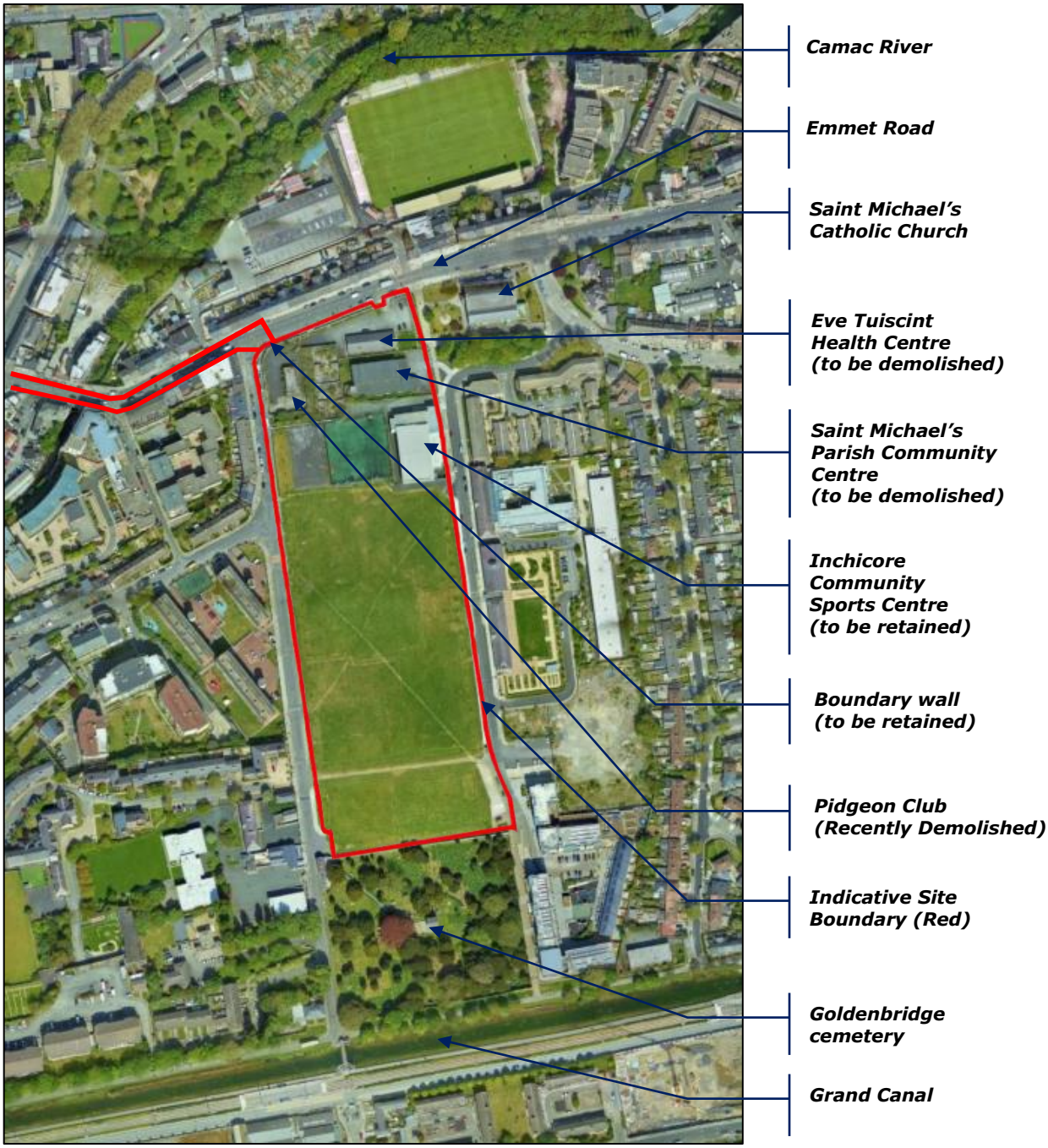



***Figure 1.2 – Aerial Overview of the Site***

## 1.5 Proposed Development Context

The proposed scheme consists of a mixed-use development with a strong emphasis on residential units in addition to commercial, retail and community facilities together with all associated infrastructure including roads, footpaths, services and landscaping.

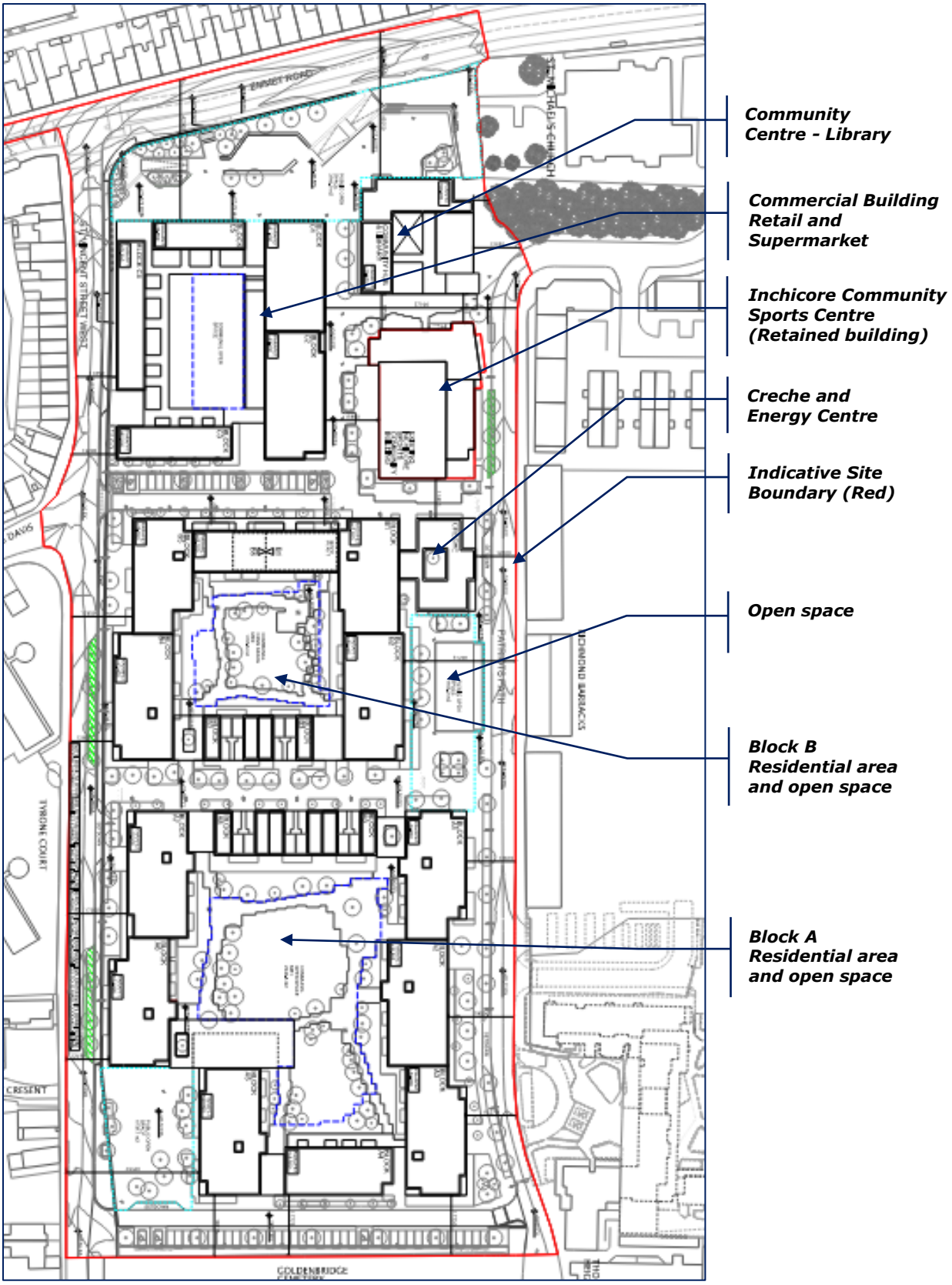



***Figure 1.3 – Proposed Site Layout***

The development will comprise 578 no. apartments, consisting of 110 no. studio apartments, 172 no. 1 bedroom apartments, 250 no. 2 bedroom apartments (including 10 no. duplex apartments) and 46 no. 3 bedroom apartments (all apartments to have balconies or terraces), community facilities Library/Community Hub, Creche, Supermarket, 5 no. units (retail/café/restaurant/class 2 financial services floorspace) & 2 no. Café units), a public plaza fronting onto Emmet Road and the installation of a new watermain c 200m in length along Emmet Road to the junction with Tyrconnell Road/Grattan Crescent. The proposal includes works to a protected structure (8705 - Richmond/Keogh Barracks, relating to works to rubble stone boundary walls).

# 2 SCOPE OF SERVICES REPORT

This Engineering Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies *i.e.,* Dublin City Council, Irish Water, The OPW, and the wider Design Team.

The following services are addressed within this report, with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Potable Water Supply.

An assessment on potential flood risks associated with, and as a result of, the proposed development is provided under separate cover, as part of this application. Refer to document **B967-OCSC-XX-XX-RP-C-0007** for details of the Site-Specific Flood Risk Assessment.

The proposed design, for the aforementioned services, have been carried out in accordance with the following technical guidelines and information:

- Dublin City Development Plan (2016 – 2022);
- Dublin City Council Draft Development Plan (2022 – 2028);
- Greater Dublin Strategic Drainage Study, 2005 (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works v6.0, 2006 (GDRCOP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03 (Revision 2 – July 2020);
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03 (Revision 2 – July 2020);
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- The Office of Public Works, the Planning System and Flood Risk Management, 2009;
- DECLG website www.myplan.ie;
- Architectural drawings;

- Topographical survey of the proposed site;
- Dublin City Council's and Irish Water's Drainage and Watermain Records.

Members of the wider design team cover all other elements of the application pertaining to roads, traffic, sustainability, landscaping, planning, ecological, and architectural detail.

This report should be read in conjunction with the set of OCSC Civil Engineering design drawings that accompany this submission.

# 3 SURFACE WATER DRAINAGE

## 3.1 Design Guidelines Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements *i.e.,* the Dublin City Development Plan, and as such, the Greater Dublin Strategic Drainage Study (Dublin City Council, 2005).

New development must ensure that a comprehensive Sustainable Drainage System (SuDS), is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, surface water volumes from extreme rainfall events up to a 1 in 100-year rainfall event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), *while also allowing for an additional climate change factor of* ***20%*** *increase in rainfall intensity* in accordance with the Dublin City Development Plan (2016 - 2022), which is carried forward in the new Draft Development Plan.

Any new development must also have the physical capacity to retain surface water volumes as directed under the Greater Dublin Strategic Drainage Strategy (GDSDS) and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate, not greater than the greenfield runoff equivalent.

A further component of the SuDS protocol is to increase the overall water quality of surface water runoff before it enters a natural watercourse or a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of surface water quality.

The surface water strategy for the proposed development is to include a number of Sustainable Drainage Systems, prior to discharging an attenuated flow to the existing storm sewers located adjacent to the eastern boundary of the development site. Development discharge rates are to be restricted to the greenfield runoff equivalent.

SuDS are designed in accordance with best practice and the CIRIA C753, 2015 (The SuDS Manual) guidance material, and DCC's SuDS Design and Evaluation Guide.

## 3.2 Surface Water Design Strategy Overview

The proposed development is to be served by a gravity surface water drainage network that is to be divided into two sub-catchments, as a result of the natural topography and other site constraints, with attenuated surface water runoff, generated within the new development site boundary, ultimately discharging to the existing 225mm-diameter concrete storm sewer at the western of the development site and 375mm-diameter concrete storm sewer at the eastern of the development site.

Sustainable Drainage Systems are to be provided, wherever practicable, and these are discussed in more detail in *Section 3.5*, with discharge rates from site being restricted to the greenfield equivalent runoff rate, for design rainfall events up to, and including, the 1% AEP, in accordance with both the current and draft Dublin City Development Plan and the GDSDS.

## 3.3 Consultation

The applicant has been involved in several stakeholder meetings and workshops with Dublin City Council, some of which included members from the drainage, landscaping and roads departments; in which, the design strategy and approach was discussed in detail.

## 3.4 Existing Site Drainage

### 3.4.1 Existing Site Catchment Area

As detailed in *Section 1.4*, the existing c.3.8-hectares (9.4 acres) site is a mixture of brownfield areas, the site is currently graded to lower levels in the south-west to north-east direction. The site therefore naturally drains to the Emmet Road located at northern boundary of the site, before ultimately discharging to the Camac River located to the north of the Emmet Road.

### 3.4.2 Existing Surface Water Drainage Infrastructure

The site and its surroundings are well served by dedicate/separate storm drainage network, as indicated in **Figure 3.1**. Refer to the **Appendix A** for the Existing Drainage Infrastructure Records.

Two main storm drains are identified serving the site. The first is a 225mm-diameter concrete sewer which travels along the western boundary of the site. This sewer later becomes a 300mm-diameter sewer before travelling in a westerly direction along Thomas Davis Street West. The Irish Water records drawings indicate that this sewer previously gathered storm drainage from Saint Michael's Estate. However, the drawings from the demolition of Saint Michael's Estate and the result of the GPR survey indicate that these connections may have been removed. It is noted that there are discrepancies between the findings of the GPR survey and the record drawings in terms of the plan location and alignment of this sewer - this will need to be further reviewed/verified on site. It is also noted that the sewer passes onto the site in a number of locations. Thus, a permanent diversion of same may be required to facilitate the development.

The second dedicated storm sewer is a 375mm-diameter concrete sewer which travels along Saint Michael's Estate to the eastern boundary of the site. This sewer later becomes a 450mm-diameter sewer before travelling under Emmet Road and to the rear of Richmond Park to discharge to the Camac River. Again, the Irish Water Record drawings indicate that this sewer previously gathered storm drainage from Saint Michael's Estate. However, the drawings from the demolition of the Saint Michael's Estate and the results of the GPR survey indicate that these connections may have been removed.

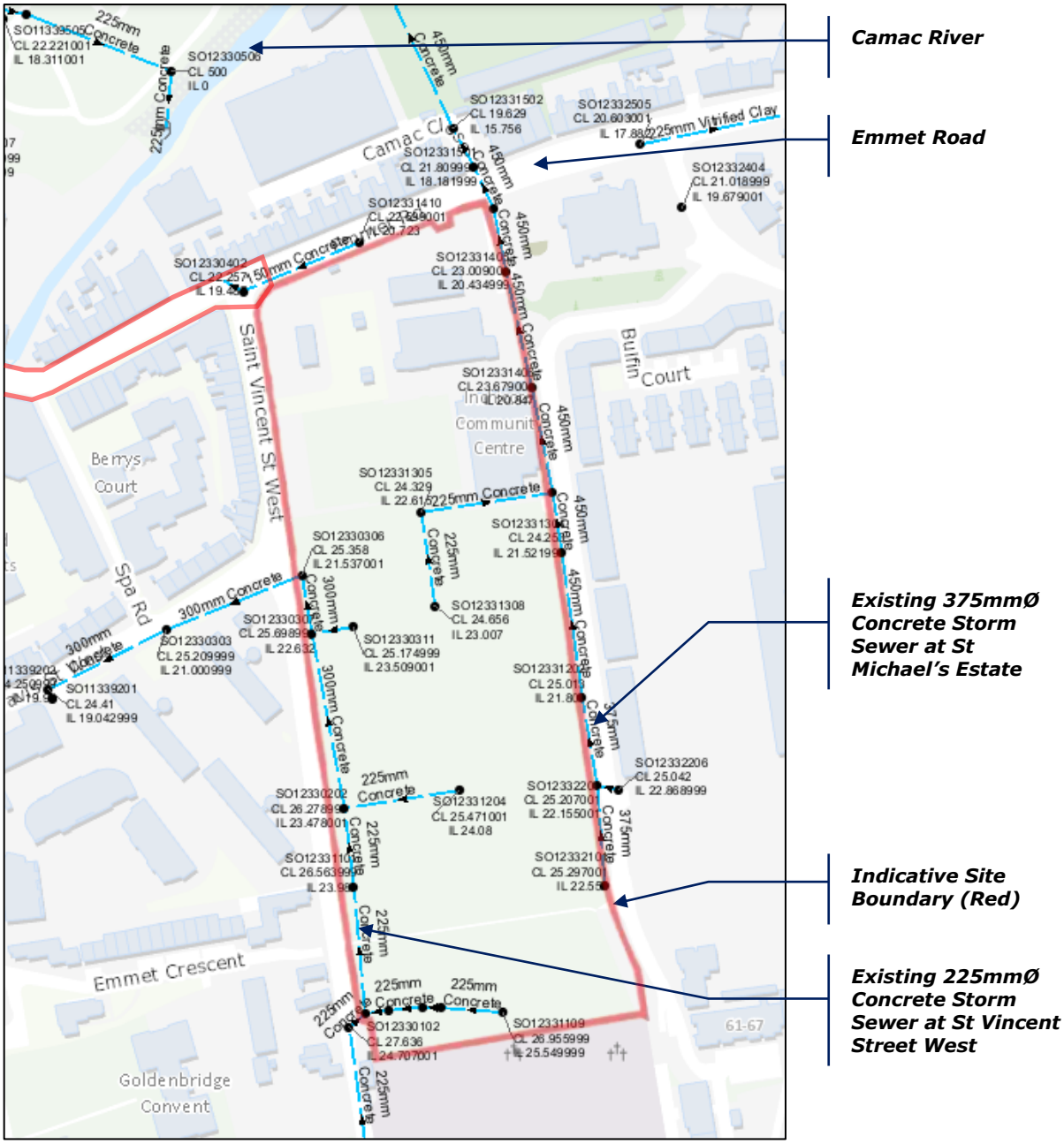



***Figure 3.1 – Existing Drainage Infrastructure Records***

### 3.4.3 Diversions of Existing Drainage Infrastructure

Sections of the existing public drainage infrastructure that is located at St Michael's Estate and St Vincent's Street West are to be relocated from within the development boundary to the public road area, so as to facilitate the new development layout, including planting of significant trees, as part of the landscaping proposal.

Further details of the sections of drainage infrastructure to be decommissioned and relocated is indicated on the drainage detailed design layout drawing **B967-OCSC-ZZ-GF-DR-C-0500**.

### 3.4.4 Existing Site Rainfall Runoff

The mixed nature of the current site, with vast areas of grassed lands together with existing buildings and hard surfaced areas provides a varied rainfall runoff response. Thus, there is a mixture of areas currently with infiltration, albeit with poor water acceptance performance, along with other areas that are positively drained to the existing storm drainage system.

The soil value can be calculated from *Figure 1.4.18 (institute of Hydrology, 1978)* which shows the various soil types. The soil classifications are also available from the *Wallingford Procedure, Volume 3, Maps, "Winter rain acceptance potential"*. The equation was first published in FSSR 16, 1985. Refer to *Figure 3.2* for the "Soil" value in MicroDrainage that consider the SPR value and it can be obtained at *Greater Dublin Strategic Drainage Study – Regional Drainage Policies Volume 2 – New Development at section 6.7.2*.

| SOIL | SPR value (% runoff) |
|---|---|
| 1 | 0.1 |
| 2 | 0.3 |
| 3 | 0.37 |
| 4 | 0.47 |
| 5 | 0.53 |

***Figure 3.2– SPR Values for Soil (Excerpt from GDSDS: Table 6.7)***

A site investigation, carried out in the October 2020 on behalf of the client, confirmed that the existing ground is unsuitable for infiltration, with poor water acceptance characteristics. A **Soil Type 4**, consistent with the confirmed soil material found on site was therefore applied in runoff calculations. A copy of the Site Investigation is provided as part of the Environmental Impact Assessment Report, submitted under separate cover as part of this application.

The Standard Annual Average Rainfall (SAAR) equivalent of **720mm**, as received from Met Éireann for the subject site, was used to determine the rainfall runoff rate. Refer to the **Appendix B** for the Return Period Rainfall Depths for Sliding Durations from Met Éireann.

Using the ICPSuDS Input, {Flood Studies Report (FSR)} Method, the rainfall runoff discharging from the total site area that is to be developed (i.e. 3.8 ha), in its existing condition, has been calculated at greenfield runoff rate, **$QBAR_{RURAL}$ = 5.0 l/s/ha** (*i.e. 19 l/s*).

Refer to **Figure 3.3** for an excerpt of the results from the MicroDrainage Runoff Calculator, which also provides the calculated QBAR runoff rate along with the discharge rate for varying Annual Recurrence Intervals (ARI). Refer to the **Appendix C** for the QBAR runoff calculations.

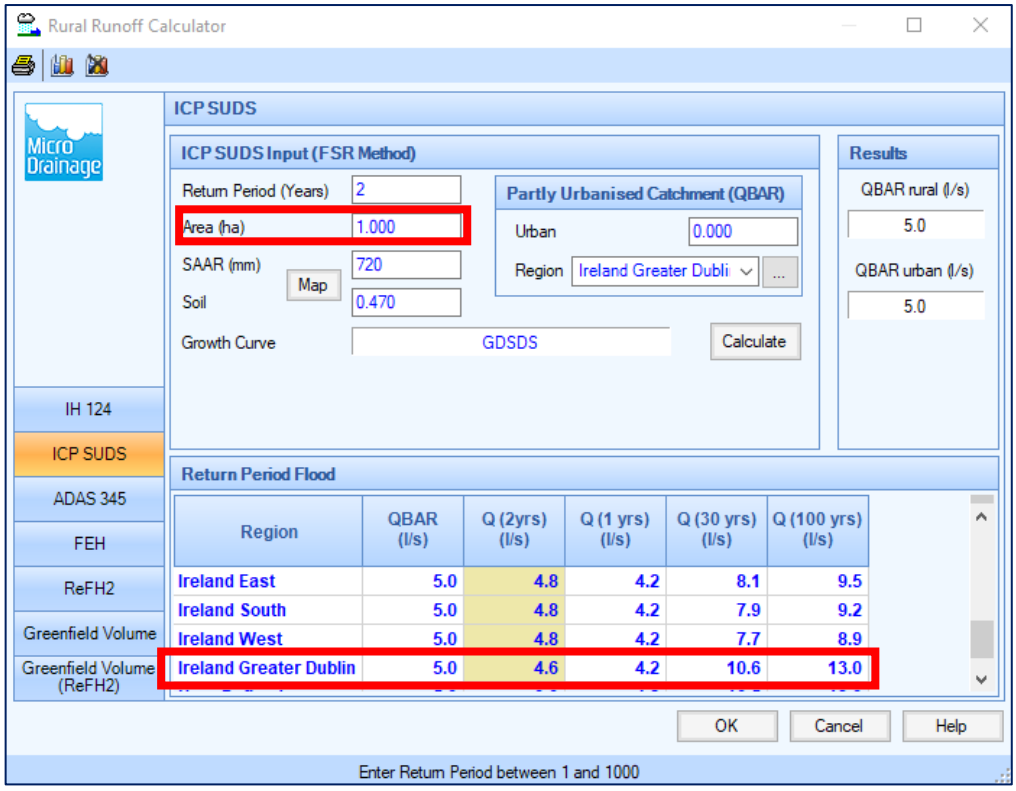



***Figure 3.3 - Existing Site Runoff Calculator Results (MicroDrainage Excerpt)***

## 3.5 Proposed Surface Water Drainage Design Strategy

### 3.5.1 Proposed Surface Water Strategy Overview

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the adjacent watercourse and local wastewater sewer network, respectively.

Refer to *Section 4* for details of the proposed wastewater drainage design.

Refer to detailed drawing **B967-OCSC-ZZ-GF-DR-C-0500** for the proposed drainage network layout, which is to serve the proposed development.

### 3.5.2 Climate Change Allowance

The proposed surface water network has been designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change projections, in accordance with both the current and draft Dublin City Development Plan and the GDSDS.

***All discussion within this report, with regards to surface water network design calculation and results, include for the allowance of an increase of <u>20%</u> in rainfall intensity, as required.***

### 3.5.3 Proposed Surface Water Management Plan

The proposed surface water network is to be split into three main gravity surface water catchments, as follows:

- Catchment A: Road and paving alongside Goldenbridge Cemetery;
- Catchment B: 2nr. Residential Blocks & associated paving / landscaping;
- Catchment C: Commercial area, and associated paving / landscaping.

Each catchment is to be separated into smaller sub-catchments, to best manage the rainfall runoff and provide treatment and attenuation at source, wherever practicable. Each catchment will also have its own independent outfall to the public surface water infrastructure, along St. Michael's Estate,

which will each discharge treated flows that are attenuated to greenfield equivalent rates.

