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# SUDS Design Statement

## Proposed Nursing Home Development

## Site at grounds of St. Mary´s Priory, Tallaght, Dublin 24.

Client: St. Mary´s Medical (Tallaght) Ltd.

Job No. D092

November 2022

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# SUDS DESIGN STATEMENT

## PROPOSED NURSING HOME DEVELOPMENT, SITE AT GROUNDS OF ST. MARY´S PRIORY, TALLAGHT, DUBLIN 24.

CONTENTS





File Location: Job-D092\B_Documents\Civil\Civil Reports\Second Application 202202\RFI\SUDS Design Statement

| | |
|---|---|
| **BS 1192 FIELD** | **D092-CSC-ZZ-XX-RP-C-0005-P0** |

| Job Ref. | Author | Reviewed By | Authorised By | Issue Date | Rev. No. |
|---|---|---|---|---|---|
| D092 | MM | NB | NB | 18.11.2022 | P0 |
| D092 | MM | NB | NB | 24.11.2022 | P1 |
| D092 | MM | NB | NB | 25.11.2022 | P2 |

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## 1.0 INTRODUCTION

Cronin & Sutton Consulting Engineers (CS Consulting) have prepared this Sustainable Drainage (SUDS) Design Statement in response to the Request For Further Information issued by South Dublin County Council to support the planning application for the construction of a 4 storey nursing home and associated infrastructure in St. Mary´s Priory in Tallaght, Dublin 24.

This statement outlines the following aspects of the proposed development:

- SUDS Philosophy
- SUDS Strategy and management train
- Potable Water Infrastructure

In preparing this report, CS Consulting has made reference to the following:

- Local City / Council Development Plan
- Local Area Plan (if any)
- Building Regulations 2010 (Part H)
- Greater Dublin Regional Code of Practice for Drainage Works (Version 6)
- Greater Dublin Strategic Drainage Study (GDSDS) 2005
- CIRIA C753 The SUDS Manual
- SDCC Sustainable Drainage Explanatory Design & Evaluation Guide 2022
- The Wallingford Procedure Volume 1
- Irish Water Drainage and Supply Records

The SUDS Design Statement is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with all other relevant documentation submitted by other members of the project design team.

## 2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

### 2.1 Site Location

The proposed development site is located within the grounds of St. Mary's Priory, on the western side of the Old Greenhills Road in Tallaght, Dublin 24. The site is located in the administrative jurisdiction of South Dublin City Council (SDCC) and has an approximate area of 1.0ha.

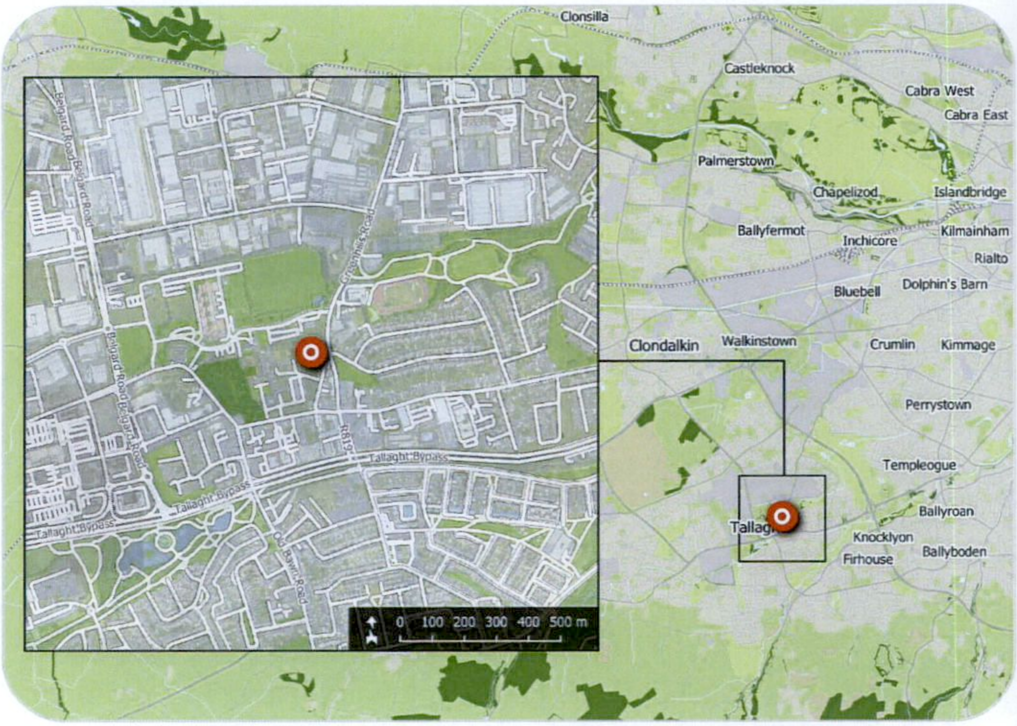


Figure 1 – Location of proposed development site
*(map data & imagery: EPA, NTA, OSM Contributors, Google)*

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 2.

The site is bounded to the north by the TU Dublin Tallaght Campus, to the east by Old Greenhills Road, and on other sides by the remaining grounds of St. Mary´s Priory. The site has a street frontage of approx. 95m on Old Greenhills Road and approx. 50m on Greenhills Road.

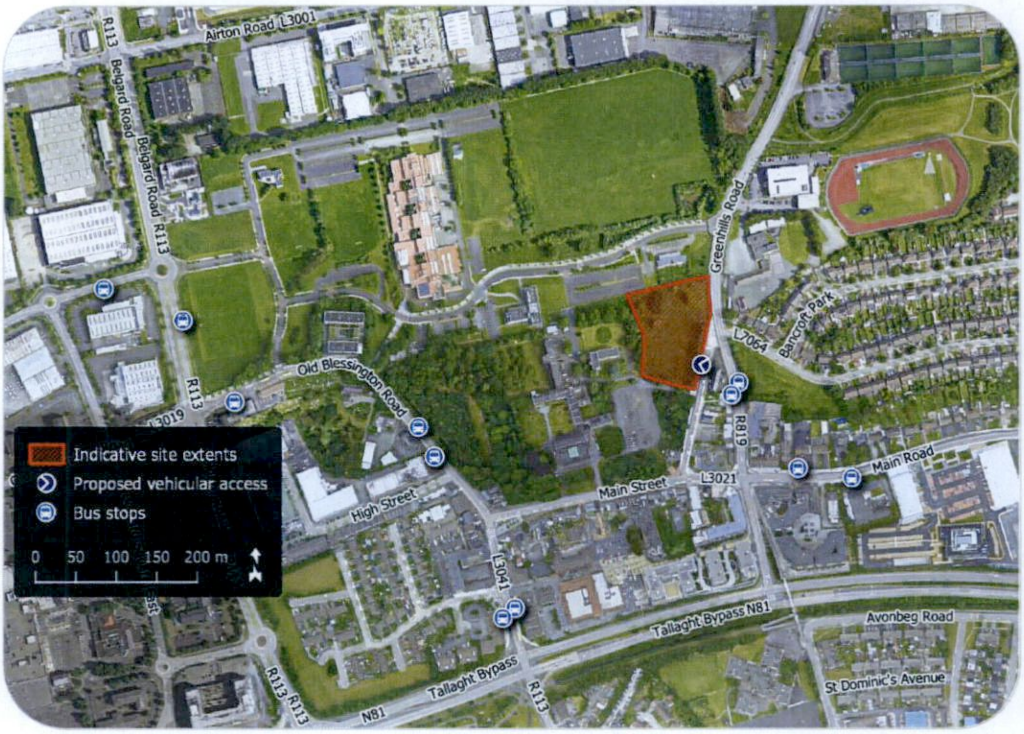


Figure 2– Development Site Surrounding Environment
*(map data & imagery: EPA, NTA, OSM Contributors, Google)*

## 2.2 Existing Land Use

The subject site is greenfield, forming part of the grounds of Saint Mary´s Priory.

## 3.0 SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)

### 3.1 Benefits of SUDS Philosophy

When rain falls on a natural landscape, it soaks into the ground, evaporates, is taken up by plants (evapotranspiration) and some of it eventually finds its way into streams and rivers.

These stages of the water cycle can be impeded when land is altered by development. In urban areas, there tends to be less permeable ground available for infiltration and less vegetation for evapotranspiration. When rain falls on impermeable surfaces, much more of it turns into surface water runoff which can cause flooding, pollution and erosion problems. As well as contributing to more surface water runoff, increasing urbanisation has also reduced wildlife in urban areas, leading to some species being lost from our green spaces to the detriment of the local ecosystem and the human population.