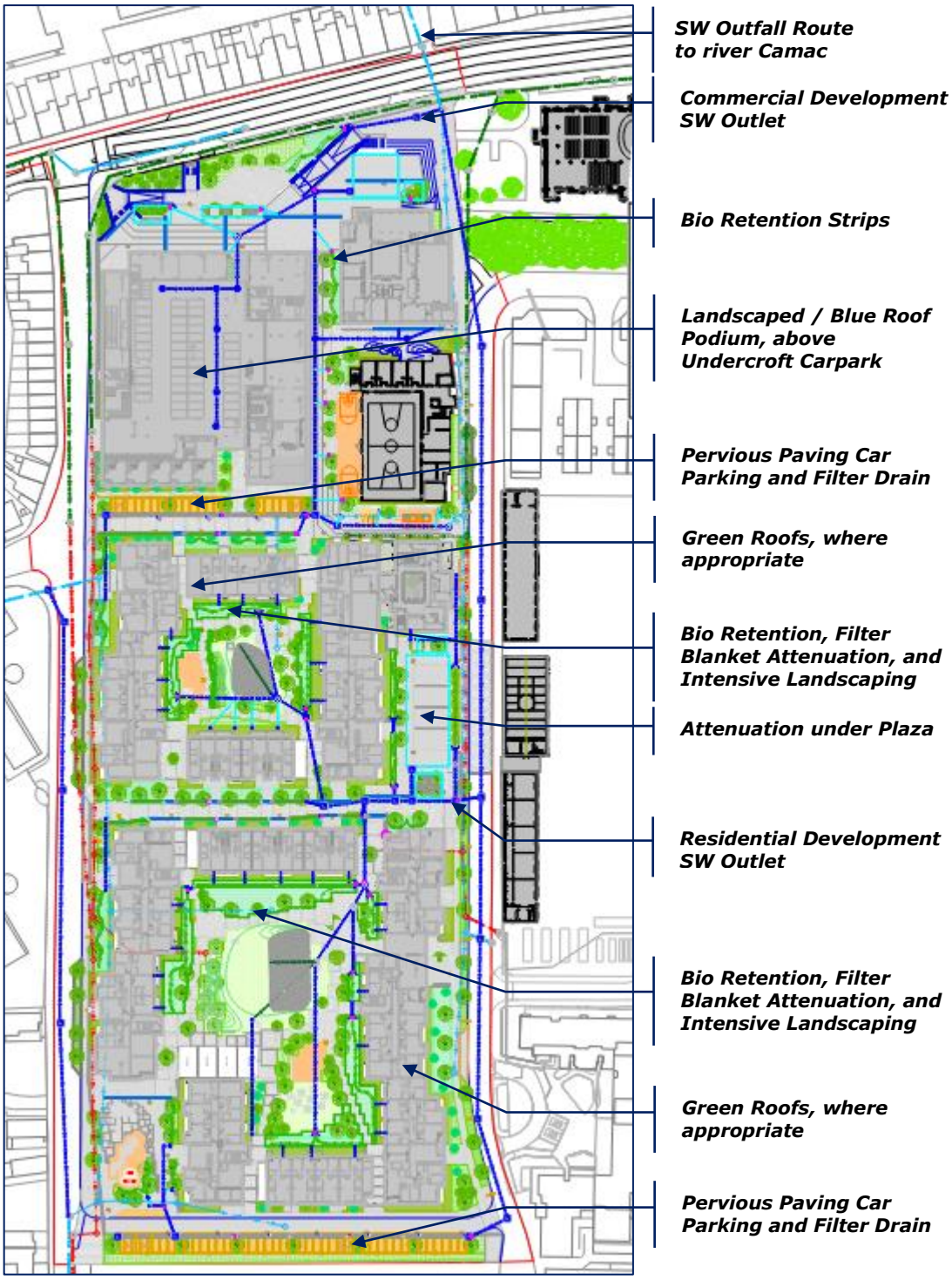



***Figure 3.4 - Proposed Surface Water (SW) Drainage Drawing***

The new development's surface water drainage network will comprise a sustainable drainage system that is heavily integrated with the landscape features, wherever practicable. The sustainable drainage systems reduce the runoff volume discharging from site, as well as improving the water quality.

The typical traditional and Sustainable Drainage Systems (SuDS) provided, all of which have been designed in accordance with CIRIA C753, the SuDS Manual, and the design guidance material listed in *Section 2* of this report, are listed and detailed in order of general sequence within the drainage network, as follows:

#### *3.5.3.1 Green Roofs*

Extensive green roofs are to be considered for use, where large flat roofs are to be provided. Green roofs are designed to intercept and retain initial rainfall, which reduces the volume and rate at which it enters the surface water network.

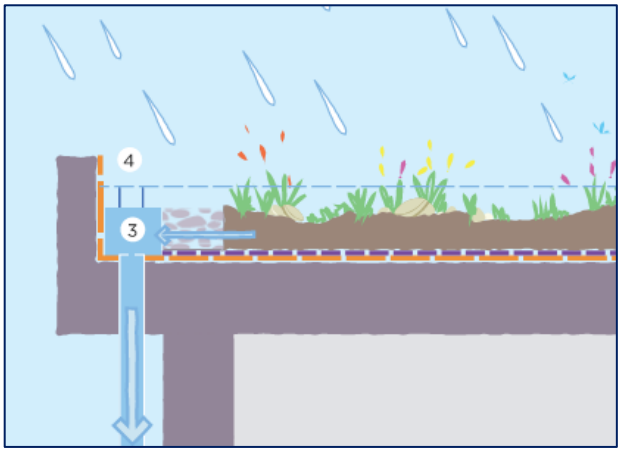



***Figure 3.5 - Typical Green Roof Build-up (DCC SuDS GUIDE)***

Significant green roof has been provided across the development, which comprises both extensive green roof along with isolated intensive green roof areas, in addition to an intensively landscaped podium area within the Commercial building. The combined extent of both the intensive and extensive roof areas are in accordance with the draft DCC Development Plan, and the requirements set out in the supplementary Dublin City Council Green Blue Roof Guide, 2021.

All roof area within the residential blocks shall discharge to the landscaping features within the central open space areas, for further treatment and attenuation.

The roof area of the main commercial building shall discharge to the podium landscaping and paving base course, for further treatment and attenuation.

#### 3.5.3.2 *Bioretention Systems / Rain Gardens*

Bioretention systems are shallow landscaped depressions that can reduce rates and volumes and treat pollution through the use of engineered soils and vegetation. They are particularly effective in delivering interception and attenuation and can also provide attractive landscape features that are self-irrigating and fertilising; habitat and biodiversity; and cooling of the local microclimate due to evapotranspiration.

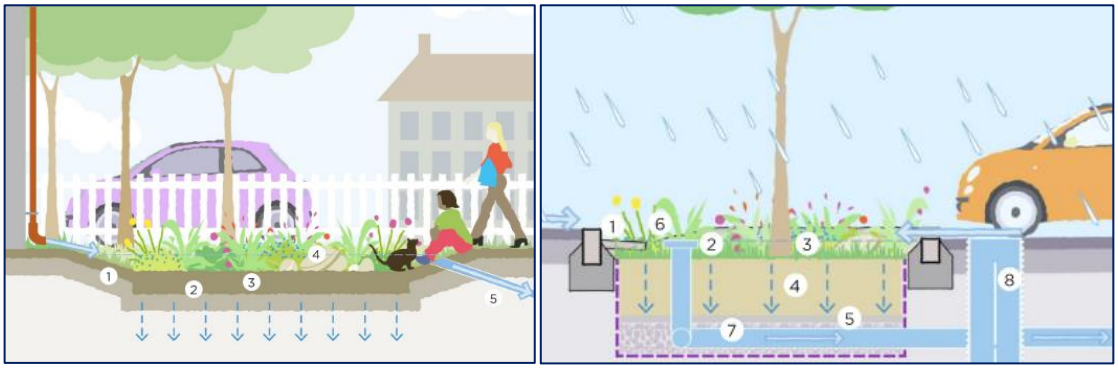


***Figure 3.6– Components of a bioretention system (DCC SuDS GUIDE)***

The bioretention systems throughout the development shall typically receive direct runoff from the development's green and other roofs, for further treatment and attenuation.

#### 3.5.3.3 *SuDS Tree Pits*

SuDS Tree Pits collect the rainfall runoff laterally from the surrounding landscaping and paving, which allows the trees to be watered every time it rains, with the growing medium also being used to store water before being released slowly to the adjacent surface water system.

These systems may also include cellular layer, at base or surround, in order to store additional rainfall.

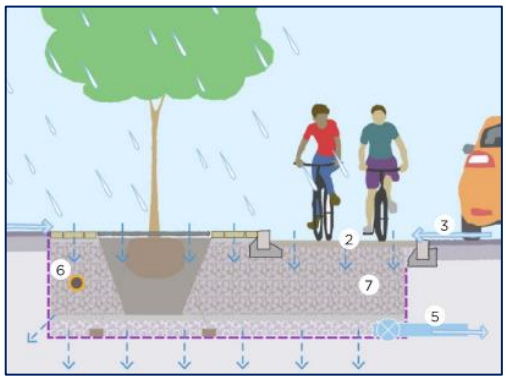



***Figure 3.7 - SuDS Tree Pit Illustration (DCC SuDS GUIDE)***

#### *3.5.3.4 Pervious Paving*

Pervious paving and surfaces allow for rainfall runoff to be captured directly by a SuDS structure for interception, treatment, infiltration (where possible) and attenuation. There are several pervious surfaces available but all work by similar practice, with the surface allowing rainfall to pass through, with an open-graded base layer providing both structural strength to the surface, while also allowing for storage within the void content.

Filter drains can be provided under the structural layer of the pervious paving, at its low-point, in order to convey excess rainfall volumes.

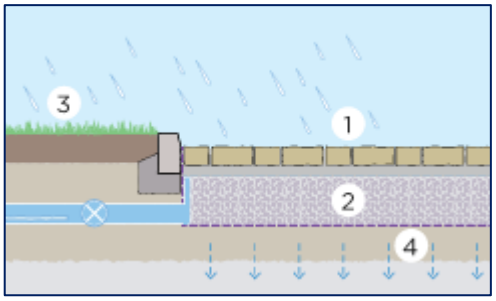



***Figure 3.8 - Pervious Paving Illustration (DCC SuDS GUIDE)***

Attenuation and storage properties of pervious paving structures can be further optimised by providing flow controls, to hold back rainfall runoff and maximise the available storage within the structure.

#### 3.5.3.5 *Filter Drains*

A filter drain is an open graded stone filled trench, which can also include a perforated pipe to assist distribution and conveyance of rainfall runoff along its length. Rainfall runoff can be stored within the void content of the stone trench, which should be wrapped in a fine geotextile to prevent fine sediment from entering the structure.

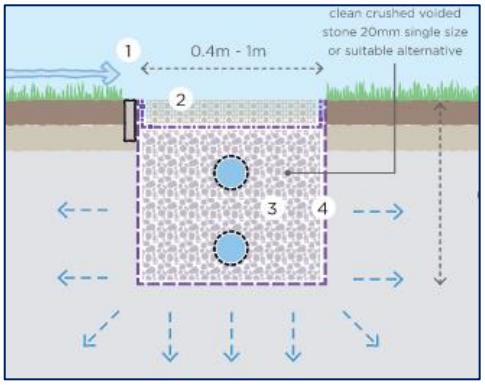



***Figure 3.9 - Filter Drain Illustration (DCC SuDS GUIDE)***

#### 3.5.3.6 *Trapped Road Gullies*

All road gullies serving the proposed development are to be trapped, to help prevent sediment and gross pollutants from entering the surface water network, and thus improving the water quality discharging from site.

The grated covers are to have a minimum load classification of D400, for frequent vehicular traffic.

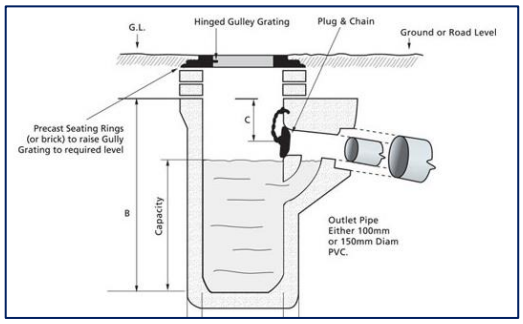



***Figure 3.10 - Trapped Road Gully (Typical Detail)***

#### 3.5.3.7 *Underground Pipe Network*

A traditional gravity pipe and manhole network will be provided, to convey the collected rainfall runoff as far as the development's outfall. Manholes,

compliant with the GDSDS and GDRCOP, are provided for maintenance access at branched connections, change in pipe size and gradient, and at intervals no greater than 90m distance.

#### 3.5.3.8 Silt Traps

A manhole upstream of attenuation system is to contain a 600mm sump, below invert level of outlet pipe, in order to trap sediment and other gross pollutants, and prevent from entering the downstream watercourse; thus, improving the water quality discharging from site.

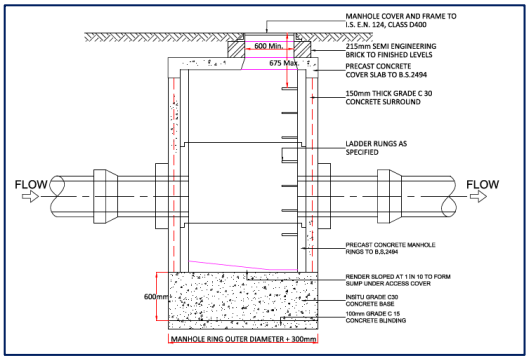



***Figure 3.11 - Typical Detail of Silt Trap Manhole***

#### 3.5.3.9 Geocellular Storage Systems

Unlined proprietary geocellular storage units are to be provided for the attenuation of rainfall runoff for the catchment area.

These systems are to provide sufficient temporary storage volume for rainfall events up to, and including, the design 1% AEP rainfall event (including climate change). Typical geocellular storage systems comprise plastic cellular units of high porosity (typically >95%), structurally arranged in rows and layers, with a perforated distribution pipe through the centre.

These systems also allow for interception of initial rainfall to be provided at the base of the system, by elevating the outlet relative to the systems base.

Access chambers for inspection and maintenance are also to be provided.

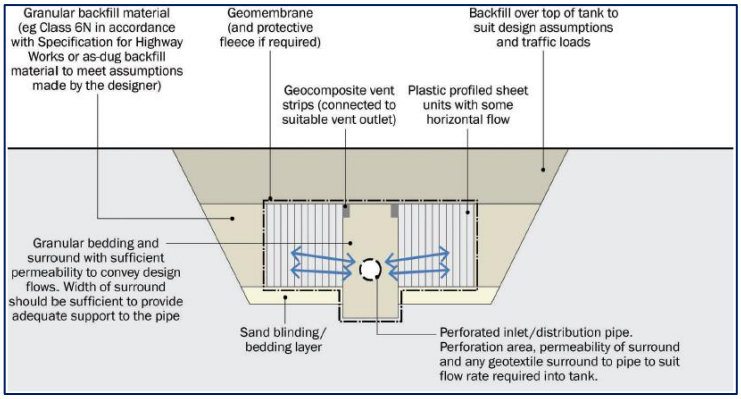



***Figure 3.12 - Typical Section of Geocellular System (CIRIA C753)***

#### *3.5.3.10 Flow Control Device*

Flow Control devices are to be provided at strategic locations across the integrated sustainable drainage network. These are typically to be provided immediately downstream of SuDS structures, in order to maximise the treatment and storage benefits at source and within the SuDS structure.

A vortex-hydrobrake type flow control shall be provided at end-of-line manholes, to limit the catchment discharge rate to the greenfield equivalent rate.

***Figure 3.13 - Vortex Hydro-Brake Flow Control Unit (Hydro International)***

All other flow control devices within the development – typically located immediately downstream of a SuDS structure – are to comprise ***protected orifices***, as the restricted flow will typically be in the order of 1.0 l/s, and therefore a small aperture will be present. This will minimise risk of blockage.

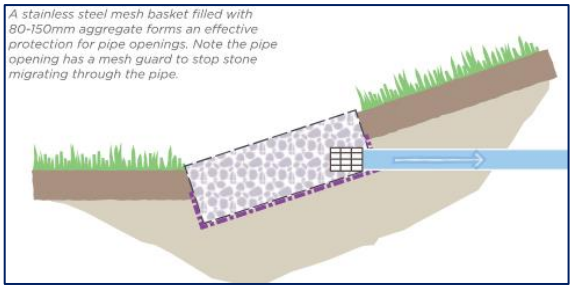



***Figure 3.14 - Illustration of Protected Orifice (DCC SuDS Guide)***

## 3.6 Proposed Surface Water Network Detailed Design

### 3.6.1 Software Design Criteria

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in *Section 2*, using MicroDrainage Network Design package, by Innovyze Inc., which simulates the performance of the integrated drainage network for varying rainfall return periods and storm durations.

The MicroDrainage Network Design software applies the Flood Studies Report (FSR) methodology for analysis of the rainfall profiles. However, the input design parameters that were used, as part of this design, were based on the available Flood Studies Update (FSU) data, *i.e.* the return period rainfall depths for sliding durations, which determine the $\mathbf{M_{5\text{-}60}}$ and **R** values, and the standard annual average rainfall (SAAR); as sourced from Met Éireann.

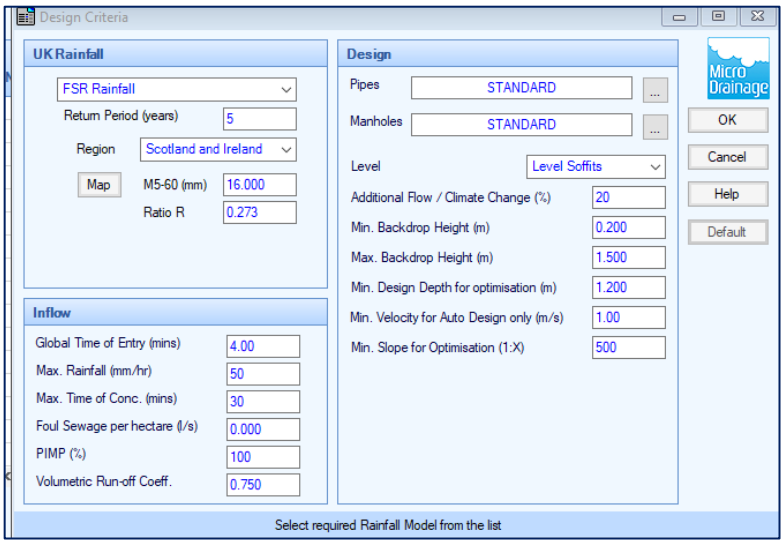



***Figure 3.15 - Surface Water Network Design Criteria (MicroDrainage Excerpt)***

### 3.6.2 Proposed Surface Water Catchment Area

The proposed development has been divided into three independent surface water networks, based on both the proposed development layout, natural topography, and resultant proposed finish levels. The northern catchment can be considered commercial, and the southern catchment can be considered residential. The total contributing drainage catchments are as follow:

- Catchment A (Southern Link Road) 0.2-hectares
- Catchment B (Residential Development) 1.5-hectares
- Catchment C (Commercial Development) 1.0-Hectares


***Figure 3.16 – Surface Water Network Catchment Overview***

Other areas outside of the above comprise footpath and landscaped areas alongside the adjacent public roads, and do not directly contribute to the new surface water drainage networks.

Refer to design layout drawings **B967-OCSC-ZZ-GF-DR-C-0500** and **B967-OCSC-ZZ-GF-DR-C-0526** for information.

### 3.6.3 Proposed Development Rainfall Runoff

It is proposed to reduce and restrict the rainfall runoff, discharging from the site of the proposed development, to the greenfield equivalent, $QBAR_{RURAL}$, runoff rate, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than $25km^2$ (25ha) in area.

This is to be achieved with the provision of a flow restrictor (Hydro-Brake Optimum by Hydro-International, or similar approved) prior to discharging to the existing storm sewers at the east and north eastern boundary of the site, with the appropriate measures of attenuation provided and sub-catchment management.

Sub-catchment flow-control devices and associated attenuation are also to be strategically provided, in order to maximise SuDS benefits and avail of the central open space for preliminary attenuation.

Refer to *Figure 3.3*, in *Section 3.4.3*, for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area (c.3.8-hectares), which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of **19 l/s** (5 l/s/ha) along with the calculated runoff for varying Average Recurrence Intervals (ARI).

This maximum flow rate (i.e. greenfield equivalent) was incorporated into the integrated drainage network design for each contributing catchment, on a pro-rata basis *i.e.*:

- Catchment A: (0.2-hectares) 1.5 l/s
- Catchment B: (1.5-hectares) 9 l/s
- Catchment C: (1.0-hectares) 5 l/s

For the purpose of the surface water network design simulation, we have applied a runoff coefficient, $C_V$ value, of 1.0 across the entire development, with a reduced percentage of permeability applied to the various surfaces. As such, and as outlined in DCC's SuDS Design and Evaluation Guideline that forms part of Dublin City Council's Draft Development Plan (2022 – 2028), an upper bound percentage impermeable value of 15% has been applied to all bio-retention and landscaping zones, which are to comprise free draining – clay soils.

The rainfall runoff at roof level has been applied to the design simulation software using Micro-drainage's built-in Green Roof calculator function.

### 3.6.4 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving both catchments in the proposed development, is to consist of a gravity sewer network that will convey runoff from the roofs and paved areas to the outfall manhole, as illustrated on the detailed design drainage layout drawing (**B967-OCSC-ZZ-GF-DR-C-0500**) that accompanies this submission. The new gravity networks will discharge a controlled attenuated flow rate to both the existing public networks (Northern and Southern catchments) at the east and north-eastern boundary of the site, as outlined in *Section 3.5.3*.

The proposed piped-network has been designed in accordance with BS EN 752 and all new infrastructure is to be compliant with the requirements of the GDSDS and the GDRCOP for Drainage Works, with minimum full-bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been designed to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI (Average Recurrence Interval) event.

Refer to drawing **B967-OCSC-ZZ-GF-DR-C-0500** for the proposed drainage infrastructure layout.

## 3.7 Proposed Surface Water Attenuation Storage

Each proposed catchment is to attenuate its own rainfall runoff, prior to discharging to the same existing storm sewer in different locations. The primary function of the attenuation systems will be to temporarily store excessive rainfall runoff, during significant rainfall events, due to the restricted discharge rates (to greenfield equivalent runoff rates) from the development outfalls.

Attenuation and temporary storage has been strategically distributed across the development site and largely provided as part of the proposed SuDS structures, which comprise:

- Bio-retention / rain garden;
- Pervious paving with filter drain;

- Filter drain;
- Infiltration blanket;
- SuDS Tree Pits;
- Proprietary Cellular Storage.

A minimum total storage volume of **2,650m³** is to be provided across the entire development, within the aforementioned SuDS structures.

All attenuation systems have been designed to temporarily store the surface water runoff for design rainfall events up to, and including, the 1% AEP with a 20% increase in rainfall intensity, along with the associated integrated surface water drainage network.

## 3.8 Surface Water Outfall Location

There are 3nr. proposed outfall locations to the public surface water network, as illustrated on the detailed design drainage layout drawing (**B967-OCSC-ZZ-GF-DR-C-0500**) that accompanies this submission: each of which will discharge treated flows that are attenuated to the greenfield equivalent rate, as described earlier in this section.

The above is to ensure that there is no increase in flow rates and volumes, from the development site, being discharged to the receiving infrastructure; thus, causing no adverse impact on adjoining and other downstream properties.

## 3.9 Water Quality

The quality of the surface water discharging from site is to be improved through the following provisions, each of which is discussed in greater detail in *Section 3.5.3*:

- Green Roofs to cover minimum of 70% roof area;
- Bioretention system at open spaces;
- Intensive landscaping, where practical, to drain paving;
- Pervious Paving at car park areas;
- Filter Drains;

- Trapped road gullies on the road carriageway, to trap silt and gross pollutants;
- Silt trap to be provided on manhole immediately upstream of attenuation system, as a further preventative measure to trap silt and other gross pollutants;
- Attenuation facilities to allow for interception and infiltration.

All of the above sustainable drainage systems will provide significant treatment of the rainfall runoff across the new development site, resulting in increased water quality discharging from site ensuring a positive impact on the receiving watercourse i.e., the river Camac, which is in line with the proposals in the Water Framework Directive.

### 3.10 Maintenance

The proposed surface water drainage networks have been carefully designed to minimise risk of blockage throughout the network, mainly through the following provisions that limit and restrict the size of pollutants entering the network:

- Green Roof;
- Bioretention systems;
- Pervious Paving;
- Filter Drains.
- Trapped road gullies;
- Silt trap manhole;
- Protected Orifices for flow controls.

All SuDS structures, including bioretention systems, pervious paving, road gullies, silt trap, flow control device and attenuation system, should be inspected regularly and maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

An appropriate inspection and maintenance schedule will be devised and implemented for the operational life of the proposed development.

## 3.11 Surface Water Impact Assessment

The design criteria for the drainage system are established in *GDSDS Volume 2*, *Section 6.3.4* and explained further in *GDSDS Volume 2, Appendix E*. There are four design criteria, each of which has been considered for the subject site:

- River Water Quality Protection;
- River Regime Protection;
- Level of Service (flooding) for the site and;
- River Flood Protection.

## 3.12 Criterion 1 – River Water Quality Protection

It is proposed that the overall drainage system, serving this development, will contain a range of surface water treatment methods, as outlined previously in *Section 3.5,* which will improve the quality of surface water being discharged from the proposed development to the River Camac.

Gross pollutants, sediments, hydrocarbons, and other impurities, will be removed at source with the following provisions:

a) Bioretention systems in open spaces;
b) Intensive landscaping, where practicable;
c) Interception storage at attenuation systems;
d) All road gullies and linear channel drains are to be trapped;
e) Silt-trap prior to attenuation storage area.

## 3.13 Criterion 2 – River Regime Protection

Surface water discharge from the overall development will be restricted to an equivalent rural runoff rate of **5.0 l/s/ha**, as per GDSDS and Dublin City Council Development Plan (and the Draft Development Plan)requirements. Refer to *Section 3.4.3* for further details of the proposed development rainfall runoff calculations.

This will be achieved with the provision of a flow control devices (Hydro-Brake Optimum, by Hydro-International, or similar approved) upstream of the outfall manhole. Refer to *Section 3.5.3.7* for further details.

## 3.14 Criterion 3 – Level of Service (Flooding) Site

There are four sub-criteria for the required level of service, for a new development; as set out in the *GDSDS Volume 2, Section 6.3.4 (Table 6.3).*

- No flooding on site except where planned (30-year high intensity rainfall event);
- No internal property flooding (100-year high intensity rainfall event);
- No internal property flooding (100-year river event and critical duration for site) and;
- No flood routing off site except where specifically planned. (100-year high intensity rainfall event).

### 3.14.1 Sub-Criterion 3.1

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding. Therefore, the system has capacity for the 30-year return period rainfall event without flooding.

The performance of the proposed drainage system has been analysed for design rainfall events up to, and including, the 1% AEP event (including 20% climate change allowance) using the *MicroDrainage Network Design Software*, by Innovyze Inc. Refer to **Appendix D** for details of design criteria, calculations and results. The analyses indicate that no flooding will occur for design rainfall events up to, and including, the 1% AEP (Annual Exceedance Probability).

### 3.14.2 Sub-Criterion 3.2

The surface water drainage systems, serving the proposed development, are yet to be designed to accommodate the 100-year return period rainfall

event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding.

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) has been analysed – Refer **Appendix D** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

### 3.14.3 Sub-Criterion 3.3

Details of the flood risk assessment associated with the proposed development is outlined in the Site-Specific Flood Risk Assessment (Document Nr. **B967-OCSC-XX-XX-RP-C-0007**), which is submitted under separate cover, as part of this application.

### 3.14.4 Sub-Criterion 3.4

The surface water drainage systems, serving the proposed development, are yet to be designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding, so no flood routing off site will be experienced for such a rainfall event.

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) has been analysed – Refer **Appendix D** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

Details of the flood risk assessment associated with the proposed development is outlined in the Site-Specific Flood Risk Assessment (Document Nr. **B967-OCSC-XX-XX-RP-C-0007**), which issubmitted under separate cover, as part of this application.

## 3.15 Criterion 4 – River Flood Protection

As outlined in *Section 3.14* (Criterion 2), the surface water runoff from the development's catchment will be limited to a maximum of **5.0 l/s/ha**.

Refer to *Section 3.4.3* and *Section 3.6* of this report for further details on the limiting discharge rates. The *GDSDS Volume 2, Appendix E* states that this practice ensures *"that sufficient stormwater runoff retention is achieved to protect the river during extreme events".*

Attenuation storage is to be provided for the 100-year return period rainfall event (including an increased 20% rainfall intensity; to allow for climate change). Discharge from site is to be achieved through the use of a vortex flow control device (e.g. Hydro-Brake Optimum, by Hydro-International, or similar approved), which will reduce the risk of blockage present with other flow devices.

Refer to **Appendix D** for details of hydraulic modelling calculations of attenuation and flow control facilities, as carried out using MicroDrainage software by Innovyze Inc.

# 4 WASTEWATER DRAINAGE

## 4.1 Overview

All proposed wastewater sewer design has been carried out in accordance with *Irish Water's Code of Practice for Wastewater Infrastructure (Revision 2 – July 2020)*. The proposed site is a mixture of brownfield areas, with no existing wastewater discharge to the public wastewater infrastructure.

The proposed development is to be served by a gravity wastewater drainage network ultimately discharging to the existing wastewater sewers located at western and eastern boundaries of the site.

## 4.2 Existing Wastewater Drainage

The proposed development site is well served by foul/combined sewers, as identified on the Irish Water Records reproduced as *Figure 4.1* and verified by GPR/Utilities survey.

Foul sewers are located to both the western and eastern boundaries of the site. There are 2nr. foul sewers located along Saint Vincent Street West. The sizes are not identified on the Irish Water Records, but the larger sewer been determined by topographical survey (by Apex Surveys in 2020) as a 375mm-diameter sewer becoming a 1600mm brick arch sewer. The second sewer is identified as a 300mm-diameter combined sewer that travels under the ground of the Pigeon Club onto Emmet Road. This has been labelled as a storm sewer on the utilities survey which may indicate the foul flow into same would have been from the Saint Michael's Estate buildings.

The foul sewer to the east of the site runs along Saint Michael's Estate. This consists of a 225mm-diamter travelling in a northern direction along the eastern boundary of the site. The sewer serves a number of adjoining developments including Richmond Barracks, Inchicore Primary Care Centre, Inchicore Community Sports Centre, Saint Michael's Parish Community Centre and Eve Tuiscint Health Centre amongst others. Both the record drawings and utilities survey confirm that this sewer becomes a combined sewer before discharging to the combined sewer along Emmet Road.

It is noted that there are a number of old connections from the site identified on the GPR survey.

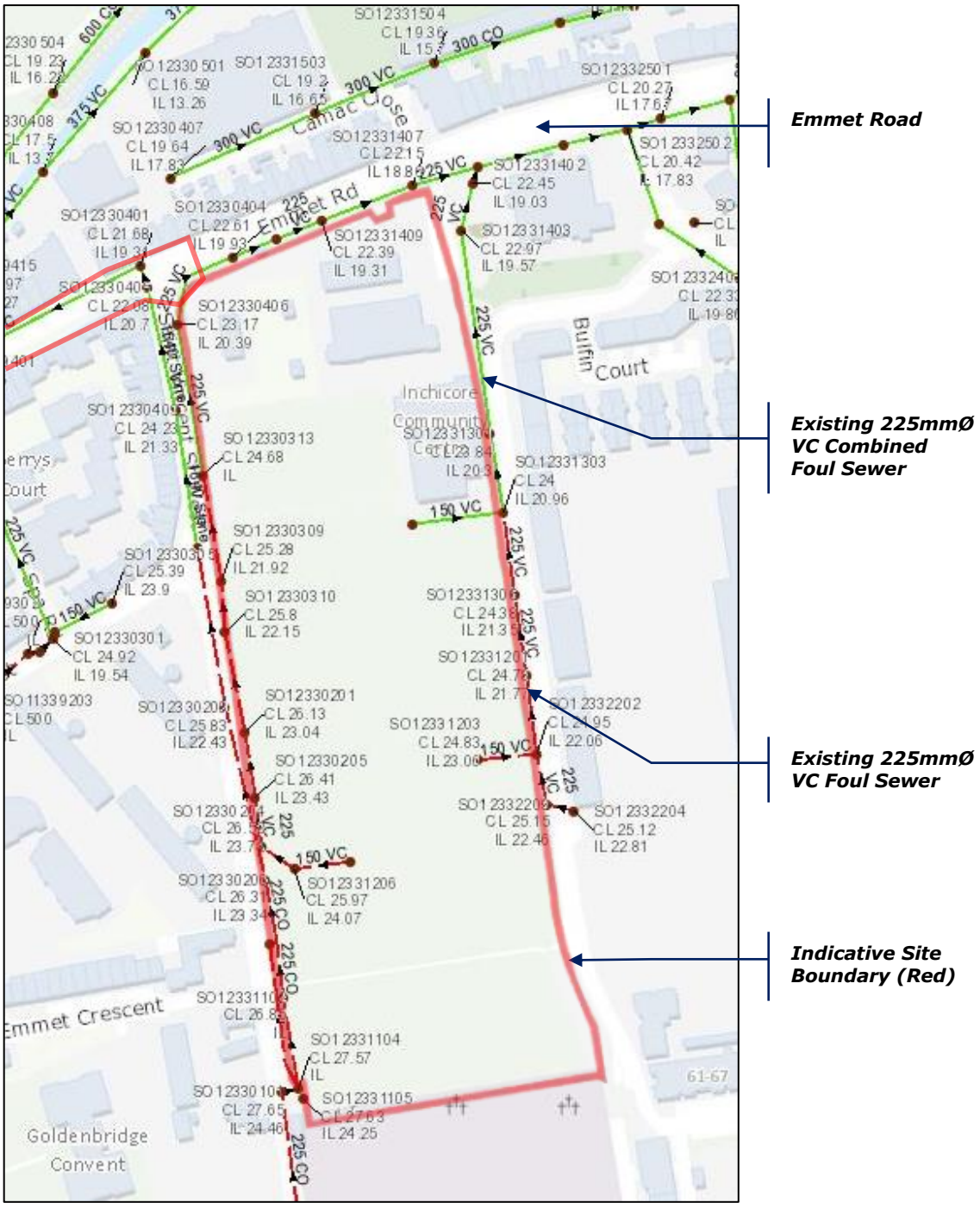



***Figure 4.1 – Irish Water Public Records (Excerpt)***

Refer to **Appendix A** for details of Irish Water existing wastewater infrastructure records.

## 4.3 Consultation

A Pre-Connection Enquiry Form ***(IW Ref Nr. CDS22003279)*** was submitted to Irish Water, with Confirmation of Feasibility subsequently confirmed by Irish Water, without the requirement for any upgrades.

Refer to **Appendix F** for a copy of the Confirmation of Feasibility Letter.

## 4.4 Proposed Wastewater Drainage Strategy

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the adjacent local wastewater and surface water sewer network infrastructure, respectively. Refer to *Section 3* for details of the proposed surface water drainage design strategy.

The overall development is to be separated into three individual gravity wastewater catchments – based on the natural topography of the development site and the proposed finish levels across the new development – to serve each of the proposed blocks.

Each wastewater network is to discharge to the existing wastewater network that is located at St Michael's Estate.

The proposed wastewater network has been designed in accordance with the Building Regulations Part H, and *Irish Water's Code of Practice for Wastewater Infrastructure (Revision 2 – July 2020)*.

Refer to detailed drawing **B967-OCSC-ZZ-GF-DR-C-0500** for the proposed drainage network layout, which is to serve the proposed development.

## 4.5 Wastewater Network Design Calculations

Wastewater (volumetric) calculations have been complied in accordance with *Irish Water's Code of Practice Wastewater Infrastructure, IW-CDS-5030-03 (Revision 2 – July 2020)* and are included in **Appendix E.**

## 4.6 Taking In Charge

It is proposed that all new wastewater drainage infrastructure installed to serve the proposed development within the redline boundary **is not** to be offered to Irish Water for to be taken-in-charge and is to be managed by the new development's building management.

# 5 POTABLE WATER SUPPLY

## 5.1 Overview

All proposed potable water design has been carried out in accordance with *Irish Water's Code of Practice for Water Infrastructure, IW-CDS-5020-03 (Revision 2 – July 2020).*

## 5.2 Consultation

A Pre-Connection Enquiry Form ***(IW Ref Nr. CDS22003279)*** was submitted to Irish Water, with Confirmation of Feasibility subsequently confirmed by Irish Water, subject to upgrading approximately 180m of existing watermain at Emmet Road, from 150mm to 200mm diameter.

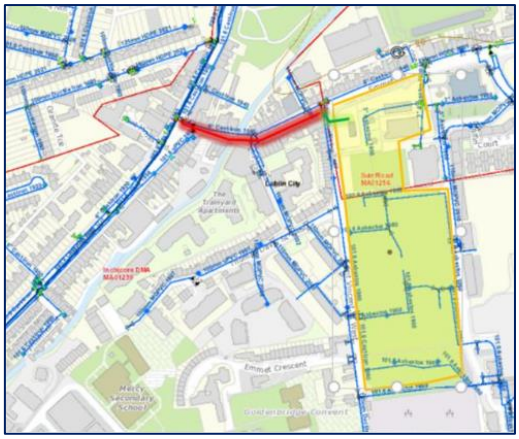


***Figure 5.1 - Section of Watermain Requiring Upgrade***

Refer to **Appendix F** for a copy of the Confirmation of Feasibility Letter.

## 5.3 Existing Watermain Infrastructure

There are a number of existing watermain services identified on the Irish Water Record drawings as serving the Emmet Road site. These include:

- 3 inches asbestos pipe supply to Eve Tuiscint Health Centre and Pigeon Club grounds;
- 3 inches asbestos pipe supply to Saint Michael's Parish Community Centre and Inchicore Community Sports Centre;
- 4 inches asbestos pipe supply to northern portion of the original Saint Michael's Estate building. This main links a 4 inches asbestos pipe main

on Saint Vincent Street West and a 3 inches asbestos pipe supply on Saint Michael's Estate;

- 4 inches asbestos pipe supply to central portion of the original Saint Michael's Estate building. This main links a 4 inches pipe main on Saint Vincent Street West and 3 inches asbestos pipe supply on Saint Michael's Estate;
- 2 nr. 4 inches asbestos pipe feeds on the southern portion of the site. Again, there mains link watermains on Saint Vincent Street West and Saint Michael's Estate. Sections of these mains also supply Thornton Heights development;
- 150mm-diameter Ductile iron 1987 pipe at Saint Vincent Street West.

In addition to the above, the record drawings indicate a separate 110mm-diameter MOPVC supply along Bulfin Road and Saint Michael's Estate. This main is indicated to supply Inchicore Primary Care Centre and/or Richmond Barracks.

It is noted that the demolition drawings for Saint Michael's Estate indicate that a number of the above watermains may have been removed as part of the demolition works.

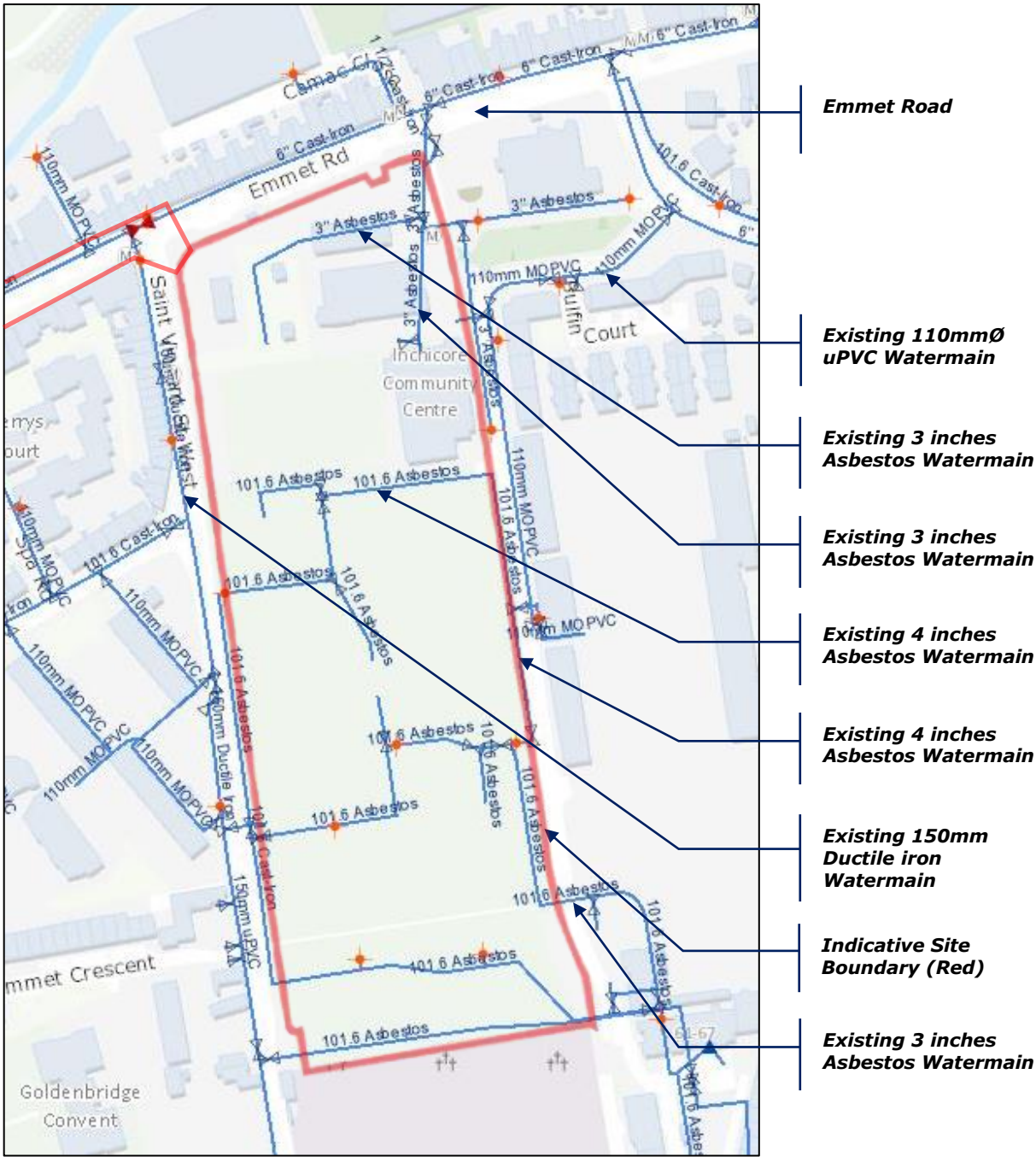



***Figure 5.2 - Irish Water Public Records (Excerpt)***

Refer to **Appendix A** for details of existing watermain infrastructure records.

## 5.4 Decommissioning of Existing Watermain

A large number of existing watermain infrastructure will require decommissioning in order to facilitate the new infill development. As part of

this, Irish Water may require diversions in place through or around the development.

## 5.5 Connection to the Existing Network

It is proposed to serve the proposed development by providing a new connection from the public infrastructure to a centralised water storage tank, located at the new Energy Centre adjacent to Richmond Barracks. From here, water will be metered and distributed to each block and individual units.

The proposed connection is to be carried out in accordance with *Irish Water's Code of Practice for Water Infrastructure (Revision 2 – July 2020)*, following a New Connection agreement with Irish Water, with a bulk water meter to be provided at the development's entrance, with separate metering provided for each induvial development unit, as per Irish Water requirements.

Refer to detailed drawing **B967-OCSC-ZZ-GF-DR-C-0550** for the proposed watermain layout, which is to serve the proposed development.

In order to facilitate the proposed development Irish Water have advised to upgrade the existing 150mm ø watermain along Emmet Road to a 200mm ø pipe; refer Section 5.2 and appended Confirmation of Feasibility Letter for details.

## 5.6 Water Meters

A bulk water meter is to be provided at the location of the new connection from the public watermain, along with individual meters provided at the connection to each unit. All metering is to be provided in accordance with Irish Water's requirements. Taking In Charge

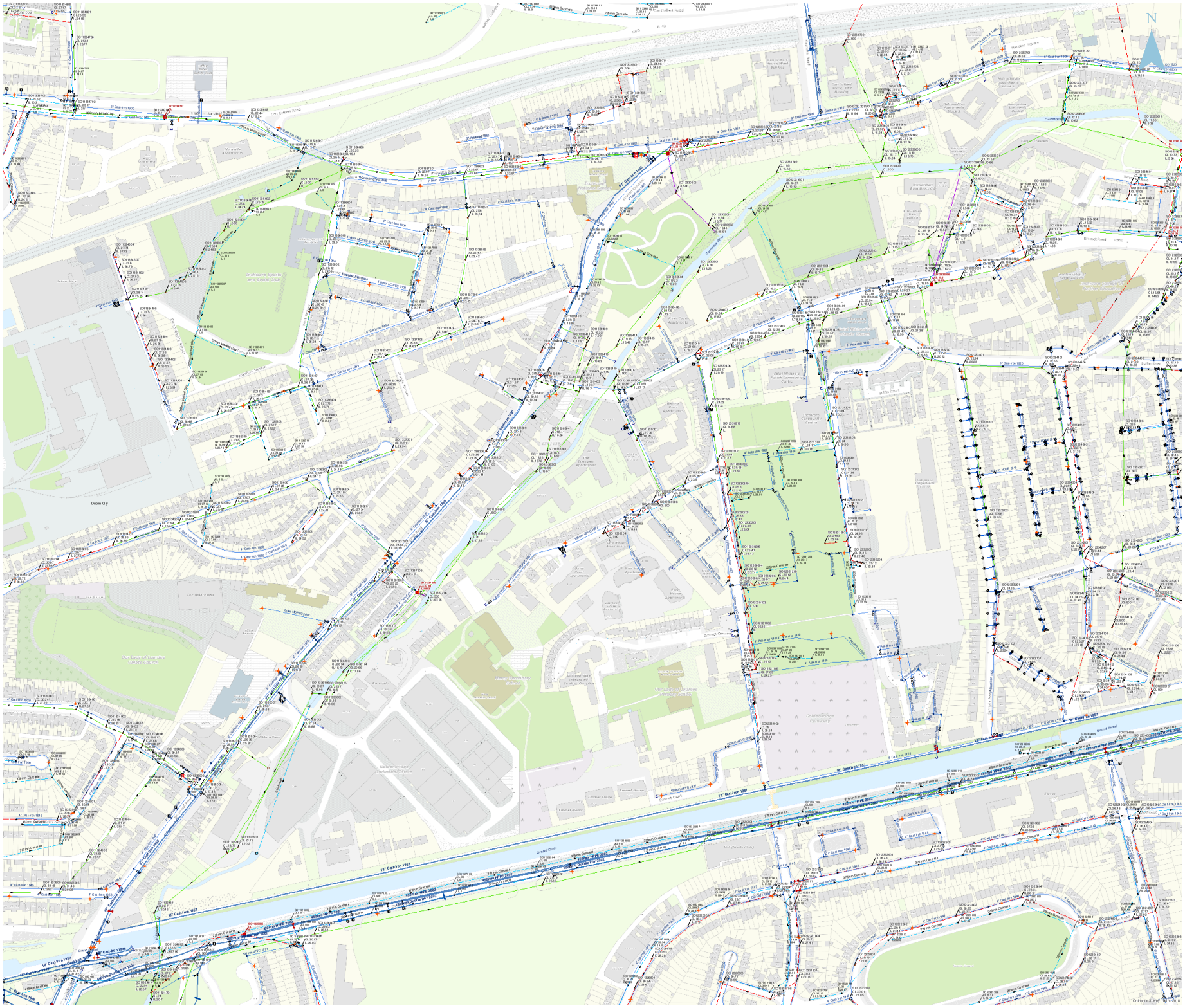
All new watermain infrastructure, installed to serve the proposed development after the bulk meter **is not** to be offered to Irish Water for to be taken-in-charge. The development's internal water infrastructure is to be managed and maintained by the building management.

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

## APPENDIX A. EXISTING DRAINAGE INFRASTRUCTURE RECORDS

# Appendix A

Existing Drainage Infrastructure Records



UISCE ÉIREANN : IRISH WATER

## Legend

- Boundary Meter
- Bulk Meter
- Unknown Meter ; Other Meter
- Non-Return
- Sluice Valve Open
- Sluice Valve Closed
- Butterfly Valve Open
- Sluice Valve Open
- Sluice Valve Closed
- Double Air Control Valve
- Water Stop Valves

### Water Hydrants

**Hydrant Function**

- Fire Hydrant
- Washout
- Water Pump Stations
- Water Kiosk
- Cap
- Other Fittings
- Reducer
- Tap

### Water Distribution Mains

**Owned By**

- Irish Water
- Irish Water
- Irish Water

### Sewer Manholes

**Manhole Type**

- Standard
- Other; Unknown
- Sewer Chambers
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Combined

### Storm Manholes

**Manhole Type**

- Standard
- Other; Unknown

### Storm Discharge Points

**Discharge Type**

- Outfall
- Surface Gravity Mains

### Storm Inlets

**Inlet Type**

- Standard

1:1,250 at A0

Last edited: 19/05/2020

Metres

0 25 50 100

# Appendix B

## Return Period Rainfall Depths

## for Sliding Durations from Met Éireann

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 312121, Northing: 233327,

| | Interval | | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DURATION | 6months, | 1year, | 2, | 3, | 4, | 5, | 10, | 20, | 30, | 50, | 75, | 100, | 150, | 200, | 250, | 500, |
| 5 mins | 2.4, | 3.5, | 4.1, | 5.0, | 5.7, | 6.2, | 7.8, | 9.7, | 11.0, | 12.8, | 14.4, | 15.7, | 17.6, | 19.2, | 20.5, | N/A , |
| 10 mins | 3.4, | 4.9, | 5.7, | 7.0, | 7.9, | 8.6, | 10.9, | 13.5, | 15.3, | 17.8, | 20.0, | 21.8, | 24.6, | 26.7, | 28.5, | N/A , |
| 15 mins | 4.0, | 5.8, | 6.8, | 8.3, | 9.3, | 10.1, | 12.8, | 15.9, | 18.0, | 20.9, | 23.6, | 25.7, | 28.9, | 31.4, | 33.5, | N/A , |
| 30 mins | 5.2, | 7.5, | 8.8, | 10.6, | 11.9, | 12.9, | 16.2, | 20.0, | 22.5, | 26.1, | 29.2, | 31.7, | 35.6, | 38.6, | 41.1, | N/A , |
| 1 hours | 6.9, | 9.8, | 11.4, | 13.7, | 15.3, | 16.5, | 20.6, | 25.1, | 28.2, | 32.5, | 36.3, | 39.2, | 43.8, | 47.4, | 50.3, | N/A , |
| 2 hours | 9.2, | 12.8, | 14.7, | 17.6, | 19.6, | 21.1, | 26.1, | 31.6, | 35.3, | 40.4, | 45.0, | 48.5, | 53.9, | 58.1, | 61.6, | N/A , |
| 3 hours | 10.8, | 14.9, | 17.2, | 20.4, | 22.7, | 24.4, | 29.9, | 36.2, | 40.2, | 46.0, | 51.0, | 54.9, | 60.9, | 65.5, | 69.4, | N/A , |
| 4 hours | 12.1, | 16.7, | 19.1, | 22.7, | 25.1, | 27.0, | 33.0, | 39.8, | 44.2, | 50.3, | 55.8, | 60.0, | 66.4, | 71.3, | 75.4, | N/A , |
| 6 hours | 14.3, | 19.5, | 22.3, | 26.3, | 29.1, | 31.2, | 37.9, | 45.5, | 50.4, | 57.2, | 63.3, | 67.9, | 75.0, | 80.4, | 84.9, | N/A , |
| 9 hours | 16.8, | 22.8, | 25.9, | 30.5, | 33.6, | 36.0, | 43.6, | 52.0, | 57.5, | 65.1, | 71.7, | 76.9, | 84.7, | 90.7, | 95.6, | N/A , |
| 12 hours | 18.9, | 25.4, | 28.9, | 33.9, | 37.2, | 39.8, | 48.1, | 57.2, | 63.1, | 71.3, | 78.4, | 83.9, | 92.3, | 98.7, | 104.0, | N/A , |
| 18 hours | 22.2, | 29.7, | 33.6, | 39.3, | 43.1, | 46.0, | 55.2, | 65.4, | 72.0, | 81.0, | 89.0, | 95.0, | 104.2, | 111.3, | 117.1, | N/A , |
| 24 hours | 24.9, | 33.2, | 37.4, | 43.6, | 47.8, | 50.9, | 60.9, | 71.9, | 79.0, | 88.8, | 97.3, | 103.8, | 113.6, | 121.2, | 127.3, | 148.6, |
| 2 days | 30.7, | 40.0, | 44.8, | 51.7, | 56.2, | 59.6, | 70.5, | 82.2, | 89.7, | 99.9, | 108.8, | 115.5, | 125.7, | 133.4, | 139.7, | 161.2, |
| 3 days | 35.4, | 45.6, | 50.8, | 58.2, | 63.0, | 66.7, | 78.2, | 90.6, | 98.5, | 109.2, | 118.4, | 125.4, | 136.0, | 143.9, | 150.4, | 172.5, |
| 4 days | 39.5, | 50.4, | 55.9, | 63.8, | 68.9, | 72.8, | 85.0, | 98.0, | 106.2, | 117.3, | 126.9, | 134.1, | 145.0, | 153.2, | 159.9, | 182.5, |
| 6 days | 46.6, | 58.8, | 65.0, | 73.6, | 79.2, | 83.5, | 96.7, | 110.7, | 119.5, | 131.4, | 141.6, | 149.3, | 160.8, | 169.4, | 176.4, | 200.1, |
| 8 days | 52.9, | 66.2, | 72.8, | 82.2, | 88.2, | 92.8, | 106.9, | 121.8, | 131.1, | 143.7, | 154.4, | 162.5, | 174.5, | 183.5, | 190.8, | 215.5, |
| 10 days | 58.7, | 73.0, | 80.0, | 90.0, | 96.4, | 101.2, | 116.1, | 131.8, | 141.6, | 154.8, | 166.0, | 174.3, | 186.9, | 196.2, | 203.8, | 229.3, |
| 12 days | 64.0, | 79.2, | 86.7, | 97.2, | 104.0, | 109.0, | 124.7, | 141.1, | 151.3, | 165.0, | 176.6, | 185.3, | 198.3, | 208.0, | 215.8, | 242.1, |
| 16 days | 74.0, | 90.8, | 99.0, | 110.5, | 117.8, | 123.3, | 140.2, | 157.9, | 168.9, | 183.5, | 196.0, | 205.2, | 219.0, | 229.3, | 237.6, | 265.3, |
| 20 days | 83.1, | 101.3, | 110.2, | 122.6, | 130.4, | 136.3, | 154.4, | 173.2, | 184.9, | 200.4, | 213.5, | 223.2, | 237.7, | 248.5, | 257.2, | 286.2, |
| 25 days | 93.9, | 113.7, | 123.2, | 136.6, | 145.1, | 151.4, | 170.8, | 190.9, | 203.2, | 219.7, | 233.6, | 243.9, | 259.2, | 270.6, | 279.7, | 310.2, |