Sustainable Drainage Systems is a series of management practices and control structures that aim to mimic natural drainage in developed areas. The philosophy of sustainable drainage systems is about maximising the benefits and minimising the negative impacts of surface water runoff from developed areas.

The SUDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing conveying and treating runoff on site, and where possible, on the surface rather than underground.

By adopting this approach, SUDS have the opportunity to deliver and enhance the green space within the developments, supporting the provision of habitats and places for wildlife as well as providing a positive impact for the wellbeing of the communities. As stated in the CIRIA C753 SUDS manual, there are four main categories of benefits that can be achieved through the implementation of SUDS: water quantity, water quality, amenity and biodiversity.

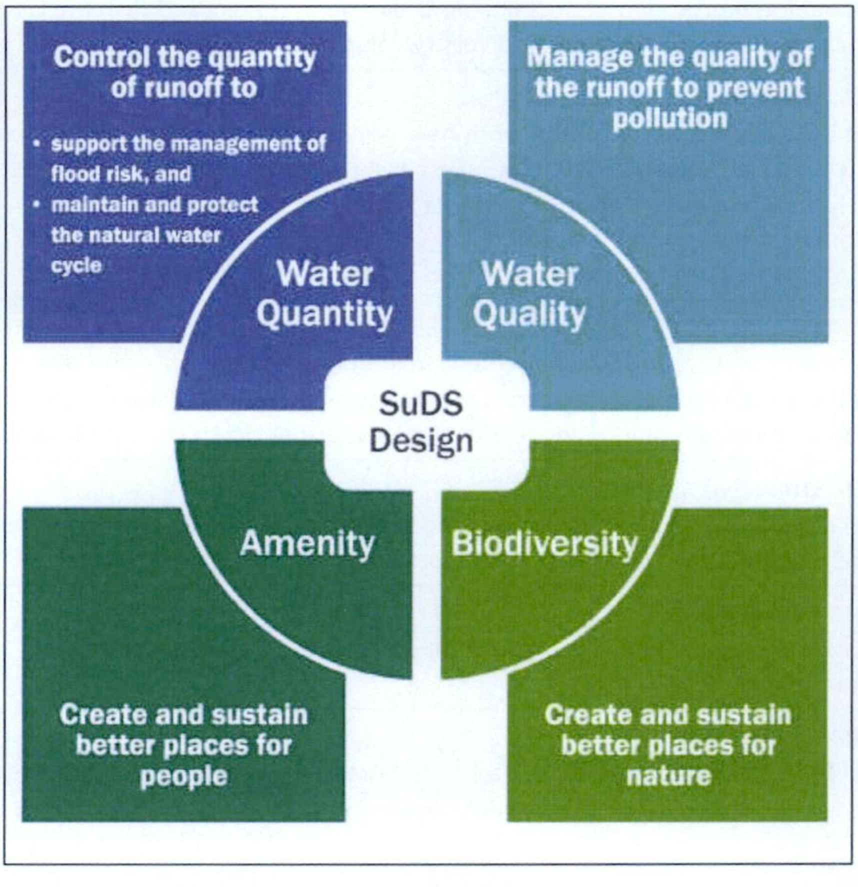


Figure 3– The four pillars of SUDS design
*(CIRIA C753 SUDS Manual)*

These benefits are aligned with the objectives established in Chapter 4 of the SDCC Development Plan 2022-2028.

| **Policy GI4: Sustainable Drainage Systems** |
|---|
| Require the provision of Sustainable Drainage Systems (SuDS) in the County and maximise the amenity and biodiversity value of these systems. |
| **GI4 Objective 1:**<br>To limit surface water run-off from new developments through the use of Sustainable Drainage Systems (SuDS) using surface water and nature-based solutions and ensure that SuDS is integrated into all new development in the County and designed in accordance with South Dublin County Council's *Sustainable Drainage Explanatory Design and Evaluation Guide,* 2022. |
| **GI4 Objective 2:**<br>To incorporate a SuDS management train during the design stage whereby surface water is managed locally in small sub-catchments rather than being conveyed to and managed in large systems further down the catchment. |
| **GI4 Objective 3:**<br>To require multifunctional open space provision within new developments to include provision for ecology and sustainable water management. |
| **GI4 Objective 4:**<br>To require that all SuDS measures are completed to a taking in charge standard. |
| **GI4 Objective 5:**<br>To promote SuDS features as part of the greening of urban and rural streets to restrict or delay runoff from streets entering the storm drainage network. |

Figure 4– South Dublin Development Plan GI Objectives
*(Sustainable Drainage Explanatory Design & Evaluation Guide)*

## 4.0 SUDS STRATEGY – DESIGN APPROACH

This SUDS Design Statement outlines the proposed approach for the management of rainfall runoff from the development to ensure that there is no increase in the risk of flooding for the development nor the adjacent areas whilst the development benefits from the improvements in the water quality, amenity and biodiversity.