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

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**APPENDIX C. $Q_{BAR}$ RUNOFF CALCULATIONS**

# Appendix C

## $Q_{BAR}$ Runoff Calculations

## ICP SUDS Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 2 | Soil | 0.470 |
| Area (ha) | 3.800 | Urban | 0.000 |
| SAAR (mm) | 720 | Region Number | User Defined |

User Defined Growth Curve

Filename gdsds_Growth Curve.gcfx Description GDSDS

| Return Period (years) | Growth Curve Factor |
|---|---|
| 1 | 0.850 |
| 2 | 0.000 |
| 5 | 0.000 |
| 10 | 1.700 |
| 20 | 0.000 |
| 25 | 0.000 |
| 30 | 2.100 |
| 50 | 0.000 |
| 100 | 2.600 |
| 200 | 2.900 |
| 500 | 0.000 |
| 1000 | 0.000 |

| Results | l/s |
|---|---|
| QBAR Rural | 19.0 |
| QBAR Urban | 19.0 |
| Q2 years | 0.0 |
| Q1 year | 16.1 |
| Q30 years | 39.8 |
| Q100 years | 49.3 |

## APPENDIX D. SURFACE WATER DESIGN CALCULATIONS

- Design Criteria;
- Area Summary;
- Network Design & Results Table;
- Simulation Criteria;
- Hydrobrake / Controls & Storage Design;
- Summary of Results.

# Appendix D

Surface Water Design Calculations

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for SW R

Pipe Sizes IW Manhole Sizes IW

FSR Rainfall Model - Scotland and Ireland

| | | | | | |
|---|---|---|---|---|---|
| Return Period (years) | 5 | Foul Sewage (l/s/ha) | 0.000 | Maximum Backdrop Height (m) | 3.000 |
| M5-60 (mm) | 16.500 | Volumetric Runoff Coeff. | 1.000 | Min Design Depth for Optimisation (m) | 0.750 |
| Ratio R | 0.277 | PIMP (%) | 100 | Min Vel for Auto Design only (m/s) | 1.00 |
| Maximum Rainfall (mm/hr) | 50 | Add Flow / Climate Change (%) | 20 | Min Slope for Optimisation (1:X) | 500 |
| Maximum Time of Concentration (mins) | 30 | Minimum Backdrop Height (m) | 0.000 | | |

Designed with Level Soffits

### Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S1.000 | 17.512 | 0.175 | 100.1 | 0.040 | 5.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S1.000 | 50.00 | 5.29 | 26.000 | 0.040 | 0.0 | 0.0 | 1.5 | 1.00 | 17.8 | 8.7 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S2.000 | 6.330 | 0.063 | 100.0 | 0.004 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S3.000 | 6.080 | 0.061 | 100.0 | 0.051 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S2.001 | 1.860 | 0.093 | 20.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S2.002 | 13.287 | 0.221 | 60.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S4.000 | 3.992 | 0.040 | 100.1 | 0.009 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S4.001 | 3.282 | 0.164 | 20.0 | 0.000 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S2.000 | 50.00 | 5.10 | 25.853 | 0.004 | 0.0 | 0.0 | 0.1 | 1.00 | 17.8 | 0.8 |
| R.S3.000 | 50.00 | 5.10 | 25.950 | 0.051 | 0.0 | 0.0 | 1.8 | 1.00 | 17.8 | 11.1 |
| R.S2.001 | 50.00 | 5.12 | 25.790 | 0.055 | 0.0 | 0.0 | 2.0 | 2.26 | 40.0 | 11.9 |
| R.S2.002 | 50.00 | 5.29 | 25.697 | 0.055 | 0.0 | 0.0 | 2.0 | 1.30 | 23.0 | 11.9 |
| R.S4.000 | 50.00 | 5.07 | 25.917 | 0.009 | 0.0 | 0.0 | 0.3 | 1.00 | 17.7 | 2.0 |
| R.S4.001 | 50.00 | 5.09 | 25.877 | 0.009 | 0.0 | 0.0 | 0.3 | 2.26 | 40.0 | 2.0 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S2.003 | 4.864 | 0.243 | 20.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S5.000 | 4.293 | 0.215 | 20.0 | 0.025 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S2.004 | 10.074 | 0.084 | 119.9 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S1.001 | 17.342 | 0.069 | 251.3 | 0.020 | 0.00 | 0.0 | | 0.045 | →\|o\|→ | | Filter Drain | |
| R.S1.002 | 17.441 | 0.070 | 249.2 | 0.023 | 0.00 | 0.0 | | 0.045 | →\|o\|→ | | Filter Drain | |
| R.S1.003 | 17.463 | 0.070 | 249.5 | 0.023 | 0.00 | 0.0 | | 0.045 | →\|o\|→ | | Filter Drain | |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S2.003 | 50.00 | 5.32 | 25.476 | 0.064 | 0.0 | 0.0 | 2.3 | 2.26 | 40.0 | 13.9 |
| R.S5.000 | 50.00 | 5.03 | 25.700 | 0.025 | 0.0 | 0.0 | 0.9 | 2.26 | 40.0 | 5.5 |
| R.S2.004 | 50.00 | 5.29 | 25.233 | 0.000 | 2.0 | 0.0 | 0.3 | 0.58 | 2.6 | 2.0 |
| R.S1.001 | 50.00 | 5.95 | 25.074 | 0.061 | 2.0 | 0.0 | 2.6 | 0.44 | 988.5 | 15.5 |
| R.S1.002 | 50.00 | 7.31 | 25.005 | 0.083 | 2.0 | 0.0 | 3.4 | 0.21 | 50.8 | 20.5 |
| R.S1.003 | 49.50 | 8.67 | 24.935 | 0.106 | 2.0 | 0.0 | 4.2 | 0.21 | 50.8 | 25.2 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S1.004 | 17.236 | 0.069 | 249.8 | 0.022 | 0.00 | 0.0 | | 0.045 | →\|○\|→ | | Filter Drain | |
| R.S1.005 | 19.937 | 0.080 | 249.2 | 0.032 | 0.00 | 0.0 | | 0.045 | →\|○\|→ | | Filter Drain | |
| R.S1.006 | 12.978 | 0.433 | 30.0 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 225 | Pipe/Conduit | |
| R.S1.007 | 31.657 | 0.396 | 80.0 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 225 | Pipe/Conduit | |
| R.S1.008 | 54.854 | 0.549 | 100.0 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 225 | Pipe/Conduit | |
| R.S1.009 | 43.143 | 0.431 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 225 | Pipe/Conduit | |
| R.S6.000 | 2.787 | 0.083 | 33.5 | 0.000 | 5.00 | 0.0 | 0.600 | | ○ | 150 | Pipe/Conduit | |
| R.S6.001 | 16.592 | 0.207 | 80.0 | 0.008 | 0.00 | 0.0 | 0.600 | | ○ | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S1.004 | 46.30 | 10.01 | 24.865 | 0.129 | 2.0 | 0.0 | 4.7 | 0.21 | 50.8 | 28.2 |
| R.S1.005 | 43.19 | 11.56 | 24.796 | 0.161 | 2.0 | 0.0 | 5.4 | 0.21 | 50.8 | 32.5 |
| R.S1.006 | 50.00 | 5.09 | 24.716 | 0.000 | 2.0 | 0.0 | 0.3 | 2.40 | 95.3 | 2.0 |
| R.S1.007 | 50.00 | 5.45 | 24.283 | 0.000 | 2.0 | 0.0 | 0.4 | 1.46 | 58.2 | 2.4 |
| R.S1.008 | 50.00 | 6.15 | 23.888 | 0.000 | 2.0 | 0.0 | 0.4 | 1.31 | 52.0 | 2.4 |
| R.S1.009 | 50.00 | 6.70 | 23.339 | 0.000 | 2.0 | 0.0 | 0.4 | 1.31 | 52.0 | 2.4 |
| R.S6.000 | 50.00 | 5.03 | 26.000 | 0.000 | 0.0 | 0.0 | 0.0 | 1.74 | 30.8 | 0.0 |
| R.S6.001 | 50.00 | 5.22 | 25.650 | 0.008 | 0.0 | 0.0 | 0.3 | 1.46 | 58.2 | 1.7 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S7.000 | 3.378 | 0.082 | 41.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S6.002 | 18.180 | 0.109 | 166.6 | 0.008 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S8.000 | 8.075 | 0.081 | 100.1 | 0.007 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S9.000 | 15.297 | 0.191 | 80.0 | 0.037 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S6.003 | 13.020 | 0.078 | 166.6 | 0.005 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S6.004 | 13.020 | 0.078 | 166.6 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S7.000 | 50.00 | 5.04 | 25.600 | 0.000 | 0.0 | 0.0 | 0.0 | 1.58 | 27.9 | 0.0 |
| R.S6.002 | 50.00 | 5.52 | 25.443 | 0.015 | 0.0 | 0.0 | 0.6 | 1.01 | 40.2 | 3.3 |
| R.S8.000 | 50.00 | 5.13 | 24.850 | 0.007 | 0.0 | 0.0 | 0.3 | 1.00 | 17.7 | 1.6 |
| R.S9.000 | 50.00 | 5.23 | 25.150 | 0.037 | 0.0 | 0.0 | 1.3 | 1.12 | 19.9 | 8.0 |
| R.S6.003 | 50.00 | 5.73 | 24.694 | 0.065 | 0.0 | 0.0 | 2.3 | 1.01 | 40.2 | 14.0 |
| R.S6.004 | 50.00 | 5.95 | 24.616 | 0.065 | 0.0 | 0.0 | 2.3 | 1.01 | 40.2 | 14.0 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S10.000 | 3.925 | 0.039 | 100.7 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S10.001 | 3.925 | 0.039 | 100.7 | 0.011 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S10.002 | 2.084 | 0.052 | 40.0 | 0.006 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S10.003 | 11.862 | 0.079 | 150.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S10.004 | 24.048 | 0.160 | 150.0 | 0.017 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S10.005 | 12.664 | 0.084 | 150.0 | 0.002 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S11.000 | 4.869 | 0.049 | 99.4 | 0.004 | 5.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S10.000 | 50.00 | 5.07 | 24.750 | 0.000 | 0.0 | 0.0 | 0.0 | 1.00 | 17.7 | 0.0 |
| R.S10.001 | 50.00 | 5.13 | 24.200 | 0.011 | 0.0 | 0.0 | 0.4 | 1.00 | 17.7 | 2.5 |
| R.S10.002 | 50.00 | 5.03 | 24.161 | 0.000 | 2.0 | 0.0 | 0.3 | 1.01 | 4.5 | 2.0 |
| R.S10.003 | 50.00 | 5.22 | 23.959 | 0.000 | 2.0 | 0.0 | 0.4 | 1.07 | 42.4 | 2.4 |
| R.S10.004 | 50.00 | 5.60 | 23.880 | 0.017 | 2.0 | 0.0 | 1.0 | 1.07 | 42.4 | 6.1 |
| R.S10.005 | 50.00 | 5.79 | 23.720 | 0.019 | 2.0 | 0.0 | 1.1 | 1.07 | 42.4 | 6.6 |
| R.S11.000 | 50.00 | 5.06 | 24.300 | 0.004 | 0.0 | 0.0 | 0.1 | 1.31 | 52.2 | 0.9 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S6.005 | 20.432 | 0.170 | 120.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S12.000 | 4.173 | 0.052 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S13.000 | 6.190 | 0.077 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S13.001 | 18.303 | 0.183 | 100.1 | 0.014 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S12.001 | 8.966 | 0.090 | 99.6 | 0.011 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S12.002 | 4.938 | 0.049 | 100.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S12.003 | 8.655 | 0.086 | 100.1 | 0.013 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S6.005 | 50.00 | 6.23 | 23.635 | 0.088 | 2.0 | 0.0 | 3.6 | 1.19 | 47.4 | 21.4 |
| R.S12.000 | 50.00 | 5.06 | 24.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S13.000 | 50.00 | 5.09 | 24.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S13.001 | 50.00 | 5.40 | 24.823 | 0.014 | 0.0 | 0.0 | 0.5 | 1.00 | 17.7 | 3.1 |
| R.S12.001 | 50.00 | 5.54 | 24.250 | 0.025 | 0.0 | 0.0 | 0.9 | 1.01 | 17.8 | 5.5 |
| R.S12.002 | 50.00 | 5.13 | 24.160 | 0.000 | 2.0 | 0.0 | 0.3 | 0.63 | 2.8 | 2.0 |
| R.S12.003 | 50.00 | 5.27 | 24.036 | 0.013 | 2.0 | 0.0 | 0.9 | 1.00 | 17.7 | 5.1 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S14.000 | 5.289 | 0.066 | 80.1 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S12.004 | 19.718 | 0.197 | 100.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S6.006 | 7.582 | 0.095 | 80.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S15.000 | 4.581 | 0.057 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S15.001 | 2.838 | 0.028 | 101.4 | 0.027 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S15.002 | 3.571 | 0.045 | 79.3 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S14.000 | 50.00 | 5.08 | 24.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S12.004 | 50.00 | 5.53 | 23.875 | 0.013 | 2.0 | 0.0 | 0.9 | 1.31 | 52.0 | 5.1 |
| R.S6.006 | 50.00 | 6.32 | 23.465 | 0.100 | 4.0 | 0.0 | 4.4 | 1.46 | 58.2 | 26.6 |
| R.S15.000 | 50.00 | 5.07 | 24.650 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S15.001 | 50.00 | 5.12 | 24.250 | 0.027 | 0.0 | 0.0 | 1.0 | 1.00 | 17.6 | 5.8 |
| R.S15.002 | 50.00 | 5.08 | 24.222 | 0.000 | 2.0 | 0.0 | 0.3 | 0.71 | 3.2 | 2.0 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S16.000 | 3.321 | 0.042 | 79.1 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S17.000 | 6.004 | 0.075 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S17.001 | 9.224 | 0.061 | 150.0 | 0.019 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S18.000 | 4.635 | 0.058 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S17.002 | 13.445 | 0.090 | 150.0 | 0.007 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S16.000 | 50.00 | 5.05 | 25.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.13 | 20.0 | 0.0 |
| R.S17.000 | 50.00 | 5.09 | 25.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S17.001 | 50.00 | 5.28 | 25.400 | 0.019 | 0.0 | 0.0 | 0.7 | 0.82 | 14.5 | 4.0 |
| R.S18.000 | 50.00 | 5.07 | 25.500 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S17.002 | 50.00 | 5.55 | 25.339 | 0.026 | 0.0 | 0.0 | 0.9 | 0.82 | 14.5 | 5.5 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S16.001 | 4.246 | 0.028 | 150.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S16.002 | 2.875 | 0.019 | 150.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S16.003 | 24.940 | 0.416 | 60.0 | 0.020 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S19.000 | 3.701 | 0.046 | 80.5 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S16.004 | 12.470 | 0.125 | 99.8 | 0.008 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S20.000 | 3.816 | 0.047 | 81.2 | 0.000 | 5.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S16.001 | 50.00 | 5.64 | 25.249 | 0.026 | 0.0 | 0.0 | 0.9 | 0.82 | 14.5 | 5.5 |
| R.S16.002 | 50.00 | 5.09 | 25.221 | 0.000 | 2.0 | 0.0 | 0.3 | 0.52 | 2.3 | 2.0 |
| R.S16.003 | 50.00 | 5.34 | 25.051 | 0.020 | 2.0 | 0.0 | 1.1 | 1.69 | 67.3 | 6.7 |
| R.S19.000 | 50.00 | 5.05 | 25.100 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.8 | 0.0 |
| R.S16.004 | 50.00 | 5.50 | 24.250 | 0.028 | 2.0 | 0.0 | 1.4 | 1.31 | 52.0 | 8.4 |
| R.S20.000 | 50.00 | 5.06 | 24.800 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.7 | 0.0 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S16.005 | 12.470 | 0.125 | 100.0 | 0.015 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S16.006 | 1.993 | 0.025 | 79.7 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S6.007 | 25.525 | 0.541 | 47.2 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S21.000 | 13.053 | 0.230 | 56.8 | 0.017 | 5.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| R.S21.001 | 10.871 | 0.072 | 151.0 | 0.005 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S21.002 | 9.564 | 0.100 | 95.6 | 0.003 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| R.S21.003 | 6.407 | 0.064 | 100.1 | 0.005 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S21.004 | 9.768 | 0.100 | 97.7 | 0.003 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S16.005 | 50.00 | 5.66 | 24.125 | 0.043 | 2.0 | 0.0 | 1.9 | 1.31 | 52.0 | 11.7 |
| R.S16.006 | 50.00 | 5.05 | 24.000 | 0.000 | 2.0 | 0.0 | 0.3 | 0.71 | 3.1 | 2.0 |
| R.S6.007 | 50.00 | 5.29 | 23.370 | 0.000 | 5.0 | 0.0 | 0.8 | 1.47 | 26.0 | 5.0 |
| R.S21.000 | 50.00 | 5.46 | 25.250 | 0.017 | 0.0 | 0.0 | 0.6 | 0.47 | 71.2 | 3.7 |
| R.S21.001 | 50.00 | 5.69 | 25.020 | 0.022 | 0.0 | 0.0 | 0.8 | 0.82 | 14.4 | 4.8 |
| R.S21.002 | 50.00 | 6.12 | 24.978 | 0.025 | 0.0 | 0.0 | 0.9 | 0.37 | 60.8 | 5.4 |
| R.S21.003 | 50.00 | 6.23 | 24.878 | 0.030 | 0.0 | 0.0 | 1.1 | 1.00 | 17.7 | 6.6 |
| R.S21.004 | 50.00 | 6.67 | 24.818 | 0.033 | 0.0 | 0.0 | 1.2 | 0.36 | 60.8 | 7.2 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S21.005 | 6.038 | 0.060 | 100.6 | 0.005 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S21.006 | 9.943 | 0.250 | 39.8 | 0.003 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| R.S21.007 | 6.021 | 0.060 | 100.4 | 0.005 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S21.008 | 6.978 | 0.130 | 53.7 | 0.015 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| R.S21.009 | 4.551 | 0.045 | 101.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S22.000 | 9.085 | 0.091 | 99.8 | 0.014 | 5.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| R.S22.001 | 4.082 | 0.051 | 80.0 | 0.005 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S22.002 | 9.696 | 0.097 | 100.0 | 0.004 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| R.S22.003 | 3.583 | 0.045 | 80.0 | 0.004 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S21.005 | 50.00 | 6.77 | 24.718 | 0.038 | 0.0 | 0.0 | 1.4 | 1.00 | 17.7 | 8.3 |
| R.S21.006 | 50.00 | 7.07 | 24.660 | 0.041 | 0.0 | 0.0 | 1.5 | 0.57 | 91.1 | 8.9 |
| R.S21.007 | 50.00 | 7.17 | 24.410 | 0.047 | 0.0 | 0.0 | 1.7 | 1.00 | 17.7 | 10.1 |
| R.S21.008 | 50.00 | 7.41 | 24.350 | 0.061 | 0.0 | 0.0 | 2.2 | 0.48 | 74.1 | 13.3 |
| R.S21.009 | 50.00 | 5.12 | 24.220 | 0.000 | 2.0 | 0.0 | 0.3 | 0.63 | 2.8 | 2.0 |
| R.S22.000 | 50.00 | 5.52 | 25.500 | 0.014 | 0.0 | 0.0 | 0.5 | 0.29 | 21.3 | 3.0 |
| R.S22.001 | 50.00 | 5.58 | 25.409 | 0.018 | 0.0 | 0.0 | 0.7 | 1.12 | 19.9 | 4.0 |
| R.S22.002 | 50.00 | 6.10 | 25.358 | 0.023 | 0.0 | 0.0 | 0.8 | 0.31 | 26.6 | 4.9 |
| R.S22.003 | 50.00 | 6.15 | 25.261 | 0.027 | 0.0 | 0.0 | 1.0 | 1.12 | 19.9 | 5.9 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S22.004 | 12.295 | 0.123 | 100.0 | 0.007 | 0.00 | 0.0 | | 0.040 | →\|○\|→ | | Filter Drain | |
| R.S22.005 | 3.669 | 0.037 | 99.2 | 0.004 | 0.00 | 0.0 | 0.600 | | ○ | 150 | Pipe/Conduit | |
| R.S22.006 | 9.854 | 0.170 | 58.0 | 0.004 | 0.00 | 0.0 | | 0.040 | →\|○\|→ | | Filter Drain | |
| R.S22.007 | 5.778 | 0.058 | 99.6 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 75 | Pipe/Conduit | |
| R.S23.000 | 5.353 | 0.150 | 35.7 | 0.030 | 5.00 | 0.0 | 0.600 | | ○ | 150 | Pipe/Conduit | |
| R.S23.001 | 7.665 | 0.077 | 99.5 | 0.010 | 0.00 | 0.0 | 0.600 | | ○ | 150 | Pipe/Conduit | |
| R.S24.000 | 4.956 | 0.077 | 64.4 | 0.028 | 5.00 | 0.0 | 0.600 | | ○ | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S22.004 | 50.00 | 6.78 | 25.216 | 0.034 | 0.0 | 0.0 | 1.2 | 0.33 | 35.8 | 7.3 |
| R.S22.005 | 50.00 | 6.84 | 25.093 | 0.038 | 0.0 | 0.0 | 1.4 | 1.01 | 17.8 | 8.2 |
| R.S22.006 | 50.00 | 7.22 | 25.056 | 0.042 | 0.0 | 0.0 | 1.5 | 0.42 | 43.5 | 9.2 |
| R.S22.007 | 50.00 | 5.15 | 24.886 | 0.000 | 2.0 | 0.0 | 0.3 | 0.64 | 2.8 | 2.0 |
| R.S23.000 | 50.00 | 5.05 | 24.550 | 0.030 | 0.0 | 0.0 | 1.1 | 1.69 | 29.9 | 6.6 |
| R.S23.001 | 50.00 | 5.18 | 23.900 | 0.040 | 0.0 | 0.0 | 1.4 | 1.01 | 17.8 | 8.7 |
| R.S24.000 | 50.00 | 5.07 | 24.400 | 0.028 | 0.0 | 0.0 | 1.0 | 1.26 | 22.2 | 6.1 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S23.002 | 4.707 | 0.047 | 100.1 | 0.006 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S23.003 | 3.411 | 0.034 | 100.3 | 0.009 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S23.004 | 23.077 | 0.132 | 174.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S25.000 | 4.836 | 0.060 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S25.001 | 4.325 | 0.043 | 100.6 | 0.009 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S26.000 | 4.818 | 0.060 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S26.001 | 10.682 | 0.107 | 99.8 | 0.012 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S23.002 | 50.00 | 5.26 | 23.823 | 0.074 | 0.0 | 0.0 | 2.7 | 1.00 | 17.7 | 16.1 |
| R.S23.003 | 50.00 | 5.09 | 23.776 | 0.000 | 2.0 | 0.0 | 0.3 | 0.63 | 2.8 | 2.0 |
| R.S23.004 | 50.00 | 5.48 | 23.592 | 0.000 | 2.0 | 0.0 | 0.4 | 0.99 | 39.2 | 2.4 |
| R.S25.000 | 50.00 | 5.07 | 25.400 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S25.001 | 50.00 | 5.14 | 24.500 | 0.009 | 0.0 | 0.0 | 0.3 | 1.00 | 17.7 | 2.0 |
| R.S26.000 | 50.00 | 5.07 | 24.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S26.001 | 50.00 | 5.25 | 24.500 | 0.012 | 0.0 | 0.0 | 0.4 | 1.01 | 17.8 | 2.6 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S27.000 | 4.158 | 0.052 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S26.002 | 5.564 | 0.056 | 100.1 | 0.004 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S25.002 | 2.554 | 0.032 | 80.0 | 0.002 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S25.003 | 15.038 | 0.100 | 150.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S28.000 | 2.263 | 0.028 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S28.001 | 11.775 | 0.117 | 100.4 | 0.010 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S27.000 | 50.00 | 5.06 | 25.300 | 0.000 | 0.0 | 0.0 | 0.0 | 1.13 | 19.9 | 0.0 |
| R.S26.002 | 50.00 | 5.34 | 24.393 | 0.016 | 0.0 | 0.0 | 0.6 | 1.00 | 17.7 | 3.4 |
| R.S25.002 | 50.00 | 5.06 | 24.337 | 0.000 | 2.0 | 0.0 | 0.3 | 0.71 | 3.1 | 2.0 |
| R.S25.003 | 50.00 | 5.30 | 24.156 | 0.000 | 2.0 | 0.0 | 0.4 | 1.07 | 42.4 | 2.4 |
| R.S28.000 | 50.00 | 5.03 | 25.050 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S28.001 | 50.00 | 5.23 | 25.022 | 0.010 | 0.0 | 0.0 | 0.4 | 1.00 | 17.7 | 2.2 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S25.004 | 5.038 | 0.050 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S29.000 | 2.359 | 0.029 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S29.001 | 8.862 | 0.089 | 100.0 | 0.007 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S25.005 | 7.627 | 0.352 | 21.7 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S30.000 | 6.486 | 0.081 | 80.1 | 0.008 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S23.005 | 10.277 | 0.103 | 100.1 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S25.004 | 50.00 | 5.36 | 24.055 | 0.010 | 2.0 | 0.0 | 0.8 | 1.31 | 51.9 | 4.6 |
| R.S29.000 | 50.00 | 5.03 | 24.900 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |
| R.S29.001 | 50.00 | 5.18 | 24.871 | 0.007 | 0.0 | 0.0 | 0.3 | 1.00 | 17.8 | 1.6 |
| R.S25.005 | 50.00 | 5.40 | 24.005 | 0.017 | 2.0 | 0.0 | 1.0 | 2.82 | 112.2 | 6.2 |
| R.S30.000 | 50.00 | 5.10 | 24.350 | 0.008 | 0.0 | 0.0 | 0.3 | 1.12 | 19.9 | 1.8 |
| R.S23.005 | 50.00 | 5.61 | 23.460 | 0.026 | 4.0 | 0.0 | 1.7 | 1.31 | 51.9 | 10.4 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S31.000 | 4.474 | 0.056 | 80.0 | 0.056 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S31.001 | 12.501 | 0.125 | 100.0 | 0.013 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S32.000 | 5.463 | 0.068 | 80.3 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S31.002 | 11.669 | 0.117 | 100.1 | 0.007 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S33.000 | 5.571 | 0.070 | 80.0 | 0.000 | 5.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S31.000 | 50.00 | 5.07 | 24.400 | 0.056 | 0.0 | 0.0 | 2.0 | 1.12 | 19.9 | 12.1 |
| R.S31.001 | 50.00 | 5.27 | 23.850 | 0.069 | 0.0 | 0.0 | 2.5 | 1.00 | 17.8 | 15.0 |
| R.S32.000 | 50.00 | 5.08 | 24.300 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.8 | 0.0 |
| R.S31.002 | 50.00 | 5.47 | 23.725 | 0.076 | 0.0 | 0.0 | 2.7 | 1.00 | 17.7 | 16.5 |
| R.S33.000 | 50.00 | 5.08 | 24.400 | 0.000 | 0.0 | 0.0 | 0.0 | 1.12 | 19.9 | 0.0 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S31.003 | 2.496 | 0.025 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S31.004 | 2.251 | 0.028 | 80.4 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 75 | Pipe/Conduit | |
| R.S23.006 | 27.764 | 0.277 | 100.2 | 0.012 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S22.008 | 12.580 | 0.126 | 100.1 | 0.012 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S6.008 | 9.223 | 0.061 | 150.0 | 0.006 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S34.000 | 10.466 | 0.105 | 99.7 | 0.011 | 5.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S31.003 | 50.00 | 5.51 | 23.608 | 0.076 | 0.0 | 0.0 | 2.7 | 1.00 | 17.7 | 16.5 |
| R.S31.004 | 50.00 | 5.05 | 23.584 | 0.000 | 2.0 | 0.0 | 0.3 | 0.71 | 3.1 | 2.0 |
| R.S23.006 | 50.00 | 5.46 | 23.357 | 0.000 | 3.0 | 0.0 | 0.5 | 1.00 | 17.7 | 3.0 |
| R.S22.008 | 50.00 | 5.67 | 23.080 | 0.012 | 5.0 | 0.0 | 1.4 | 1.00 | 17.7 | 8.5 |
| R.S6.008 | 50.00 | 5.81 | 22.754 | 0.017 | 12.0 | 0.0 | 3.0 | 1.07 | 42.4 | 18.1 |
| R.S34.000 | 50.00 | 5.17 | 23.700 | 0.011 | 0.0 | 0.0 | 0.4 | 1.01 | 17.8 | 2.5 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S34.001 | 8.204 | 0.082 | 100.1 | 0.003 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S34.002 | 3.321 | 0.033 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S34.003 | 7.630 | 0.076 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S34.004 | 8.635 | 0.086 | 100.1 | 0.010 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S34.005 | 4.363 | 0.250 | 17.5 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| R.S6.009 | 18.434 | 0.184 | 100.2 | 0.027 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S35.000 | 7.985 | 0.080 | 99.8 | 0.000 | 5.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S35.001 | 13.934 | 0.139 | 100.1 | 0.019 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S34.001 | 50.00 | 5.31 | 23.595 | 0.015 | 0.0 | 0.0 | 0.5 | 1.00 | 17.7 | 3.1 |
| R.S34.002 | 50.00 | 5.36 | 23.513 | 0.015 | 0.0 | 0.0 | 0.5 | 1.00 | 17.7 | 3.1 |
| R.S34.003 | 50.00 | 5.49 | 23.480 | 0.015 | 0.0 | 0.0 | 0.5 | 1.00 | 17.7 | 3.1 |
| R.S34.004 | 50.00 | 5.63 | 23.404 | 0.024 | 0.0 | 0.0 | 0.9 | 1.00 | 17.7 | 5.2 |
| R.S34.005 | 50.00 | 5.03 | 23.317 | 0.000 | 2.0 | 0.0 | 0.3 | 2.42 | 42.8 | 2.0 |
| R.S6.009 | 50.00 | 6.05 | 22.693 | 0.044 | 14.0 | 0.0 | 4.4 | 1.31 | 51.9 | 26.3 |
| R.S35.000 | 50.00 | 5.10 | 23.500 | 0.000 | 0.0 | 0.0 | 0.0 | 1.31 | 52.0 | 0.0 |
| R.S35.001 | 50.00 | 5.28 | 23.420 | 0.019 | 0.0 | 0.0 | 0.7 | 1.31 | 51.9 | 4.1 |