The approach to the SUDS design has followed the below steps as recommended by CIRIA The SUDS Manual:

- Identify and existing and modified flow routes.
- Identify suitable mechanisms of discharge for site drainage.
- Allocate a management train and appropriate number of subcatchments to provide the collection, treatment and storage of runoff across the site.
- Identify suitable SUDS components which are aligned with the landscape character of the site.

Please note that the design presented and summarised in this report is at a planning stage and the surface water drainage design at the site will be subject to detail post-planning design.

## 4.1 FLOW ROUTE ANALYSIS

### 4.1.1 Existing Flow Route Analysis

The topography of the site has been assessed to determine how the site naturally behaves before development. The site drain in a north eastern direction toward Greenhills Road. Refer to CS Consulting drawing **D092-CSC-XX-XX-DR-C-0017** for further information

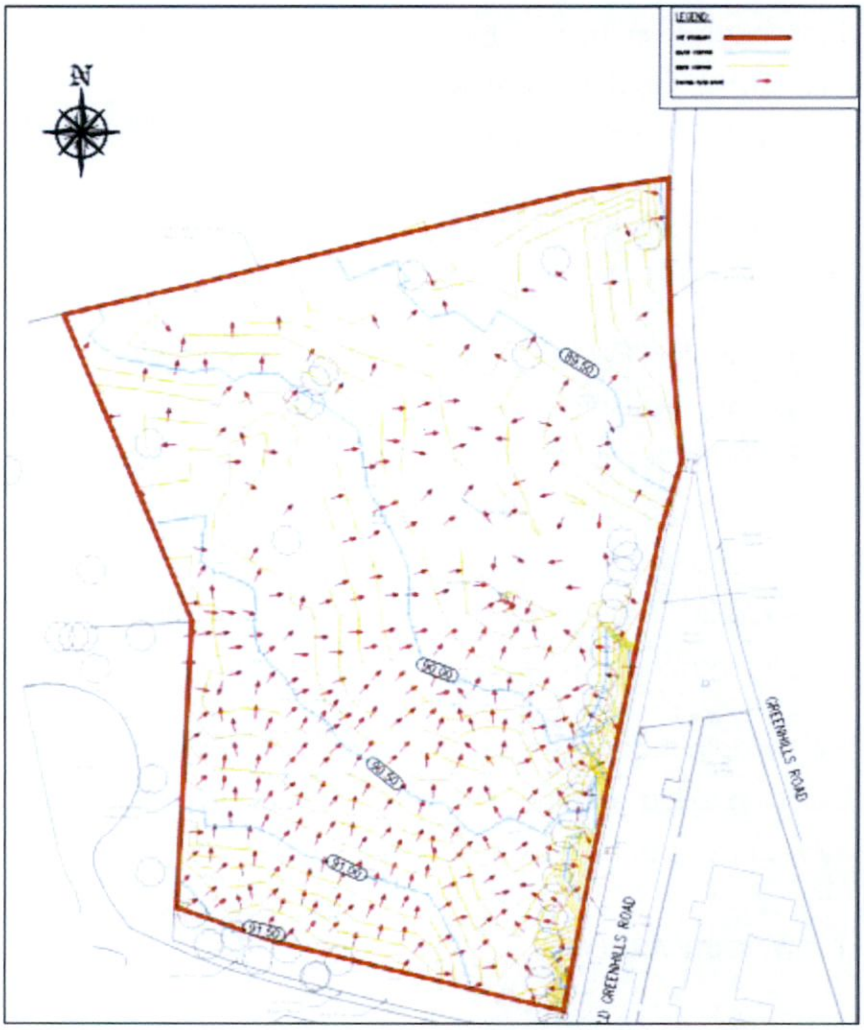


Figure 5– Existing Flow Route Analysis
*(Source: CS Consulting)*

### 4.1.2 Modified Flow Route Analysis

The modified flow route analysis is the basis for low flow conveyance, overflow arrangements and exceedance routes when design criteria are exceeded. The modified flow routes have been assessed, based on proposed site layout drawing. Refer to CS Consulting drawing **D092-CSC-XX-XX-DR-C-0018** for further information