## Network Design Table for SW R

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.S35.002 | 2.636 | 0.026 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S35.003 | 25.200 | 0.252 | 100.0 | 0.033 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S35.004 | 4.734 | 0.047 | 100.7 | 0.009 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S35.005 | 11.226 | 0.112 | 100.2 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S6.010 | 7.963 | 0.080 | 99.5 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| R.S1.010 | 60.130 | 0.122 | 492.7 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |
| R.S1.011 | 77.334 | 0.192 | 401.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |
| R.S1.012 | 73.148 | 0.182 | 401.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| R.S35.002 | 50.00 | 5.31 | 23.281 | 0.019 | 0.0 | 0.0 | 0.7 | 1.31 | 51.9 | 4.1 |
| R.S35.003 | 50.00 | 5.63 | 23.255 | 0.052 | 0.0 | 0.0 | 1.9 | 1.31 | 52.0 | 11.3 |
| R.S35.004 | 50.00 | 5.69 | 23.003 | 0.061 | 0.0 | 0.0 | 2.2 | 1.30 | 51.8 | 13.3 |
| R.S35.005 | 50.00 | 5.84 | 22.400 | 0.061 | 0.0 | 0.0 | 2.2 | 1.31 | 51.9 | 13.3 |
| R.S6.010 | 50.00 | 6.15 | 22.288 | 0.105 | 14.0 | 0.0 | 6.6 | 1.31 | 52.1 | 39.6 |
| R.S1.010 | 50.00 | 8.13 | 22.133 | 0.105 | 16.0 | 0.0 | 7.0 | 0.70 | 49.6 | 42.0 |
| R.S1.011 | 46.81 | 9.78 | 22.011 | 0.105 | 16.0 | 0.0 | 7.0 | 0.78 | 55.0 | 42.0 |
| R.S1.012 | 43.59 | 11.35 | 21.818 | 0.105 | 16.0 | 0.0 | 7.0 | 0.78 | 55.0 | 42.0 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | As Zoned | Default | 90 | 0.043 | 0.039 | 0.039 |
| | | Bioretention / Planted | 30 | 0.005 | 0.001 | 0.040 |
| 2.000 | As Zoned | Default | 90 | 0.001 | 0.001 | 0.001 |
| | | Bioretention / Planted | 30 | 0.009 | 0.003 | 0.004 |
| 3.000 | As Zoned | Default | 90 | 0.057 | 0.051 | 0.051 |
| | | Grass (Lawn) | 15 | 0.000 | 0.000 | 0.051 |
| 2.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 2.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 4.000 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.009 |
| 4.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 2.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 5.000 | As Zoned | Default | 90 | 0.025 | 0.022 | 0.022 |
| | | Bioretention / Planted | 30 | 0.009 | 0.003 | 0.025 |
| 2.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.001 | As Zoned | Default | 90 | 0.022 | 0.020 | 0.020 |
| | | Bioretention / Planted | 30 | 0.002 | 0.000 | 0.020 |
| 1.002 | As Zoned | Default | 90 | 0.025 | 0.022 | 0.022 |
| | | Bioretention / Planted | 30 | 0.002 | 0.001 | 0.023 |
| 1.003 | As Zoned | Default | 90 | 0.024 | 0.022 | 0.022 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.023 |
| 1.004 | As Zoned | Default | 90 | 0.024 | 0.022 | 0.022 |
| | | Bioretention / Planted | 30 | 0.002 | 0.001 | 0.022 |
| 1.005 | As Zoned | Default | 90 | 0.023 | 0.021 | 0.021 |
| | | Bioretention / Planted | 30 | 0.002 | 0.001 | 0.021 |
| | As Zoned | Default | 90 | 0.009 | 0.008 | 0.029 |
| | | Bioretention / Planted | 30 | 0.009 | 0.003 | 0.032 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.006 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.007 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.008 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.009 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.001 | As Zoned | Default | 90 | 0.005 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.009 | 0.003 | 0.008 |
| | | Grass (Lawn) | 15 | 0.001 | 0.000 | 0.008 |
| 7.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.002 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.002 | 0.001 | 0.008 |
| 8.000 | As Zoned | Default | 90 | 0.002 | 0.002 | 0.002 |
| | | Grass (Lawn) | 15 | 0.040 | 0.006 | 0.007 |
| 9.000 | As Zoned | Default | 90 | 0.040 | 0.036 | 0.036 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.036 |
| | | Grass (Lawn) | 15 | 0.002 | 0.000 | 0.037 |
| 6.003 | As Zoned | Grass (Lawn) | 15 | 0.030 | 0.004 | 0.005 |
| 6.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.001 | As Zoned | Default | 90 | 0.004 | 0.004 | 0.004 |
| | | Bioretention / Planted | 30 | 0.025 | 0.007 | 0.011 |
| 10.002 | As Zoned | Default | 90 | 0.001 | 0.001 | 0.001 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.001 |
| | | Grass (Lawn) | 15 | 0.033 | 0.005 | 0.006 |
| 10.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.004 | As Zoned | Default | 90 | 0.016 | 0.015 | 0.015 |
| | | Grass (Lawn) | 15 | 0.017 | 0.003 | 0.017 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 10.005 | As Zoned | Grass (Lawn) | 15 | 0.014 | 0.002 | 0.002 |
| 11.000 | As Zoned | Default | 90 | 0.001 | 0.001 | 0.001 |
| | | Grass (Lawn) | 15 | 0.020 | 0.003 | 0.004 |
| 6.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 12.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 13.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 13.001 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.023 | 0.007 | 0.014 |
| 12.001 | As Zoned | Default | 90 | 0.010 | 0.009 | 0.009 |
| | | Bioretention / Planted | 30 | 0.007 | 0.002 | 0.011 |
| 12.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 12.003 | As Zoned | Default | 90 | 0.011 | 0.010 | 0.010 |
| | | Bioretention / Planted | 30 | 0.008 | 0.002 | 0.013 |
| 14.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 12.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.006 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 15.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 15.001 | As Zoned | Default | 90 | 0.030 | 0.027 | 0.027 |
| | | Grass (Lawn) | 15 | 0.000 | 0.000 | 0.027 |
| 15.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 16.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 17.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 17.001 | As Zoned | Default | 90 | 0.014 | 0.013 | 0.013 |
| | | Bioretention / Planted | 30 | 0.020 | 0.006 | 0.019 |
| | | Grass (Lawn) | 15 | 0.001 | 0.000 | 0.019 |
| 18.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 17.002 | As Zoned | Default | 90 | 0.004 | 0.004 | 0.004 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| | | Bioretention / Planted | 30 | 0.010 | 0.003 | 0.007 |
| 16.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 16.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 16.003 | As Zoned | Default | 90 | 0.012 | 0.011 | 0.011 |
| | | Bioretention / Planted | 30 | 0.029 | 0.009 | 0.020 |
| 19.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 16.004 | As Zoned | Default | 90 | 0.004 | 0.004 | 0.004 |
| | | Bioretention / Planted | 30 | 0.014 | 0.004 | 0.008 |
| | | Grass (Lawn) | 15 | 0.000 | 0.000 | 0.008 |
| 20.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 16.005 | As Zoned | Default | 90 | 0.014 | 0.012 | 0.012 |
| | | Bioretention / Planted | 30 | 0.009 | 0.003 | 0.015 |
| 16.006 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.007 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 21.000 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.031 | 0.009 | 0.017 |
| 21.001 | As Zoned | Default | 90 | 0.006 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.005 |
| 21.002 | As Zoned | Default | 90 | 0.002 | 0.002 | 0.002 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.003 |
| 21.003 | As Zoned | Default | 90 | 0.006 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.005 |
| 21.004 | As Zoned | Default | 90 | 0.002 | 0.002 | 0.002 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.003 |
| 21.005 | As Zoned | Default | 90 | 0.006 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.005 |
| 21.006 | As Zoned | Default | 90 | 0.002 | 0.002 | 0.002 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.003 |
| 21.007 | As Zoned | Default | 90 | 0.006 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.005 |
| 21.008 | As Zoned | Default | 90 | 0.016 | 0.014 | 0.014 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.015 |
| 21.009 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 22.000 | As Zoned | Default | 90 | 0.011 | 0.010 | 0.010 |
| | | Bioretention / Planted | 30 | 0.013 | 0.004 | 0.014 |
| 22.001 | As Zoned | Default | 90 | 0.005 | 0.004 | 0.004 |
| | | Bioretention / Planted | 30 | 0.002 | 0.000 | 0.005 |
| 22.002 | As Zoned | Default | 90 | 0.004 | 0.003 | 0.003 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.004 |
| 22.003 | As Zoned | Default | 90 | 0.005 | 0.004 | 0.004 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.004 |
| 22.004 | As Zoned | Default | 90 | 0.005 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.007 | 0.002 | 0.007 |
| 22.005 | As Zoned | Default | 90 | 0.005 | 0.004 | 0.004 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.004 |
| 22.006 | As Zoned | Default | 90 | 0.003 | 0.003 | 0.003 |
| | | Bioretention / Planted | 30 | 0.006 | 0.002 | 0.004 |
| 22.007 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 23.000 | As Zoned | Roof (Std) | 95 | 0.032 | 0.030 | 0.030 |
| 23.001 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.010 | 0.003 | 0.010 |
| | | Grass (Lawn) | 15 | 0.000 | 0.000 | 0.010 |
| 24.000 | As Zoned | Roof (Std) | 95 | 0.029 | 0.028 | 0.028 |
| 23.002 | As Zoned | Default | 90 | 0.004 | 0.004 | 0.004 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| | | Bioretention / Planted | 30 | 0.008 | 0.002 | 0.006 |
| | | Grass (Lawn) | 15 | 0.002 | 0.000 | 0.006 |
| 23.003 | As Zoned | Default | 90 | 0.007 | 0.006 | 0.006 |
| | | Grass (Lawn) | 15 | 0.018 | 0.003 | 0.009 |
| 23.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 25.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 25.001 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.009 |
| 26.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 26.001 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.015 | 0.004 | 0.012 |
| 27.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 26.002 | As Zoned | Default | 90 | 0.003 | 0.003 | 0.003 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.004 |
| 25.002 | As Zoned | Default | 90 | 0.001 | 0.001 | 0.001 |
| | | Grass (Lawn) | 15 | 0.006 | 0.001 | 0.002 |
| 25.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 28.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 28.001 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.010 |
| | | Grass (Lawn) | 15 | 0.002 | 0.000 | 0.010 |
| 25.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 29.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 29.001 | As Zoned | Default | 90 | 0.006 | 0.006 | 0.006 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.007 |
| | | Grass (Lawn) | 15 | 0.002 | 0.000 | 0.007 |
| 25.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 30.000 | As Zoned | Default | 90 | 0.005 | 0.004 | 0.004 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.004 |
| | | Grass (Lawn) | 15 | 0.026 | 0.004 | 0.008 |
| 23.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 31.000 | As Zoned | Default | 90 | 0.001 | 0.000 | 0.000 |
| | | Roof (Std) | 95 | 0.058 | 0.056 | 0.056 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.056 |
| 31.001 | As Zoned | Default | 90 | 0.011 | 0.010 | 0.010 |
| | | Bioretention / Planted | 30 | 0.010 | 0.003 | 0.013 |
| | | Grass (Lawn) | 15 | 0.003 | 0.000 | 0.013 |
| 32.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 31.002 | As Zoned | Default | 90 | 0.003 | 0.002 | 0.002 |
| | | Bioretention / Planted | 30 | 0.012 | 0.004 | 0.006 |
| | | Grass (Lawn) | 15 | 0.004 | 0.001 | 0.007 |
| 33.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 31.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 31.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 23.006 | As Zoned | Default | 90 | 0.013 | 0.012 | 0.012 |
| | | Bioretention / Planted | 30 | 0.001 | 0.000 | 0.012 |
| 22.008 | As Zoned | Default | 90 | 0.011 | 0.010 | 0.010 |
| | | Bioretention / Planted | 30 | 0.005 | 0.001 | 0.012 |
| 6.008 | As Zoned | Default | 90 | 0.006 | 0.005 | 0.005 |
| | | Bioretention / Planted | 30 | 0.002 | 0.000 | 0.006 |
| 34.000 | As Zoned | Default | 90 | 0.010 | 0.009 | 0.009 |
| | | Bioretention / Planted | 30 | 0.008 | 0.002 | 0.011 |
| 34.001 | As Zoned | Default | 90 | 0.002 | 0.002 | 0.002 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.003 |

## Area Summary for SW R

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 34.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 34.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 34.004 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.007 | 0.002 | 0.010 |
| 34.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.009 | As Zoned | Default | 90 | 0.026 | 0.023 | 0.023 |
| | | Bioretention / Planted | 30 | 0.010 | 0.003 | 0.027 |
| 35.000 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 35.001 | As Zoned | Default | 90 | 0.018 | 0.016 | 0.016 |
| | | Pervious Paving | 70 | 0.004 | 0.003 | 0.019 |
| 35.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 35.003 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Pervious Paving | 70 | 0.034 | 0.024 | 0.031 |
| | | Bioretention / Planted | 30 | 0.006 | 0.002 | 0.033 |
| 35.004 | As Zoned | Default | 90 | 0.010 | 0.009 | 0.009 |
| 35.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.011 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| | | | | Total | Total | Total |
| | | | | 1.495 | 0.945 | 0.945 |

## Free Flowing Outfall Details for SW R

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| R.S1.012 | R.S | 22.500 | 21.636 | 0.000 | 0 | 0 |

## Online Controls for SW R

### Hydro-Brake® Optimum Manhole: R.S3, DS/PN: R.S1.006, Volume (m³): 6.7

| | | | |
|---|---|---|---|
| Unit Reference | MD-SHE-0052-1500-1500-1500 | Sump Available | Yes |
| Design Head (m) | 1.500 | Diameter (mm) | 52 |
| Design Flow (l/s) | 1.5 | Invert Level (m) | 24.716 |
| Flush-Flo™ | Calculated | Minimum Outlet Pipe Diameter (mm) | 75 |
| Objective | Minimise upstream storage | Suggested Manhole Diameter (mm) | 1200 |
| Application | Surface | | |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.500 | 1.5 | Kick-Flo® | 0.469 | 0.9 |
| Flush-Flo™ | 0.233 | 1.1 | Mean Flow over Head Range | - | 1.1 |

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

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 1.0 | 0.600 | 1.0 | 1.600 | 1.5 | 2.600 | 1.9 | 5.000 | 2.6 | 7.500 | 3.1 |
| 0.200 | 1.1 | 0.800 | 1.1 | 1.800 | 1.6 | 3.000 | 2.1 | 5.500 | 2.7 | 8.000 | 3.2 |
| 0.300 | 1.1 | 1.000 | 1.2 | 2.000 | 1.7 | 3.500 | 2.2 | 6.000 | 2.8 | 8.500 | 3.3 |
| 0.400 | 1.0 | 1.200 | 1.4 | 2.200 | 1.8 | 4.000 | 2.3 | 6.500 | 2.9 | 9.000 | 3.4 |
| 0.500 | 0.9 | 1.400 | 1.4 | 2.400 | 1.9 | 4.500 | 2.5 | 7.000 | 3.0 | 9.500 | 3.5 |

Orifice Manhole: R.SHW A2, DS/PN: R.S12.002, Volume (m³): 0.6

Diameter (m) 0.018 Discharge Coefficient 0.600 Invert Level (m) 24.160

Orifice Manhole: R.SHW A3, DS/PN: R.S12.004, Volume (m³): 0.8

Diameter (m) 0.022 Discharge Coefficient 0.600 Invert Level (m) 23.875

Complex Manhole: R.SHW 3, DS/PN: R.S15.002, Volume (m³): 0.4

Orifice

Diameter (m) 0.023 Discharge Coefficient 0.600 Invert Level (m) 24.222

Orifice

Diameter (m) 0.021 Discharge Coefficient 0.600 Invert Level (m) 23.880

Orifice Manhole: R.SHW 4, DS/PN: R.S16.006, Volume (m³): 2.3

Diameter (m) 0.021 Discharge Coefficient 0.600 Invert Level (m) 24.000

Hydro-Brake® Optimum Manhole: R.S15, DS/PN: R.S6.007, Volume (m³): 2.4

| | | | |
|---|---|---|---|
| Unit Reference | MD-SHE-0104-6000-1750-6000 | Flush-Flo™ | Calculated |
| Design Head (m) | 1.750 | Objective | Minimise upstream storage |
| Design Flow (l/s) | 6.0 | Application | Surface |

## Hydro-Brake® Optimum Manhole: R.S15, DS/PN: R.S6.007, Volume (m³): 2.4

Sump Available Yes Minimum Outlet Pipe Diameter (mm) 150
Diameter (mm) 104 Suggested Manhole Diameter (mm) 1200
Invert Level (m) 23.370

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.750 | 6.0 | Kick-Flo® | 0.926 | 4.5 |
| Flush-Flo™ | 0.456 | 5.6 | Mean Flow over Head Range | - | 5.0 |

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) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 3.5 | 0.600 | 5.5 | 1.600 | 5.8 | 2.600 | 7.2 | 5.000 | 9.8 | 7.500 | 11.9 |
| 0.200 | 5.0 | 0.800 | 5.1 | 1.800 | 6.1 | 3.000 | 7.7 | 5.500 | 10.3 | 8.000 | 12.3 |
| 0.300 | 5.4 | 1.000 | 4.6 | 2.000 | 6.4 | 3.500 | 8.3 | 6.000 | 10.7 | 8.500 | 12.7 |
| 0.400 | 5.6 | 1.200 | 5.0 | 2.200 | 6.7 | 4.000 | 8.8 | 6.500 | 11.1 | 9.000 | 13.0 |
| 0.500 | 5.6 | 1.400 | 5.4 | 2.400 | 7.0 | 4.500 | 9.4 | 7.000 | 11.5 | 9.500 | 13.4 |

## Orifice Manhole: R.SHW B2, DS/PN: R.S23.003, Volume (m³): 0.5

Diameter (m) 0.021 Discharge Coefficient 0.600 Invert Level (m) 23.776

## Orifice Manhole: R.S94, DS/PN: R.S25.003, Volume (m³): 0.0

Diameter (m) 0.021 Discharge Coefficient 0.600 Invert Level (m) 24.156

## Orifice Manhole: R.SHW B3, DS/PN: R.S31.004, Volume (m³): 0.5

Diameter (m) 0.021 Discharge Coefficient 0.600 Invert Level (m) 23.584

## Hydro-Brake® Optimum Manhole: R.S72, DS/PN: R.S23.006, Volume (m³): 2.7

| | | | |
|---|---|---|---|
| Unit Reference | MD-SHE-0098-5000-1500-5000 | Sump Available | Yes |
| Design Head (m) | 1.500 | Diameter (mm) | 98 |
| Design Flow (l/s) | 5.0 | Invert Level (m) | 23.357 |
| Flush-Flo™ | Calculated | Minimum Outlet Pipe Diameter (mm) | 150 |
| Objective | Minimise upstream storage | Suggested Manhole Diameter (mm) | 1200 |
| Application | Surface | | |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.500 | 5.0 | Kick-Flo® | 0.878 | 3.9 |
| Flush-Flo™ | 0.431 | 4.9 | Mean Flow over Head Range | - | 4.3 |