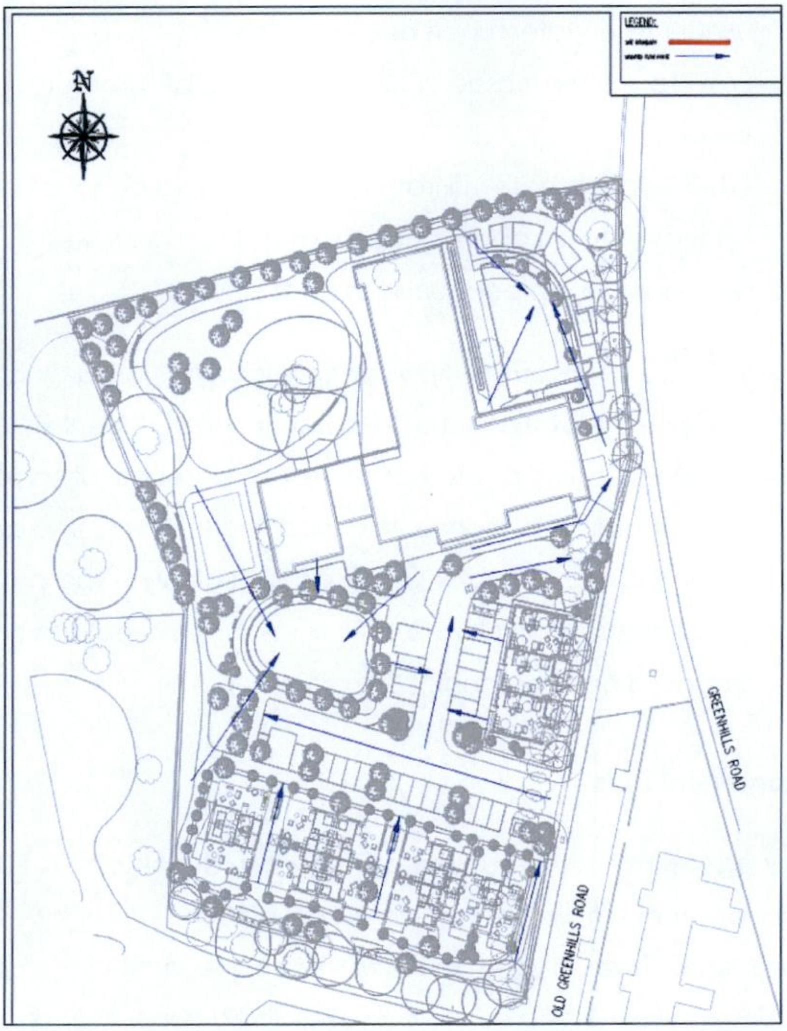


Figure 6– Modified Flow Route Analysis
(Source: *CS Consulting*)

### 4.2 Drainage Hierarchy

As set in section 5.2 of the SDCC Explanatory, Design and Evaluation Guide 2022, SUDS designs should explore opportunities for sustainable reuse of rainfall, recharge of aquifers and direct discharge to open watercourses

The following ways of managing or releasing surface runoff to the wider environment should be considered and are set out in order of preference:

1. Use surface water runoff as a resource
2. Provide nature-based SUDS features that promotes interception losses.
3. Where appropriate infiltrate runoff into the ground.
4. Discharge to an open surface water drainage system.
5. Discharge to a piped surface water system.

For the purpose of this outline SUDS design, following the drainage hierarchy outlined above the existing surface water sewer on Greenhills Road is taken as the preferred point of discharge. In the absence of re-use, sufficient infiltration potential or presence of a local watercourse, the surface water drainage pipe is the only viable means of drainage. The proposed SUDS elements will ensure that the rate of flow is not increased as a consequence of the proposed development.

## 4.3 Management Train

A management train is usually required when developing a SUDS strategy. A management train sets a hierarchy of SUDS techniques which are subsequently linked together. Each technique employed contributes in different ways and degrees to the overall drainage network. Following a review of all the information presented in the previous sections and taking into consideration the site constraints the following SUDS components have been considered the most suitable for the development in question.