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) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 3.2 | 0.600 | 4.8 | 1.600 | 5.1 | 2.600 | 6.5 | 5.000 | 8.8 | 7.500 | 10.7 |
| 0.200 | 4.4 | 0.800 | 4.3 | 1.800 | 5.4 | 3.000 | 6.9 | 5.500 | 9.2 | 8.000 | 11.0 |
| 0.300 | 4.8 | 1.000 | 4.1 | 2.000 | 5.7 | 3.500 | 7.4 | 6.000 | 9.6 | 8.500 | 11.3 |
| 0.400 | 4.9 | 1.200 | 4.5 | 2.200 | 6.0 | 4.000 | 7.9 | 6.500 | 10.0 | 9.000 | 11.6 |
| 0.500 | 4.9 | 1.400 | 4.8 | 2.400 | 6.2 | 4.500 | 8.4 | 7.000 | 10.3 | 9.500 | 11.9 |

## Hydro-Brake® Optimum Manhole: R.S17, DS/PN: R.S6.010, Volume (m³): 4.8

| | | | |
|---|---|---|---|
| Unit Reference | MD-SHE-0124-9000-2000-9000 | Sump Available | Yes |
| Design Head (m) | 2.000 | Diameter (mm) | 124 |
| Design Flow (l/s) | 9.0 | Invert Level (m) | 22.288 |
| Flush-Flo™ | Calculated | Minimum Outlet Pipe Diameter (mm) | 150 |
| Objective | Minimise upstream storage | Suggested Manhole Diameter (mm) | 1200 |
| Application | Surface | | |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 2.000 | 9.0 | Kick-Flo® | 1.108 | 6.8 |
| Flush-Flo™ | 0.543 | 8.6 | Mean Flow over Head Range | - | 7.7 |

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

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 4.4 | 0.600 | 8.6 | 1.600 | 8.1 | 2.600 | 10.2 | 5.000 | 13.9 | 7.500 | 16.9 |
| 0.200 | 7.4 | 0.800 | 8.3 | 1.800 | 8.6 | 3.000 | 10.9 | 5.500 | 14.5 | 8.000 | 17.4 |
| 0.300 | 8.1 | 1.000 | 7.6 | 2.000 | 9.0 | 3.500 | 11.7 | 6.000 | 15.2 | 8.500 | 17.9 |
| 0.400 | 8.5 | 1.200 | 7.1 | 2.200 | 9.4 | 4.000 | 12.5 | 6.500 | 15.7 | 9.000 | 18.4 |
| 0.500 | 8.6 | 1.400 | 7.6 | 2.400 | 9.8 | 4.500 | 13.2 | 7.000 | 16.3 | 9.500 | 18.9 |

## Offline Controls for SW R

### Pipe Manhole: R.SOF1, DS/PN: R.S2.001, Loop to PN: R.S1.001

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 26.200 |
| Slope (1:X) | 60.0 | Entry Loss Coefficient | 0.500 | | |

### Pipe Manhole: R.S4, DS/PN: R.S5.000, Loop to PN: R.S1.001

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.225 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 26.250 |
| Slope (1:X) | 80.0 | Entry Loss Coefficient | 0.500 | | |

### Pipe Manhole: R.SHW A2, DS/PN: R.S12.002, Loop to PN: R.S6.005

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 25.200 |
| Slope (1:X) | 50.0 | Entry Loss Coefficient | 0.500 | | |

### Pipe Manhole: R.SHW A3, DS/PN: R.S12.004, Loop to PN: R.S6.005

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 25.200 |
| Slope (1:X) | 40.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW 3, DS/PN: R.S15.002, Loop to PN: R.S6.006

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 25.000 |
| Slope (1:X) | 100.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW 3, DS/PN: R.S15.002, Loop to PN: R.S6.005

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 25.000 |
| Slope (1:X) | 40.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW A5, DS/PN: R.S16.002, Loop to PN: R.S6.005

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 25.000 |
| Slope (1:X) | 100.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW 4, DS/PN: R.S16.006, Loop to PN: R.S6.005

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.300 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 25.000 |
| Slope (1:X) | 100.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW B2, DS/PN: R.S23.003, Loop to PN: R.S30.000

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 23.800 |
| Slope (1:X) | 400.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.S94, DS/PN: R.S25.003, Loop to PN: R.S30.000

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.800 |
| Slope (1:X) | 40.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW B3, DS/PN: R.S31.004, Loop to PN: R.S30.000

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.750 |
| Slope (1:X) | 40.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.S72, DS/PN: R.S23.006, Loop to PN: R.S6.008

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.225 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.750 |
| Slope (1:X) | 40.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.SHW B5, DS/PN: R.S34.005, Loop to PN: R.S6.009

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.100 |
| Slope (1:X) | 20.0 | Entry Loss Coefficient | 0.500 | | |

Pipe Manhole: R.S94, DS/PN: R.S35.005, Loop to PN: R.S6.010

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.200 |
| Slope (1:X) | 40.0 | Entry Loss Coefficient | 0.500 | | |

## Storage Structures for SW R

### Infiltration Basin Manhole: R.SOF1, DS/PN: R.S2.001

Invert Level (m) 25.790 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 25.0 | 0.450 | 58.0 | 0.451 | 0.0 |

### Infiltration Basin Manhole: R.S9, DS/PN: R.S4.001

Invert Level (m) 25.877 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 12.0 | 0.450 | 28.0 | 0.451 | 0.0 |

### Complex Manhole: R.S4, DS/PN: R.S5.000

#### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 25.700 Cap Volume Depth (m) 0.400
Safety Factor 1.0 Diameter/Width (m) 8.0
Porosity 0.30 Length (m) 10.0

## Bio-Retention Area

Invert Level (m) 26.100 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 1.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 53.0 | 54.000 | 0.450 | 93.0 | 72.000 | 0.451 | 0.0 | 72.000 |

## Filter Drain Pipe: R.S1.001

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.045 | Invert Level (m) | 25.074 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 5.0 | Slope (1:X) | 251.3 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 17.3 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 1.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.250 | | |

## Filter Drain Pipe: R.S1.002

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.045 | Invert Level (m) | 25.005 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 249.2 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 17.4 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 1.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.250 | | |

## Filter Drain Pipe: R.S1.003

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.045 | Infiltration Coefficient Side (m/hr) | 0.00000 | Porosity | 0.30 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Safety Factor | 1.0 | Invert Level (m) | 24.935 |

## Filter Drain Pipe: R.S1.003

| | | | | | |
|---|---|---|---|---|---|
| Trench Width (m) | 0.5 | Pipe Depth above Invert (m) | 0.250 | Cap Volume Depth (m) | 1.500 |
| Trench Length (m) | 17.5 | Number of Pipes | 1 | Cap Infiltration Depth (m) | 0.000 |
| Pipe Diameter (m) | 0.150 | Slope (1:X) | 249.5 | | |

## Filter Drain Pipe: R.S1.004

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.045 | Invert Level (m) | 24.865 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 249.8 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 17.2 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 1.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.250 | | |

## Filter Drain Pipe: R.S1.005

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.045 | Invert Level (m) | 24.796 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 249.2 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 19.9 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 1.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.250 | | |

## Porous Car Park Manhole: R.S3, DS/PN: R.S1.006

| | | | | | |
|---|---|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.30 | Slope (1:X) | 300.0 |
| Membrane Percolation (mm/hr) | 1000 | Invert Level (m) | 24.716 | Depression Storage (mm) | 5 |
| Max Percolation (l/s) | 125.0 | Width (m) | 5.0 | Evaporation (mm/day) | 1 |
| Safety Factor | 2.0 | Length (m) | 90.0 | Cap Volume Depth (m) | 1.500 |

## Infiltration Basin Manhole: R.S14, DS/PN: R.S10.002

Invert Level (m) 24.772 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 120.0 | 0.500 | 180.0 | 0.501 | 0.0 |

## Complex Manhole: R.SHW A2, DS/PN: R.S12.002

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 24.160 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 4.0
Porosity 0.30 Length (m) 41.0

### Bio-Retention Area

Invert Level (m) 24.910 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 124.0 | 80.000 | 0.450 | 165.0 | 90.000 | 0.451 | 0.0 | 90.000 |

## Complex Manhole: R.SHW A3, DS/PN: R.S12.004

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.875 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 4.0
Porosity 0.30 Length (m) 9.5

### Bio-Retention Area

Invert Level (m) 24.625 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 28.0 | 26.000 | 0.500 | 37.0 | 24.000 | 0.501 | 0.0 | 24.000 |

## Infiltration Basin Manhole: R.S14, DS/PN: R.S6.006

Invert Level (m) 22.465 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 400.0 | 1.250 | 400.0 | 1.251 | 0.0 |

## Complex Manhole: R.SHW 3, DS/PN: R.S15.002

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 24.222 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 6.0
Porosity 0.30 Length (m) 11.0

### Bio-Retention Area

Invert Level (m) 24.722 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 40.0 | 22.000 | 0.500 | 68.0 | 30.000 | 0.501 | 0.0 | 30.000 |

## Complex Manhole: R.SHW A5, DS/PN: R.S16.002

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 25.221 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 6.0
Porosity 0.30 Length (m) 30.0

## Bio-Retention Area

Invert Level (m) 25.971 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 138.0 | 54.000 | 0.500 | 180.0 | 78.000 | 0.501 | 0.0 | 78.000 |

## Complex Manhole: R.SHW 4, DS/PN: R.S16.006

## Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 24.000 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 8.0
Porosity 0.30 Length (m) 51.0

## Bio-Retention Area

Invert Level (m) 24.750 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 340.0 | 70.000 | 0.500 | 410.0 | 120.000 | 0.501 | 0.0 | 120.000 |

## Filter Drain Pipe: R.S21.000

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 25.250 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 56.8 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 13.1 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Filter Drain Pipe: R.S21.002

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 24.978 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 95.6 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.6 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Filter Drain Pipe: R.S21.004

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 24.818 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 97.7 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.8 | Cap Volume Depth (m) | 1.500 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Filter Drain Pipe: R.S21.006

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Safety Factor | 2.0 | Trench Width (m) | 0.5 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.30 | Trench Length (m) | 9.9 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Invert Level (m) | 24.660 | Pipe Diameter (m) | 0.150 |

## Filter Drain Pipe: R.S21.006

| | | | | | |
|---|---|---|---|---|---|
| Pipe Depth above Invert (m) | 0.100 | Slope (1:X) | 39.8 | Cap Infiltration Depth (m) | 0.000 |
| Number of Pipes | 1 | Cap Volume Depth (m) | 1.500 | | |

## Filter Drain Pipe: R.S21.008

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 24.350 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 53.7 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 7.0 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.500 | | |

## Infiltration Blanket Manhole: R.S58, DS/PN: R.S21.009

| | | | | | |
|---|---|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Invert Level (m) | 24.280 | Cap Volume Depth (m) | 0.800 |
| Safety Factor | 2.0 | Diameter/Width (m) | 0.5 | | |
| Porosity | 0.30 | Length (m) | 50.0 | | |

## Filter Drain Pipe: R.S22.000

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 25.500 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 99.8 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.1 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Filter Drain Pipe: R.S22.002

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 25.358 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 100.0 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.7 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Filter Drain Pipe: R.S22.004

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 25.216 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 100.0 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 12.3 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Filter Drain Pipe: R.S22.006

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 25.056 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 58.0 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.9 | Cap Volume Depth (m) | 0.600 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.100 | | |

## Infiltration Blanket Manhole: R.S66, DS/PN: R.S22.007

| | | | | | |
|---|---|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Invert Level (m) | 24.886 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Diameter/Width (m) | 1.0 | | |
| Porosity | 0.30 | Length (m) | 50.0 | | |

## Complex Manhole: R.SHW B2, DS/PN: R.S23.003

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.776 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 4.0
Porosity 0.30 Length (m) 25.0

### Bio-Retention Area

Invert Level (m) 24.276 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 78.0 | 45.000 | 0.500 | 98.0 | 60.000 | 0.501 | 0.0 | 60.000 |

## Complex Manhole: R.SHW B1, DS/PN: R.S25.002

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 24.337 Cap Volume Depth (m) 0.700
Safety Factor 2.0 Diameter/Width (m) 4.0
Porosity 0.30 Length (m) 34.0

## Bio-Retention Area

Invert Level (m) 25.037 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 112.0 | 68.000 | 0.500 | 135.0 | 80.000 | 0.501 | 0.0 | 80.000 |

## Infiltration Basin Manhole: R.S71, DS/PN: R.S23.005

Invert Level (m) 23.460 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.40
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 165.0 | 1.200 | 165.0 | 1.210 | 0.0 |

## Complex Manhole: R.SHW B3, DS/PN: R.S31.004

## Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.584 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 4.0
Porosity 0.30 Length (m) 25.0

## Bio-Retention Area

Invert Level (m) 24.084 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 75.0 | 45.000 | 0.500 | 98.0 | 60.000 | 0.501 | 0.0 | 60.000 |

## Complex Manhole: R.S93, DS/PN: R.S34.004

## Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.404 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 3.0
Porosity 0.30 Length (m) 30.0

## Bio-Retention Area

Invert Level (m) 23.904 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 75.0 | 45.000 | 0.500 | 90.0 | 66.000 | 0.501 | 0.0 | 66.000 |

## Complex Manhole: R.SHW B4, DS/PN: R.S35.004

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.003 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 2.0
Porosity 0.30 Length (m) 30.0

### Bio-Retention Area

Invert Level (m) 23.753 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 50.0 | 25.000 | 0.500 | 68.0 | 42.000 | 0.501 | 0.0 | 42.000 |

## Cellular Storage Manhole: R.S17, DS/PN: R.S6.010

Invert Level (m) 22.288 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 420.0 | 0.0 | 1.200 | 420.0 | 0.0 | 1.201 | 0.0 | 0.0 |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

### Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 14 Number of Time/Area Diagrams 19
Number of Online Controls 11 Number of Storage Structures 34 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.500 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.277 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 20

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S1.000 | R.S1 | 15 minute 100 year Summer I+20% | 27.400 | 26.211 | 0.061 | 1.17 | 19.4 | SURCHARGED |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S2.000 | R.S3 | 30 minute 100 year Summer I+20% | 26.400 | 26.003 | 0.000 | 0.08 | 1.2 | SURCHARGED* |
| R.S3.000 | R.S4 | 15 minute 100 year Summer I+20% | 26.500 | 26.210 | 0.110 | 1.69 | 25.0 | FLOOD RISK |
| R.S2.001 | R.SOF1 | 60 minute 100 year Summer I+20% | 26.400 | 26.048 | 0.108 | 0.37 | 7.0 | SURCHARGED |
| R.S2.002 | R.S2 | 60 minute 100 year Summer I+20% | 26.400 | 26.080 | 0.233 | 0.33 | 6.9 | SURCHARGED |
| R.S4.000 | R.S8 | 60 minute 100 year Summer I+20% | 26.500 | 26.030 | -0.037 | 0.27 | 3.4 | OK* |
| R.S4.001 | R.S9 | 60 minute 100 year Summer I+20% | 26.500 | 26.030 | 0.003 | 0.11 | 2.7 | SURCHARGED* |
| R.S2.003 | R.S3 | 60 minute 100 year Summer I+20% | 26.500 | 26.067 | 0.442 | 0.29 | 9.1 | SURCHARGED |
| R.S5.000 | R.S4 | 60 minute 100 year Summer I+20% | 26.600 | 26.025 | 0.175 | 0.14 | 3.9 | SURCHARGED |
| R.S2.004 | R.S4 | 60 minute 100 year Summer I+20% | 26.600 | 26.060 | 0.753 | 2.65 | 6.4 | SURCHARGED |
| R.S1.001 | R.S2 | 960 minute 100 year Winter I+20% | 26.800 | 25.824 | -0.750 | 0.01 | 5.3 | OK |
| R.S1.002 | R.S11 | 960 minute 100 year Winter I+20% | 26.750 | 25.824 | -0.681 | 0.11 | 5.5 | OK |
| R.S1.003 | R.S11 | 960 minute 100 year Winter I+20% | 26.500 | 25.822 | -0.613 | 0.12 | 6.2 | OK |
| R.S1.004 | R.S13 | 960 minute 100 year Winter I+20% | 26.400 | 25.821 | -0.544 | 0.14 | 6.9 | OK |
| R.S1.005 | R.S14 | 960 minute 100 year Winter I+20% | 26.300 | 25.820 | -0.476 | 0.16 | 8.0 | OK |
| R.S1.006 | R.S3 | 960 minute 100 year Winter I+20% | 26.250 | 25.818 | 0.877 | 0.02 | 1.3 | SURCHARGED |
| R.S1.007 | R.S4 | 960 minute 100 year Winter I+20% | 26.000 | 24.307 | -0.202 | 0.02 | 1.3 | OK |
| R.S1.008 | R.S5 | 960 minute 100 year Winter I+20% | 25.750 | 23.912 | -0.201 | 0.03 | 1.3 | OK |
| R.S1.009 | R.S6 | 960 minute 100 year Winter I+20% | 25.250 | 23.363 | -0.201 | 0.03 | 1.3 | OK |
| R.S6.000 | R.SGR B2 | 60 minute 100 year Summer I+20% | 26.600 | 26.057 | -0.093 | 0.31 | 5.6 | OK |
| R.S6.001 | R.S10 | 30 minute 100 year Summer I+20% | 26.500 | 25.711 | -0.164 | 0.15 | 7.9 | OK |
| R.S7.000 | R.SGR B1 | 15 minute 100 year Summer I+20% | 26.500 | 25.600 | -0.150 | 0.00 | 0.0 | OK |
| R.S6.002 | R.S11 | 30 minute 100 year Summer I+20% | 26.500 | 25.530 | -0.137 | 0.30 | 10.7 | OK |
| R.S8.000 | R.S12 | 600 minute 100 year Summer I+20% | 25.750 | 25.112 | 0.112 | 0.04 | 0.7 | SURCHARGED |
| R.S9.000 | R.S13 | 15 minute 100 year Summer I+20% | 26.000 | 25.274 | -0.026 | 0.99 | 18.1 | OK |
| R.S6.003 | R.S12 | 600 minute 100 year Summer I+20% | 26.500 | 25.111 | 0.192 | 0.24 | 8.2 | SURCHARGED |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S6.004 | R.S28 | 2880 minute 100 year Winter I+20% | 26.000 | 24.841 | 0.000 | 0.05 | 1.8 | SURCHARGED* |
| R.S10.000 | R.SGR B3 | 1440 minute 100 year Summer I+20% | 25.400 | 25.090 | 0.190 | 0.20 | 2.5 | SURCHARGED |
| R.S10.001 | R.S30 | 1440 minute 100 year Summer I+20% | 25.400 | 25.088 | 0.738 | 0.24 | 3.0 | SURCHARGED |
| R.S10.002 | R.S14 | 1440 minute 100 year Summer I+20% | 25.400 | 25.086 | 0.850 | 0.89 | 3.2 | SURCHARGED |
| R.S10.003 | R.S32 | 10080 minute 100 year Summer I+20% | 25.700 | 24.184 | 0.000 | 0.02 | 0.8 | SURCHARGED* |
| R.S10.004 | R.S30 | 10080 minute 100 year Summer I+20% | 26.000 | 24.105 | 0.000 | 0.02 | 1.0 | SURCHARGED* |
| R.S10.005 | R.S31 | 1440 minute 100 year Summer I+20% | 26.000 | 25.083 | 1.138 | 0.10 | 3.8 | SURCHARGED |
| R.S11.000 | R.S16 | 600 minute 100 year Summer I+20% | 25.500 | 25.101 | 0.576 | 0.01 | 0.4 | SURCHARGED |
| R.S6.005 | R.S13 | 600 minute 100 year Summer I+20% | 26.000 | 25.103 | 1.243 | 0.65 | 28.1 | SURCHARGED |
| R.S12.000 | R.SGR B5 | 2160 minute 100 year Summer I+20% | 25.400 | 25.241 | 0.191 | 0.08 | 1.1 | FLOOD RISK |
| R.S13.000 | R.SGR B4 | 2160 minute 100 year Summer I+20% | 25.400 | 25.248 | 0.198 | 0.13 | 2.1 | FLOOD RISK |
| R.S13.001 | R.S38 | 10080 minute 100 year Summer I+20% | 25.400 | 24.973 | 0.000 | 0.05 | 0.9 | SURCHARGED* |
| R.S12.001 | R.S17 | 10080 minute 100 year Summer I+20% | 25.400 | 24.998 | 0.598 | 0.08 | 1.3 | SURCHARGED* |
| R.S12.002 | R.SHW A2 | 2160 minute 100 year Summer I+20% | 25.400 | 25.236 | 1.001 | 0.23 | 0.6 | FLOOD RISK |
| R.S12.003 | R.S32 | 15 minute 100 year Summer I+20% | 25.400 | 24.186 | 0.000 | 0.40 | 7.1 | SURCHARGED* |
| R.S14.000 | R.SGR B6 | 1440 minute 100 year Summer I+20% | 25.400 | 25.224 | 0.174 | 0.10 | 1.6 | FLOOD RISK |
| R.S12.004 | R.SHW A3 | 2160 minute 100 year Winter I+20% | 25.400 | 25.251 | 1.152 | 0.02 | 1.0 | FLOOD RISK |
| R.S6.006 | R.S14 | 600 minute 100 year Summer I+20% | 25.400 | 25.106 | 1.416 | 0.17 | 7.3 | FLOOD RISK |
| R.S15.000 | R.SGR B7 | 600 minute 100 year Summer I+20% | 25.250 | 25.106 | 0.306 | 0.32 | 4.7 | FLOOD RISK |
| R.S15.001 | R.S23 | 15 minute 100 year Summer I+20% | 25.250 | 24.743 | 0.343 | 1.36 | 14.8 | SURCHARGED* |
| R.S15.002 | R.SHW 3 | 600 minute 100 year Summer I+20% | 25.250 | 25.096 | 0.799 | 0.57 | 1.6 | FLOOD RISK |
| R.S16.000 | R.SGR B10 | 60 minute 100 year Summer I+20% | 26.500 | 25.987 | -0.063 | 0.63 | 8.1 | OK |
| R.S17.000 | R.SGR B8 | 60 minute 100 year Summer I+20% | 26.500 | 25.980 | -0.070 | 0.56 | 9.2 | OK |
| R.S17.001 | R.S50 | 60 minute 100 year Summer I+20% | 26.400 | 25.802 | 0.252 | 0.98 | 14.2 | SURCHARGED* |
| R.S18.000 | R.SGR B9 | 60 minute 100 year Summer I+20% | 27.000 | 25.750 | 0.100 | 0.30 | 4.6 | SURCHARGED |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S17.002 | R.S51 | 30 minute 100 year Summer I+20% | 26.200 | 25.593 | 0.104 | 1.22 | 17.7 | SURCHARGED* |
| R.S16.001 | R.S26 | 60 minute 100 year Summer I+20% | 26.500 | 25.566 | 0.167 | 2.60 | 28.2 | SURCHARGED* |
| R.S16.002 | R.SHW A5 | 60 minute 100 year Summer I+20% | 26.500 | 25.222 | -0.074 | 0.00 | 0.0 | OK |
| R.S16.003 | R.S28 | 15 minute 100 year Summer I+20% | 26.500 | 25.112 | -0.165 | 0.16 | 10.9 | OK* |
| R.S19.000 | R.SGR B11 | 60 minute 100 year Summer I+20% | 25.750 | 25.165 | -0.085 | 0.39 | 5.2 | OK |
| R.S16.004 | R.S34 | 2160 minute 100 year Summer I+20% | 25.250 | 24.901 | 0.426 | 0.04 | 2.1 | SURCHARGED* |
| R.S20.000 | R.SGR B12 | 2160 minute 100 year Summer I+20% | 25.750 | 24.901 | -0.049 | 0.08 | 1.1 | OK |
| R.S16.005 | R.S35 | 2160 minute 100 year Summer I+20% | 25.250 | 24.901 | 0.551 | 0.07 | 3.6 | SURCHARGED* |
| R.S16.006 | R.SHW 4 | 2160 minute 100 year Summer I+20% | 25.250 | 24.901 | 0.825 | 0.35 | 0.9 | SURCHARGED |
| R.S6.007 | R.S15 | 720 minute 100 year Summer I+20% | 25.250 | 25.106 | 1.586 | 0.24 | 5.9 | FLOOD RISK |
| R.S21.000 | R.S49 | 15 minute 100 year Summer I+20% | 26.180 | 25.394 | -0.786 | 0.12 | 8.4 | OK |
| R.S21.001 | R.S50 | 15 minute 100 year Summer I+20% | 25.950 | 25.237 | 0.067 | 0.85 | 11.0 | SURCHARGED |
| R.S21.002 | R.S51 | 15 minute 100 year Summer I+20% | 26.000 | 25.185 | -0.815 | 0.20 | 12.1 | OK |
| R.S21.003 | R.S52 | 15 minute 100 year Summer I+20% | 25.900 | 25.130 | 0.102 | 0.95 | 14.2 | SURCHARGED |
| R.S21.004 | R.S53 | 15 minute 100 year Summer I+20% | 25.850 | 25.070 | -0.780 | 0.26 | 15.5 | OK |
| R.S21.005 | R.S54 | 30 minute 100 year Summer I+20% | 25.750 | 25.039 | 0.171 | 1.10 | 16.3 | SURCHARGED |
| R.S21.006 | R.S55 | 30 minute 100 year Summer I+20% | 25.650 | 25.020 | -0.630 | 0.18 | 16.5 | OK |
| R.S21.007 | R.S56 | 30 minute 100 year Summer I+20% | 25.430 | 25.012 | 0.452 | 1.19 | 17.6 | SURCHARGED |
| R.S21.008 | R.S57 | 30 minute 100 year Summer I+20% | 25.290 | 24.992 | -0.298 | 0.31 | 22.1 | FLOOD RISK |
| R.S21.009 | R.S58 | 30 minute 100 year Summer I+20% | 25.160 | 24.985 | 0.690 | 4.05 | 10.2 | FLOOD RISK |
| R.S22.000 | R.S59 | 15 minute 100 year Summer I+20% | 25.900 | 25.653 | -0.247 | 0.32 | 6.8 | FLOOD RISK |
| R.S22.001 | R.S60 | 15 minute 100 year Summer I+20% | 25.850 | 25.578 | 0.019 | 0.65 | 9.2 | FLOOD RISK |
| R.S22.002 | R.S61 | 15 minute 100 year Summer I+20% | 25.850 | 25.559 | -0.291 | 0.43 | 11.3 | FLOOD RISK |
| R.S22.003 | R.S62 | 15 minute 100 year Summer I+20% | 25.870 | 25.513 | 0.102 | 0.99 | 13.1 | SURCHARGED |
| R.S22.004 | R.S63 | 15 minute 100 year Summer I+20% | 25.860 | 25.469 | -0.391 | 0.45 | 16.0 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S22.005 | R.S64 | 15 minute 100 year Summer I+20% | 25.770 | 25.369 | 0.126 | 1.46 | 17.6 | SURCHARGED |
| R.S22.006 | R.S65 | 15 minute 100 year Summer I+20% | 25.670 | 25.289 | -0.367 | 0.44 | 19.0 | OK |
| R.S22.007 | R.S66 | 30 minute 100 year Summer I+20% | 25.490 | 25.269 | 0.308 | 2.53 | 6.5 | FLOOD RISK |
| R.S23.000 | R.SR C1 | 960 minute 100 year Summer I+20% | 25.150 | 24.858 | 0.158 | 0.08 | 1.9 | FLOOD RISK |
| R.S23.001 | R.S68 | 15 minute 100 year Summer I+20% | 25.000 | 24.550 | 0.500 | 0.99 | 17.2 | SURCHARGED* |
| R.S24.000 | R.SR C2 | 720 minute 100 year Summer I+20% | 25.000 | 24.856 | 0.306 | 0.12 | 2.1 | FLOOD RISK |
| R.S23.002 | R.S69 | 15 minute 100 year Summer I+20% | 25.000 | 24.473 | 0.500 | 2.33 | 31.6 | SURCHARGED* |
| R.S23.003 | R.SHW B2 | 960 minute 100 year Summer I+20% | 25.000 | 24.916 | 1.065 | 0.30 | 0.7 | FLOOD RISK |
| R.S23.004 | R.S86 | 2880 minute 100 year Winter I+20% | 25.000 | 23.817 | 0.000 | 0.02 | 0.7 | SURCHARGED* |
| R.S25.000 | R.SGR C4 | 60 minute 100 year Summer I+20% | 26.000 | 25.461 | -0.089 | 0.35 | 5.4 | OK |
| R.S25.001 | R.S81 | 360 minute 100 year Summer I+20% | 26.000 | 25.143 | 0.493 | 0.33 | 4.2 | SURCHARGED* |
| R.S26.000 | R.SGR C6 | 360 minute 100 year Summer I+20% | 25.400 | 25.167 | 0.117 | 0.29 | 4.5 | FLOOD RISK |
| R.S26.001 | R.S82 | 600 minute 100 year Winter I+20% | 25.500 | 24.990 | 0.340 | 0.18 | 3.2 | SURCHARGED* |
| R.S27.000 | R.SGR C5 | 60 minute 100 year Summer I+20% | 25.900 | 25.375 | -0.075 | 0.49 | 7.1 | OK |
| R.S26.002 | R.S83 | 360 minute 100 year Summer I+20% | 25.750 | 25.151 | 0.608 | 0.70 | 10.3 | SURCHARGED* |
| R.S25.002 | R.SHW B1 | 360 minute 100 year Summer I+20% | 26.000 | 25.140 | 0.728 | 2.97 | 7.8 | SURCHARGED |
| R.S25.003 | R.S94 | 15 minute 100 year Summer I+20% | 25.875 | 24.381 | 0.000 | 0.02 | 0.7 | SURCHARGED* |
| R.S28.000 | R.SGR C2 | 60 minute 100 year Summer I+20% | 25.750 | 25.106 | -0.094 | 0.30 | 3.3 | OK |
| R.S28.001 | R.S109 | 30 minute 100 year Summer I+20% | 25.750 | 25.092 | -0.079 | 0.41 | 6.6 | OK |
| R.S25.004 | R.S83 | 960 minute 100 year Summer I+20% | 25.750 | 24.823 | 0.543 | 0.08 | 2.6 | SURCHARGED |
| R.S29.000 | R.SGR C1 | 60 minute 100 year Summer I+20% | 25.500 | 24.956 | -0.094 | 0.30 | 3.3 | OK |
| R.S29.001 | R.S80 | 30 minute 100 year Summer I+20% | 25.500 | 24.936 | -0.085 | 0.35 | 5.5 | OK |
| R.S25.005 | R.S84 | 960 minute 100 year Summer I+20% | 25.750 | 24.823 | 0.593 | 0.05 | 4.2 | SURCHARGED |
| R.S30.000 | R.S78 | 720 minute 100 year Summer I+20% | 25.500 | 24.956 | 0.456 | 0.96 | 16.2 | SURCHARGED |
| R.S23.005 | R.S71 | 720 minute 100 year Summer I+20% | 25.000 | 24.822 | 1.137 | 0.26 | 11.4 | FLOOD RISK |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S31.000 | R.SR C3 | 960 minute 100 year Summer I+20% | 25.000 | 24.896 | 0.346 | 0.22 | 3.3 | FLOOD RISK |
| R.S31.001 | R.S81 | 15 minute 100 year Summer I+20% | 24.900 | 24.494 | 0.494 | 1.59 | 28.3 | SURCHARGED* |
| R.S32.000 | R.SGR C7 | 960 minute 100 year Summer I+20% | 25.000 | 24.892 | 0.442 | 0.16 | 2.6 | FLOOD RISK |
| R.S31.002 | R.S82 | 15 minute 100 year Summer I+20% | 24.900 | 24.382 | 0.507 | 1.67 | 29.6 | SURCHARGED* |
| R.S33.000 | R.SGR C8 | 960 minute 100 year Summer I+20% | 25.000 | 24.882 | 0.332 | 0.11 | 1.8 | FLOOD RISK |
| R.S31.003 | R.S83 | 10080 minute 100 year Summer I+20% | 24.900 | 24.480 | 0.722 | 0.16 | 1.7 | SURCHARGED* |
| R.S31.004 | R.SHW B3 | 720 minute 100 year Summer I+20% | 25.000 | 24.940 | 1.281 | 0.33 | 0.8 | FLOOD RISK |
| R.S23.006 | R.S72 | 960 minute 100 year Summer I+20% | 25.000 | 24.805 | 1.298 | 0.29 | 4.9 | FLOOD RISK |
| R.S22.008 | R.S67 | 4320 minute 100 year Summer I+20% | 25.390 | 23.455 | 0.224 | 0.37 | 6.0 | SURCHARGED |
| R.S6.008 | R.S16 | 4320 minute 100 year Summer I+20% | 25.150 | 23.443 | 0.464 | 0.37 | 12.9 | SURCHARGED |
| R.S34.000 | R.S89 | 15 minute 100 year Summer I+20% | 24.700 | 23.758 | -0.092 | 0.32 | 5.6 | OK* |
| R.S34.001 | R.S90 | 15 minute 100 year Summer I+20% | 24.700 | 23.663 | -0.082 | 0.41 | 7.3 | OK* |
| R.S34.002 | R.SHW B5 | 15 minute 100 year Summer I+20% | 24.900 | 23.601 | -0.062 | 0.64 | 7.3 | OK |
| R.S34.003 | R.S92 | 15 minute 100 year Summer I+20% | 24.900 | 23.548 | -0.082 | 0.42 | 7.3 | OK* |
| R.S34.004 | R.S93 | 30 minute 100 year Summer I+20% | 24.900 | 23.482 | -0.072 | 0.53 | 9.4 | OK* |
| R.S34.005 | R.SHW B5 | 4320 minute 100 year Summer I+20% | 25.000 | 23.434 | -0.034 | 0.02 | 0.5 | OK |
| R.S6.009 | R.S69 | 4320 minute 100 year Summer I+20% | 24.900 | 23.434 | 0.516 | 0.30 | 13.9 | SURCHARGED |
| R.S35.000 | R.SGR C9 | 30 minute 100 year Summer I+20% | 25.000 | 23.571 | -0.154 | 0.19 | 7.4 | OK |
| R.S35.001 | R.S90 | 30 minute 100 year Summer I+20% | 24.400 | 23.508 | -0.137 | 0.31 | 13.9 | OK |
| R.S35.002 | R.S91 | 4320 minute 100 year Summer I+20% | 24.400 | 23.421 | -0.085 | 0.05 | 1.4 | OK |
| R.S35.003 | R.S92 | 4320 minute 100 year Summer I+20% | 24.400 | 23.421 | -0.058 | 0.04 | 2.1 | OK* |
| R.S35.004 | R.SHW B4 | 4320 minute 100 year Summer I+20% | 25.000 | 23.421 | 0.194 | 0.08 | 2.3 | SURCHARGED |
| R.S35.005 | R.S94 | 4320 minute 100 year Summer I+20% | 24.900 | 23.421 | 0.796 | 0.05 | 2.3 | SURCHARGED |
| R.S6.010 | R.S17 | 4320 minute 100 year Summer I+20% | 24.900 | 23.421 | 0.908 | 0.22 | 8.6 | SURCHARGED |
| R.S1.010 | R.S7 | 600 minute 100 year Winter I+20% | 24.750 | 22.226 | -0.207 | 0.21 | 9.9 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for SW R

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| R.S1.011 | R.S8 | 600 minute 100 year Winter I+20% | 24.250 | 22.098 | -0.213 | 0.19 | 9.9 | OK |
| R.S1.012 | R.S9 | 600 minute 100 year Winter I+20% | 23.400 | 21.906 | -0.213 | 0.19 | 9.9 | OK |

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for SW C

Pipe Sizes IW Manhole Sizes IW

FSR Rainfall Model - Scotland and Ireland

| | | | | | |
|---|---|---|---|---|---|
| Return Period (years) | 5 | Foul Sewage (l/s/ha) | 0.000 | Maximum Backdrop Height (m) | 1.500 |
| M5-60 (mm) | 16.500 | Volumetric Runoff Coeff. | 0.750 | Min Design Depth for Optimisation (m) | 0.750 |
| Ratio R | 0.277 | PIMP (%) | 100 | Min Vel for Auto Design only (m/s) | 1.00 |
| Maximum Rainfall (mm/hr) | 50 | Add Flow / Climate Change (%) | 20 | Min Slope for Optimisation (1:X) | 500 |
| Maximum Time of Concentration (mins) | 30 | Minimum Backdrop Height (m) | 0.000 | | |

Designed with Level Soffits

### Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C1.000 | 33.854 | 0.282 | 120.0 | 0.026 | 5.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C1.000 | 50.00 | 5.47 | 23.100 | 0.026 | 0.0 | 0.0 | 0.7 | 1.19 | 47.4 | 4.2 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C2.000 | 5.435 | 0.217 | 25.0 | 0.031 | 5.00 | 0.0 | 0.600 | | o | 100 | Pipe/Conduit | |
| SW C1.001 | 7.543 | 0.045 | 166.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| SW C3.000 | 18.364 | 0.092 | 199.6 | 0.019 | 5.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| SW C3.001 | 16.746 | 0.084 | 199.4 | 0.014 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| SW C3.002 | 10.206 | 0.051 | 200.1 | 0.009 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |
| SW C3.003 | 15.226 | 0.076 | 200.3 | 0.018 | 0.00 | 0.0 | | 0.040 | →\|o\|→ | | Filter Drain | |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C2.000 | 50.00 | 5.06 | 23.850 | 0.031 | 0.0 | 0.0 | 0.8 | 1.55 | 12.2 | 5.1 |
| SW C1.001 | 50.00 | 5.60 | 22.818 | 0.057 | 0.0 | 0.0 | 1.5 | 1.01 | 40.2 | 9.3 |
| SW C3.000 | 50.00 | 6.21 | 23.800 | 0.019 | 0.0 | 0.0 | 0.5 | 0.25 | 41.1 | 3.1 |
| SW C3.001 | 50.00 | 7.31 | 23.708 | 0.033 | 0.0 | 0.0 | 0.9 | 0.25 | 41.1 | 5.4 |
| SW C3.002 | 50.00 | 7.98 | 23.624 | 0.043 | 0.0 | 0.0 | 1.2 | 0.25 | 41.1 | 6.9 |
| SW C3.003 | 48.69 | 8.99 | 23.350 | 0.060 | 0.0 | 0.0 | 1.6 | 0.25 | 41.0 | 9.6 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C4.000 | 23.994 | 0.120 | 200.0 | 0.010 | 5.00 | 0.0 | | 0.040 | →\|○\|→ | | Filter Drain | |
| SW C4.001 | 9.626 | 0.064 | 150.0 | 0.007 | 0.00 | 0.0 | | 0.040 | →\|○\|→ | | Filter Drain | |
| SW C4.002 | 14.499 | 0.097 | 149.5 | 0.005 | 0.00 | 0.0 | | 0.040 | →\|○\|→ | | Filter Drain | |
| SW C4.003 | 9.778 | 0.049 | 199.5 | 0.005 | 0.00 | 0.0 | | 0.040 | →\|○\|→ | | Filter Drain | |
| SW C4.004 | 5.852 | 0.058 | 100.9 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 150 | Pipe/Conduit | |
| SW C3.004 | 3.311 | 0.033 | 100.3 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 150 | Pipe/Conduit | |
| SW C1.002 | 18.010 | 0.108 | 166.6 | 0.000 | 0.00 | 0.0 | 0.600 | | ○ | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C4.000 | 50.00 | 6.75 | 23.950 | 0.010 | 0.0 | 0.0 | 0.3 | 0.23 | 27.4 | 1.6 |
| SW C4.001 | 50.00 | 7.30 | 23.830 | 0.017 | 0.0 | 0.0 | 0.5 | 0.29 | 47.4 | 2.7 |
| SW C4.002 | 50.00 | 8.13 | 23.700 | 0.022 | 0.0 | 0.0 | 0.6 | 0.29 | 47.5 | 3.5 |
| SW C4.003 | 49.20 | 8.79 | 23.710 | 0.027 | 0.0 | 0.0 | 0.7 | 0.25 | 36.6 | 4.3 |
| SW C4.004 | 48.95 | 8.88 | 23.661 | 0.027 | 0.0 | 0.0 | 0.7 | 1.00 | 17.7 | 4.3 |
| SW C3.004 | 48.55 | 9.04 | 23.274 | 0.088 | 0.0 | 0.0 | 2.3 | 1.00 | 17.7 | 13.8 |
| SW C1.002 | 47.84 | 9.34 | 22.773 | 0.145 | 0.0 | 0.0 | 3.8 | 1.01 | 40.2 | 22.5 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C5.000 | 2.045 | 0.014 | 150.0 | 0.010 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C5.001 | 2.137 | 0.014 | 150.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C1.003 | 16.062 | 0.096 | 166.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| SW C6.000 | 1.658 | 0.017 | 100.1 | 0.013 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C6.001 | 1.658 | 0.017 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C1.004 | 10.216 | 0.061 | 166.6 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C5.000 | 50.00 | 5.04 | 23.150 | 0.010 | 0.0 | 0.0 | 0.3 | 0.82 | 14.5 | 1.6 |
| SW C5.001 | 50.00 | 5.09 | 23.136 | 0.010 | 0.0 | 0.0 | 0.3 | 0.82 | 14.5 | 1.6 |
| SW C1.003 | 47.22 | 9.60 | 22.665 | 0.155 | 0.0 | 0.0 | 4.0 | 1.01 | 40.2 | 23.7 |
| SW C6.000 | 50.00 | 5.03 | 23.400 | 0.013 | 0.0 | 0.0 | 0.4 | 1.00 | 17.7 | 2.1 |
| SW C6.001 | 50.00 | 5.06 | 23.383 | 0.013 | 0.0 | 0.0 | 0.4 | 1.00 | 17.7 | 2.1 |
| SW C1.004 | 46.83 | 9.77 | 22.568 | 0.168 | 0.0 | 0.0 | 4.3 | 1.01 | 40.2 | 25.5 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C7.000 | 2.046 | 0.020 | 102.3 | 0.011 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C7.001 | 2.046 | 0.020 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C1.005 | 9.366 | 0.056 | 166.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| SW C8.000 | 27.878 | 0.278 | 100.1 | 0.037 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C1.006 | 33.387 | 0.200 | 166.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| SW C9.000 | 1.640 | 0.016 | 100.0 | 0.016 | 5.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C7.000 | 50.00 | 5.03 | 23.000 | 0.011 | 0.0 | 0.0 | 0.3 | 0.99 | 17.6 | 1.8 |
| SW C7.001 | 50.00 | 5.07 | 22.980 | 0.011 | 0.0 | 0.0 | 0.3 | 1.00 | 17.7 | 1.8 |
| SW C1.005 | 46.49 | 9.93 | 22.507 | 0.178 | 0.0 | 0.0 | 4.5 | 1.01 | 40.2 | 27.0 |
| SW C8.000 | 50.00 | 5.46 | 23.100 | 0.037 | 0.0 | 0.0 | 1.0 | 1.00 | 17.7 | 6.0 |
| SW C1.006 | 45.31 | 10.48 | 22.451 | 0.216 | 0.0 | 0.0 | 5.3 | 1.01 | 40.2 | 31.8 |
| SW C9.000 | 50.00 | 5.03 | 22.650 | 0.016 | 0.0 | 0.0 | 0.4 | 1.00 | 17.8 | 2.7 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C9.001 | 6.731 | 0.042 | 161.3 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C1.007 | 11.575 | 0.083 | 138.9 | 0.032 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| SW C10.000 | 15.872 | 0.200 | 79.4 | 0.004 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C10.001 | 6.873 | 0.300 | 22.9 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C11.000 | 3.780 | 0.134 | 28.3 | 0.031 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C11.001 | 22.978 | 0.134 | 172.0 | 0.000 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C9.001 | 50.00 | 5.17 | 22.634 | 0.016 | 0.0 | 0.0 | 0.4 | 0.79 | 13.9 | 2.7 |
| SW C1.007 | 44.95 | 10.65 | 22.250 | 0.264 | 0.0 | 0.0 | 6.4 | 1.11 | 44.0 | 38.6 |
| SW C10.000 | 50.00 | 5.23 | 23.100 | 0.004 | 0.0 | 0.0 | 0.1 | 1.13 | 20.0 | 0.7 |
| SW C10.001 | 50.00 | 5.29 | 22.000 | 0.004 | 0.0 | 0.0 | 0.1 | 2.11 | 37.3 | 0.7 |
| SW C11.000 | 50.00 | 5.03 | 22.600 | 0.031 | 0.0 | 0.0 | 0.8 | 1.90 | 33.6 | 5.1 |
| SW C11.001 | 50.00 | 5.53 | 22.466 | 0.031 | 0.0 | 0.0 | 0.8 | 0.76 | 13.5 | 5.1 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C10.002 | 6.873 | 0.069 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C12.000 | 2.168 | 0.022 | 100.1 | 0.048 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C12.001 | 2.168 | 0.022 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C10.003 | 13.746 | 0.137 | 100.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C13.000 | 2.236 | 0.150 | 14.9 | 0.047 | 5.00 | 0.0 | 0.600 | | o | 150 | Pipe/Conduit | |
| SW C13.001 | 19.366 | 0.150 | 129.1 | 0.000 | 0.00 | 0.0 | 0.600 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C10.002 | 50.00 | 5.65 | 21.700 | 0.035 | 0.0 | 0.0 | 1.0 | 1.00 | 17.7 | 5.7 |
| SW C12.000 | 50.00 | 5.04 | 22.600 | 0.048 | 0.0 | 0.0 | 1.3 | 1.00 | 17.7 | 7.9 |
| SW C12.001 | 50.00 | 5.07 | 22.578 | 0.048 | 0.0 | 0.0 | 1.3 | 1.00 | 17.7 | 7.9 |
| SW C10.003 | 50.00 | 5.88 | 21.631 | 0.084 | 0.0 | 0.0 | 2.3 | 1.00 | 17.7 | 13.6 |
| SW C13.000 | 50.00 | 5.01 | 22.900 | 0.047 | 0.0 | 0.0 | 1.3 | 2.62 | 46.3 | 7.6 |
| SW C13.001 | 50.00 | 5.38 | 22.750 | 0.047 | 0.0 | 0.0 | 1.3 | 0.88 | 15.6 | 7.6 |

## Network Design Table for SW C

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SW C1.008 | 7.604 | 0.527 | 14.4 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | Pipe/Conduit | |
| SW C1.009 | 10.573 | 0.044 | 240.0 | 0.011 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |
| SW C1.010 | 9.023 | 0.038 | 240.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |
| SW C1.011 | 21.839 | 0.118 | 184.5 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |
| SW C1.012 | 7.981 | 0.033 | 240.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| SW C1.008 | 44.88 | 10.69 | 21.419 | 0.395 | 0.0 | 0.0 | 9.6 | 3.46 | 137.7 | 57.6 |
| SW C1.009 | 44.53 | 10.86 | 20.817 | 0.406 | 0.0 | 0.0 | 9.8 | 1.01 | 71.4 | 58.7 |
| SW C1.010 | 44.24 | 11.01 | 20.773 | 0.406 | 0.0 | 0.0 | 9.8 | 1.01 | 71.4 | 58.7 |
| SW C1.011 | 43.63 | 11.33 | 20.736 | 0.406 | 0.0 | 0.0 | 9.8 | 1.15 | 81.6 | 58.7 |
| SW C1.012 | 43.39 | 11.46 | 20.617 | 0.406 | 0.0 | 0.0 | 9.8 | 1.01 | 71.4 | 58.7 |

## Area Summary for SW C

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | As Zoned | Default | 90 | 0.028 | 0.025 | 0.025 |
| | | Roof (Std) | 95 | 0.000 | 0.000 | 0.025 |
| | | Bioretention / Planted | 30 | 0.002 | 0.001 | 0.026 |
| 2.000 | As Zoned | Default | 90 | 0.031 | 0.028 | 0.028 |
| | | Bioretention / Planted | 30 | 0.010 | 0.003 | 0.031 |
| | | Grass (Lawn) | 15 | 0.000 | 0.000 | 0.031 |
| 1.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.000 | As Zoned | Default | 90 | 0.012 | 0.011 | 0.011 |
| | | Pervious Paving | 70 | 0.009 | 0.006 | 0.017 |
| | | Bioretention / Planted | 30 | 0.006 | 0.002 | 0.019 |
| 3.001 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Pervious Paving | 70 | 0.008 | 0.006 | 0.013 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.014 |
| 3.002 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Pervious Paving | 70 | 0.000 | 0.000 | 0.008 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.009 |
| 3.003 | As Zoned | Default | 90 | 0.013 | 0.012 | 0.012 |
| | | Pervious Paving | 70 | 0.008 | 0.006 | 0.018 |
| | | Bioretention / Planted | 30 | 0.001 | 0.000 | 0.018 |
| 4.000 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.009 | 0.003 | 0.010 |
| 4.001 | As Zoned | Default | 90 | 0.008 | 0.007 | 0.007 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.007 |
| 4.002 | As Zoned | Default | 90 | 0.004 | 0.004 | 0.004 |
| | | Roof (Std) | 95 | 0.000 | 0.000 | 0.004 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.005 |
| 4.003 | As Zoned | Default | 90 | 0.006 | 0.005 | 0.005 |

## Area Summary for SW C

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 4.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 5.000 | As Zoned | Default | 90 | 0.010 | 0.009 | 0.009 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.010 |
| 5.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 6.000 | As Zoned | Default | 90 | 0.013 | 0.012 | 0.012 |
| | | Bioretention / Planted | 30 | 0.003 | 0.001 | 0.013 |
| 6.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 7.000 | As Zoned | Default | 90 | 0.010 | 0.009 | 0.009 |
| | | Bioretention / Planted | 30 | 0.005 | 0.002 | 0.011 |
| 7.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 8.000 | As Zoned | Default | 90 | 0.039 | 0.035 | 0.035 |
| | | Bioretention / Planted | 30 | 0.007 | 0.002 | 0.037 |
| 1.006 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 9.000 | As Zoned | Default | 90 | 0.015 | 0.014 | 0.014 |
| | | Bioretention / Planted | 30 | 0.008 | 0.003 | 0.016 |
| 9.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.007 | As Zoned | Default | 90 | 0.036 | 0.032 | 0.032 |
| 10.000 | As Zoned | Default | 90 | 0.004 | 0.003 | 0.003 |
| | | Roof (Std) | 95 | 0.000 | 0.000 | 0.003 |
| | | Bioretention / Planted | 30 | 0.002 | 0.001 | 0.004 |
| 10.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 11.000 | As Zoned | Default | 90 | 0.033 | 0.030 | 0.030 |

## Area Summary for SW C

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| | | Roof (Std) | 95 | 0.000 | 0.000 | 0.030 |
| | | Bioretention / Planted | 30 | 0.004 | 0.001 | 0.031 |
| 11.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 12.000 | As Zoned | Default | 90 | 0.051 | 0.046 | 0.046 |
| | | Roof (Std) | 95 | 0.000 | 0.000 | 0.046 |
| | | Bioretention / Planted | 30 | 0.000 | 0.000 | 0.046 |
| | | Tree SuDS Pit | 50 | 0.005 | 0.003 | 0.048 |
| 12.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 13.000 | As Zoned | Default | 90 | 0.052 | 0.047 | 0.047 |
| 13.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.008 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.009 | As Zoned | Default | 90 | 0.009 | 0.008 | 0.008 |
| | | Bioretention / Planted | 30 | 0.012 | 0.004 | 0.011 |
| 1.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.011 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| | | | | Total | Total | Total |
| | | | | 0.514 | 0.406 | 0.406 |

## Free Flowing Outfall Details for SW C

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| SW C1.012 | SW C | 22.300 | 20.584 | 0.000 | 0 | 0 |

## Online Controls for SW C

**Orifice Manhole: SW C11, DS/PN: SW C4.004, Volume (m³): 1.7**

Diameter (m) 0.021 Discharge Coefficient 0.600 Invert Level (m) 23.661

**Orifice Manhole: SW C7, DS/PN: SW C3.004, Volume (m³): 2.9**

Diameter (m) 0.031 Discharge Coefficient 0.600 Invert Level (m) 23.274

**Orifice Manhole: SW C16, DS/PN: SW C5.001, Volume (m³): 0.5**

Diameter (m) 0.015 Discharge Coefficient 0.600 Invert Level (m) 23.136

**Orifice Manhole: SW C18, DS/PN: SW C6.001, Volume (m³): 0.3**

Diameter (m) 0.015 Discharge Coefficient 0.600 Invert Level (m) 23.383

**Orifice Manhole: SW C22, DS/PN: SW C7.001, Volume (m³): 0.5**

Diameter (m) 0.015 Discharge Coefficient 0.600 Invert Level (m) 22.980

**Orifice Manhole: SW C27, DS/PN: SW C9.001, Volume (m³): 0.5**

Diameter (m) 0.015 Discharge Coefficient 0.600 Invert Level (m) 22.634

## Hydro-Brake® Optimum Manhole: SW C9, DS/PN: SW C1.008, Volume (m³): 4.0

| | | | |
|---|---|---|---|
| Unit Reference | MD-SHE-0092-5000-2000-5000 | Sump Available | Yes |
| Design Head (m) | 2.000 | Diameter (mm) | 92 |
| Design Flow (l/s) | 5.0 | Invert Level (m) | 21.419 |
| Flush-Flo™ | Calculated | Minimum Outlet Pipe Diameter (mm) | 150 |
| Objective | Minimise upstream storage | Suggested Manhole Diameter (mm) | 1200 |
| Application | Surface | | |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 2.000 | 5.0 | Kick-Flo® | 0.816 | 3.3 |
| Flush-Flo™ | 0.398 | 4.1 | 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) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 2.9 | 0.600 | 4.0 | 1.600 | 4.5 | 2.600 | 5.6 | 5.000 | 7.7 | 7.500 | 9.3 |
| 0.200 | 3.8 | 0.800 | 3.4 | 1.800 | 4.8 | 3.000 | 6.0 | 5.500 | 8.0 | 8.000 | 9.6 |
| 0.300 | 4.1 | 1.000 | 3.6 | 2.000 | 5.0 | 3.500 | 6.5 | 6.000 | 8.4 | 8.500 | 9.9 |
| 0.400 | 4.1 | 1.200 | 3.9 | 2.200 | 5.2 | 4.000 | 6.9 | 6.500 | 8.7 | 9.000 | 10.2 |
| 0.500 | 4.1 | 1.400 | 4.2 | 2.400 | 5.4 | 4.500 | 7.3 | 7.000 | 9.0 | 9.500 | 10.4 |

## Offline Controls for SW C

### Pipe Manhole: SW C11, DS/PN: SW C4.004, Loop to PN: SW C3.003

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.500 |
| Slope (1:X) | 20.0 | Entry Loss Coefficient | 0.500 | | |

### Pipe Manhole: SW C16, DS/PN: SW C5.001, Loop to PN: SW C1.003

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.100 |
| Slope (1:X) | 20.0 | Entry Loss Coefficient | 0.500 | | |

### Pipe Manhole: SW C18, DS/PN: SW C6.001, Loop to PN: SW C1.004

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.100 |
| Slope (1:X) | 20.0 | Entry Loss Coefficient | 0.500 | | |

### Pipe Manhole: SW C22, DS/PN: SW C7.001, Loop to PN: SW C1.005

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 2.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 24.050 |
| Slope (1:X) | 20.0 | Entry Loss Coefficient | 0.500 | | |

## Pipe Manhole: SW C27, DS/PN: SW C9.001, Loop to PN: SW C1.007

| | | | | | |
|---|---|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 5.000 | Coefficient of Contraction | 0.600 |
| Section Type | Pipe/Conduit | Roughness k (mm) | 0.600 | Upstream Invert Level (m) | 23.750 |
| Slope (1:X) | 20.0 | Entry Loss Coefficient | 0.500 | | |

## Storage Structures for SW C

### Filter Drain Pipe: SW C3.000

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.800 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 199.6 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 18.4 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

### Filter Drain Pipe: SW C3.001

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.708 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 199.4 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 16.7 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

### Filter Drain Pipe: SW C3.002

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.624 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 200.1 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 10.2 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

## Filter Drain Pipe: SW C3.003

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.350 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 200.3 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 15.2 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

## Filter Drain Pipe: SW C4.000

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.950 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.4 | Slope (1:X) | 200.0 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 24.0 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

## Filter Drain Pipe: SW C4.001

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.830 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 150.0 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.6 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

## Filter Drain Pipe: SW C4.002

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Safety Factor | 2.0 | Trench Width (m) | 0.5 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.30 | Trench Length (m) | 14.5 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Invert Level (m) | 23.700 | Pipe Diameter (m) | 0.150 |

## Filter Drain Pipe: SW C4.002

| | | | | | |
|---|---|---|---|---|---|
| Pipe Depth above Invert (m) | 0.150 | Slope (1:X) | 149.5 | Cap Infiltration Depth (m) | 0.000 |
| Number of Pipes | 1 | Cap Volume Depth (m) | 1.000 | | |

## Filter Drain Pipe: SW C4.003

| | | | | | |
|---|---|---|---|---|---|
| Manning's N | 0.040 | Invert Level (m) | 23.710 | Number of Pipes | 1 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Trench Width (m) | 0.5 | Slope (1:X) | 199.5 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Trench Length (m) | 9.8 | Cap Volume Depth (m) | 1.000 |
| Safety Factor | 2.0 | Pipe Diameter (m) | 0.150 | Cap Infiltration Depth (m) | 0.000 |
| Porosity | 0.30 | Pipe Depth above Invert (m) | 0.150 | | |

## Complex Manhole: SW C11, DS/PN: SW C4.004

### Infiltration Blanket

| | | | | | |
|---|---|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Invert Level (m) | 23.586 | Cap Volume Depth (m) | 0.500 |
| Safety Factor | 2.0 | Diameter/Width (m) | 5.0 | | |
| Porosity | 0.30 | Length (m) | 25.0 | | |

### Bio-Retention Area

| | | | | | |
|---|---|---|---|---|---|
| Invert Level (m) | 24.086 | Infiltration Coefficient Base (m/hr) | 0.00000 | Safety Factor | 2.0 |
| Porosity | 1.00 | Infiltration Coefficient Side (m/hr) | 0.00000 | | |

## Bio-Retention Area

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 90.0 | 50.000 | 0.500 | 120.0 | 60.000 | 0.501 | 0.0 | 60.000 |

## Infiltration Blanket Manhole: SW C7, DS/PN: SW C3.004

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.274 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 5.0
Porosity 0.30 Length (m) 55.0

## Complex Manhole: SW C16, DS/PN: SW C5.001

## Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.136 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 3.0
Porosity 0.30 Length (m) 8.5

## Bio-Retention Area

Invert Level (m) 23.636 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 15.0 | 16.000 | 0.400 | 25.0 | 22.000 | 0.401 | 0.0 | 22.000 |

## Complex Manhole: SW C18, DS/PN: SW C6.001

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 23.383 Cap Volume Depth (m) 0.500
Safety Factor 2.0 Diameter/Width (m) 3.0
Porosity 0.30 Length (m) 11.0

### Bio-Retention Area

Invert Level (m) 23.883 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 23.0 | 19.000 | 0.400 | 33.0 | 28.000 | 0.401 | 0.0 | 28.000 |

## Complex Manhole: SW C22, DS/PN: SW C7.001

### Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 22.980 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 8.0
Porosity 0.30 Length (m) 7.0

## Bio-Retention Area

Invert Level (m) 23.730 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 42.0 | 28.000 | 0.500 | 55.0 | 33.000 | 0.501 | 0.0 | 33.000 |

## Complex Manhole: SW C27, DS/PN: SW C9.001

## Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Invert Level (m) 22.634 Cap Volume Depth (m) 0.750
Safety Factor 2.0 Diameter/Width (m) 3.0
Porosity 0.30 Length (m) 21.0

## Bio-Retention Area

Invert Level (m) 23.384 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0
Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) | Depth (m) | Area (m²) | Perimeter (m) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 40.0 | 55.000 | 0.500 | 63.0 | 65.000 | 0.501 | 0.0 | 65.000 |

## Tank or Pond Manhole: SW C9, DS/PN: SW C1.008

Invert Level (m) 21.419

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 500.0 | 1.250 | 500.0 | 1.251 | 0.0 |

## Summary of Critical Results by Maximum Level (Rank 1) for SW C

### Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 5 Number of Time/Area Diagrams 0
Number of Online Controls 7 Number of Storage Structures 15 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.500 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.277 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 20

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| SW C1.000 | SW C1 | 15 minute 100 year Summer I+20% | 24.000 | 23.183 | -0.142 | 0.28 | 12.7 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for SW C

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| SW C2.000 | SW C2 | 15 minute 100 year Summer I+20% | 24.750 | 24.147 | 0.197 | 1.39 | 14.9 | SURCHARGED |
| SW C1.001 | SW C2 | 15 minute 100 year Summer I+20% | 24.400 | 22.987 | -0.056 | 0.91 | 27.4 | OK |
| SW C3.000 | SW C3 | 15 minute 100 year Summer I+20% | 25.180 | 24.063 | -0.737 | 0.22 | 9.1 | OK |
| SW C3.001 | SW C4 | 15 minute 100 year Summer I+20% | 24.950 | 24.032 | -0.676 | 0.33 | 13.5 | OK |
| SW C3.002 | SW C5 | 30 minute 100 year Summer I+20% | 24.750 | 23.984 | -0.640 | 0.40 | 16.0 | OK |
| SW C3.003 | SW C6 | 30 minute 100 year Summer I+20% | 24.800 | 23.827 | -0.523 | 0.52 | 21.0 | OK |
| SW C4.000 | SW C7 | 15 minute 100 year Summer I+20% | 24.850 | 24.145 | -0.705 | 0.17 | 4.6 | OK |
| SW C4.001 | SW C8 | 15 minute 100 year Summer I+20% | 24.850 | 24.020 | -0.810 | 0.14 | 6.6 | OK |
| SW C4.002 | SW C9 | 30 minute 100 year Summer I+20% | 24.780 | 23.971 | -0.729 | 0.18 | 8.2 | OK |
| SW C4.003 | SW C10 | 30 minute 100 year Summer I+20% | 24.610 | 23.956 | -0.654 | 0.27 | 9.8 | OK |
| SW C4.004 | SW C11 | 720 minute 100 year Summer I+20% | 24.700 | 23.932 | 0.121 | 0.03 | 0.5 | SURCHARGED |
| SW C3.004 | SW C7 | 960 minute 100 year Summer I+20% | 24.500 | 23.655 | 0.231 | 0.11 | 1.2 | SURCHARGED |
| SW C1.002 | SW C3 | 15 minute 100 year Summer I+20% | 24.400 | 22.921 | -0.076 | 0.77 | 27.6 | OK |
| SW C5.000 | SW C15 | 240 minute 100 year Summer I+20% | 24.400 | 23.567 | 0.267 | 0.14 | 1.5 | SURCHARGED |
| SW C5.001 | SW C16 | 240 minute 100 year Summer I+20% | 24.350 | 23.566 | 0.280 | 0.03 | 0.3 | SURCHARGED |
| SW C1.003 | SW C4 | 15 minute 100 year Summer I+20% | 24.300 | 22.821 | -0.069 | 0.66 | 26.6 | OK* |
| SW C6.000 | SW C17 | 360 minute 100 year Summer I+20% | 24.300 | 23.868 | 0.318 | 0.14 | 1.5 | SURCHARGED |
| SW C6.001 | SW C18 | 360 minute 100 year Summer I+20% | 24.300 | 23.868 | 0.335 | 0.03 | 0.3 | SURCHARGED |
| SW C1.004 | SW C5 | 15 minute 100 year Summer I+20% | 24.300 | 22.777 | -0.016 | 0.80 | 27.9 | OK* |
| SW C7.000 | SW C19 | 360 minute 100 year Summer I+20% | 24.200 | 23.244 | 0.094 | 0.12 | 1.3 | SURCHARGED |
| SW C7.001 | SW C22 | 360 minute 100 year Summer I+20% | 24.250 | 23.244 | 0.114 | 0.02 | 0.2 | SURCHARGED |
| SW C1.005 | SW C6 | 15 minute 100 year Summer I+20% | 24.300 | 22.748 | 0.017 | 0.88 | 29.5 | SURCHARGED* |
| SW C8.000 | SW C7 | 15 minute 100 year Summer I+20% | 24.000 | 23.283 | 0.033 | 1.06 | 18.0 | SURCHARGED |
| SW C1.006 | SW C7 | 15 minute 100 year Summer I+20% | 24.300 | 22.723 | 0.047 | 1.06 | 39.9 | SURCHARGED |
| SW C9.000 | SW C23 | 600 minute 100 year Summer I+20% | 23.850 | 23.024 | 0.224 | 0.13 | 1.4 | SURCHARGED |

## Summary of Critical Results by Maximum Level (Rank 1) for SW C

| PN | US/MH Name | Event | US/CL (m) | Water Level (m) | Surcharged Depth (m) | Flow / Cap. | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|
| SW C9.001 | SW C27 | 600 minute 100 year Summer I+20% | 24.075 | 23.024 | 0.240 | 0.02 | 0.3 | SURCHARGED |
| SW C1.007 | SW C8 | 30 minute 100 year Summer I+20% | 24.300 | 22.500 | 0.025 | 1.18 | 48.1 | SURCHARGED* |
| SW C10.000 | SW C20 | 15 minute 100 year Summer I+20% | 24.000 | 23.133 | -0.117 | 0.11 | 2.0 | OK |
| SW C10.001 | SW C21 | 15 minute 100 year Summer I+20% | 23.800 | 22.359 | 0.209 | 0.13 | 4.1 | SURCHARGED |
| SW C11.000 | SW C27 | 15 minute 100 year Summer I+20% | 23.500 | 22.722 | -0.028 | 0.66 | 15.0 | OK |
| SW C11.001 | SW C32 | 15 minute 100 year Summer I+20% | 23.500 | 22.662 | 0.045 | 1.18 | 15.0 | SURCHARGED |
| SW C10.002 | SW C27 | 15 minute 100 year Summer I+20% | 23.500 | 22.354 | 0.504 | 1.04 | 15.7 | SURCHARGED |
| SW C12.000 | SW C29 | 15 minute 100 year Summer I+20% | 23.500 | 22.987 | 0.237 | 2.17 | 23.5 | SURCHARGED |
| SW C12.001 | SW C35 | 15 minute 100 year Summer I+20% | 23.500 | 22.842 | 0.114 | 2.17 | 23.5 | SURCHARGED |
| SW C10.003 | SW C27 | 15 minute 100 year Summer I+20% | 23.500 | 22.287 | 0.506 | 2.16 | 35.1 | SURCHARGED |
| SW C13.000 | SW C22 | 15 minute 100 year Summer I+20% | 23.800 | 23.209 | 0.159 | 0.91 | 22.0 | SURCHARGED |
| SW C13.001 | SW C38 | 15 minute 100 year Summer I+20% | 23.650 | 23.084 | 0.184 | 1.49 | 21.8 | SURCHARGED |
| SW C1.008 | SW C9 | 960 minute 100 year Summer I+20% | 23.500 | 21.767 | 0.123 | 0.04 | 3.8 | SURCHARGED |
| SW C1.009 | SW C10 | 30 minute 100 year Summer I+20% | 22.500 | 20.884 | -0.233 | 0.11 | 6.7 | OK* |
| SW C1.010 | SW C11 | 30 minute 100 year Summer I+20% | 22.500 | 20.839 | -0.234 | 0.11 | 6.7 | OK* |
| SW C1.011 | SW C12 | 30 minute 100 year Summer I+20% | 22.500 | 20.797 | -0.239 | 0.09 | 6.7 | OK |
| SW C1.012 | SW C13 | 30 minute 100 year Summer I+20% | 22.300 | 20.687 | -0.230 | 0.13 | 6.7 | OK |

## APPENDIX E. WASTEWATER DESIGN CALCULATIONS

- As per Irish Water Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03

# Appendix E

Wastewater Design Calculations

| JOB NAME: | JOB NO: | DATE: |
|---|---|---|
| Emmet Road | B967 | 19.09.2022 |
| **TITLE:** | **CALCS BY:** | **CHECK'D:** |
| Wastewater Design Calculations | MK | PR |

| Zone | Area ($m^2$) | No. of Units (nr) | Area/person ($m^2$) | Occupancy ($nr/m^2$) | Population Equivalent | Flow (l/unit/day) | Infiltration (% of flow) | Total Flow ($m^3$/day) | DWF (l/s) | Peak Factor for Pipe Sizing | Peak Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| **Domestic** | | | | | | | | | | | |
| *Apartments* | | | | | | | | | | | |
| Block A | | 306 | | 2.7 | 826 | 150 | 10% | 136.32 | 1.6 | | |
| Block B | | 181 | | 2.7 | 489 | 150 | 10% | 80.64 | 0.9 | | |
| Block C | | 91 | | 2.7 | 246 | 150 | 10% | 40.54 | 0.5 | | |
| **TOTAL Domestic** | | **578** | | | **1,561** | | | **257.50** | **3.0** | **3.0** | **8.9** |
| | | | | | | | | | | | |
| **Non-Domestic** | | | | | | | | | | | |
| *Retail* | 3,245 | | | | | | | | | | |
| Large Unit | 2,476 | | 80 | 0.013 | 31 | 90 | 10% | 3.1 | 0.07 | | |
| Other Retail | 769 | | 50 | 0.020 | 15 | 90 | 10% | 1.5 | 0.04 | | |
| | | | | | | | | | | | |
| *Community Buildings* | 2,810 | | | | | | | | | | |
| Library / Community Hub | 2,810 | | 200 | 0.005 | 50 | 15 | 10% | 0.8 | 0.02 | | |
| | | | | | | | | | | | |
| *Childcare* | 816 | | 18 | 0.056 | 45 | 90 | 10% | 4.5 | 0.10 | | |
| | | | | | | | | | | | |
| **TOTAL Non-Domestic** | **6,871** | | | | **142** | | | **9.9** | **0.23** | **4.5** | **1.03** |
| | | | | | | | | | | | |
| **DEVELOPMENT TOTAL** | | | | | **1,702** | | | **267** | **3.21** | | **9.97** |
| | | | | | | | | | | | |

*Occupancy Rates are assumed with flow rates adjusted to hourly rates*

*Residential Occupancy rates from Appendix C of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)*

*Flow rates from Appendix D of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)*

*Infiltration rates from Appendix C of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)*

*Peaking Factor from Appendix C of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)*

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

**APPENDIX F. IRISH WATER CONFIRMATION OF FEASIBILITY**

# Appendix F

Irish Water Confirmation of Feasibility

Mark Killian

OCSC
9 Prussia Street
Stoneybatter
Dublin 7
D07KT57

**Uisce Éireann**
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

**Irish Water**
PO Box 448,
South City
Delivery Office
Cork City

**www.water.ie**

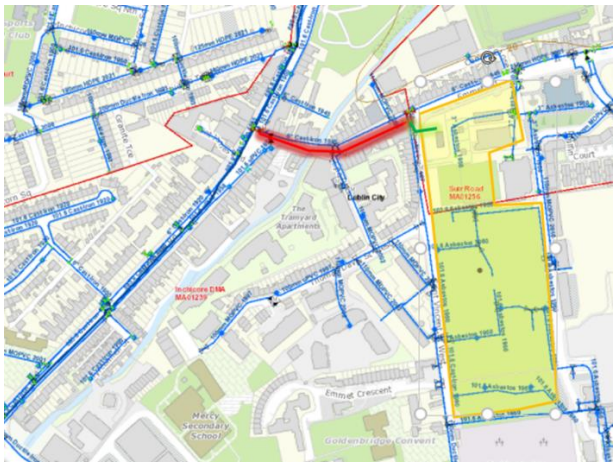
8 June 2022

**Re: CDS22003279 pre-connection enquiry - Subject to contract | Contract denied**

**Connection for Multi/Mixed Use Development of 634 units at Emmet Road, Inchicore, Dublin**

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Emmet Road, Inchicore, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

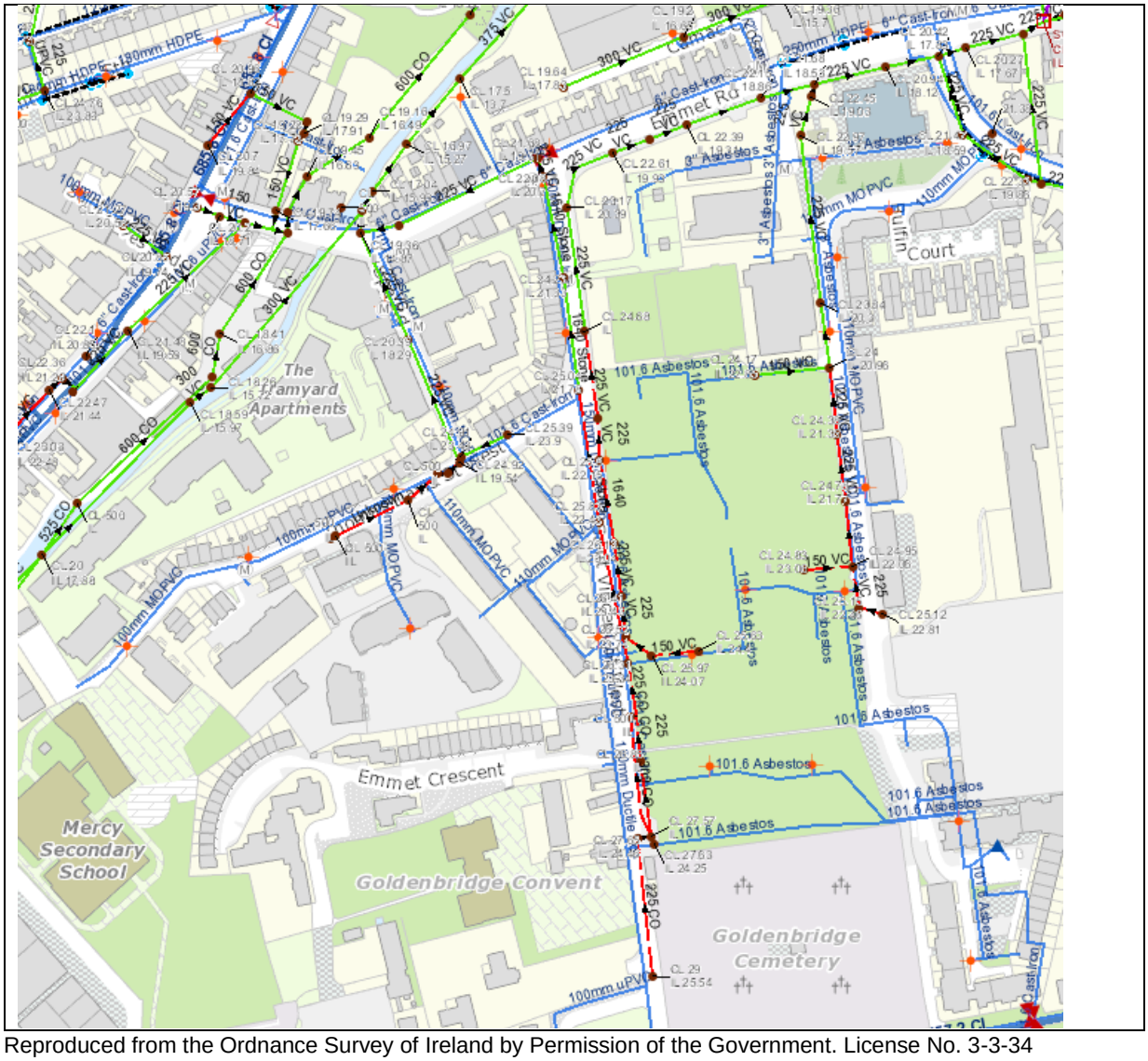
| **SERVICE** | **OUTCOME OF PRE-CONNECTION ENQUIRY**<br>**THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.** |
|---|---|
| Water Connection | Feasible Subject to upgrades |
| Wastewater Connection | Feasible without infrastructure upgrade by Irish Water |
| **SITE SPECIFIC COMMENTS** | |
| Water Connection | In order to accommodate the proposed connection, upgrade of the existing 6'' main to a 200mm ID pipe in Emmet Road for approximately 180mm (including bridge crossing) will be required. The water main section is highlighted in red below.<br>  |

| | |
|---|---|
| | Connection main should be also a 200 mm ID pipe connected to the new 200mm ID main. A DMA meter is to be installed on the connection main and linked to telemetry online. |

The proposed Development indicates that Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the Development. A wayleave in favour of Irish Water will be required over the assets that are not located within the Public Space. For design submissions and queries related to diversion/build near or over, please contact IW Diversion Team via email address diversions@water.ie

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

**The map included below outlines the current Irish Water infrastructure adjacent to your site:**



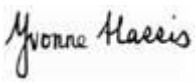
Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

**General Notes:**

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



**Yvonne Harris**

**Head of Customer Operations**

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