### 4.3.1 Green Roofs

Green roofs are areas of living vegetation, installed on the top of the buildings that provide visual benefits, ecological value, enhanced visual performance and the reduction of surface water runoff. Over

60% of the Nursing Home building shall be covered with an extensive green roof, which is a type of green roof with low substrate depth, simple planting and low maintenance requirements. They are generally non-accessible.

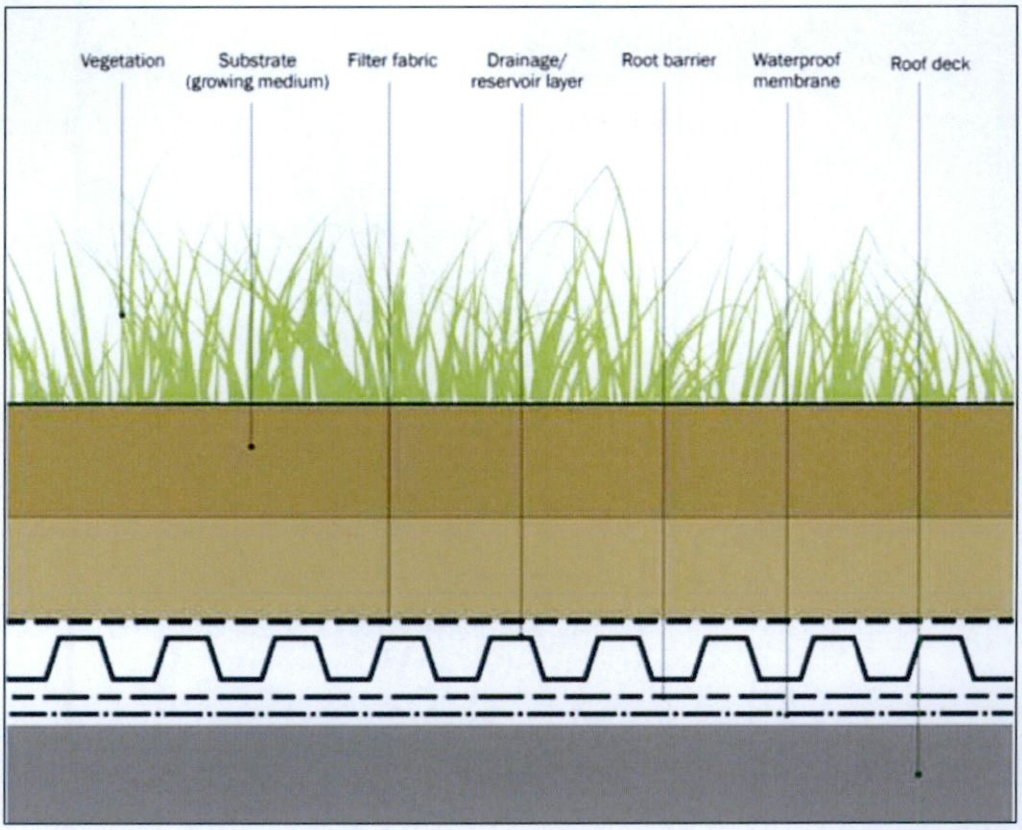


Figure 7– Section showing typical extensive green roof components
(Source: CIRIA C753 The SuDS Manual)

### 4.3.2 Water Butts

Water Butts are small offline storage devices designed to collect runoff from roofs. They are the most common means of harvesting rainwater for garden use and have a typical capacity of less than $0.5m^3$. Two stage devices can provide some storage volume for attenuation using a throttled overflow, however poor maintenance can lead to blockages. Some of the advantages of water butts are listed below

- Ease of installation
- Inexpensive
- Provides water for non-potable means -typically garden use
- Suitable for all developments.
- Rainwater Butts have been proposed for all ILUs in the scheme.

Figure 8– Rain Water Butt Detail
(Source: SDCC SUDS Explanatory Design & Evaluation guide)

4.3.3 SUDS Tree Pits

SUDS tree pits are designed to collect runoff from the surrounding landscape. They are versatile as they can be integrated into both new and urban renewal enabling trees to thrive by being watered every time it rains. Healthy trees also need sufficient soil to grow, and this growing medium can also be used to store water before being released slowly to the next component of the management train. Tree pits associated with kerb inlet gullies have been proposed throughout the scheme to capture, intercept and treat runoff from hardstanding areas before being released to the next stage of the management train.

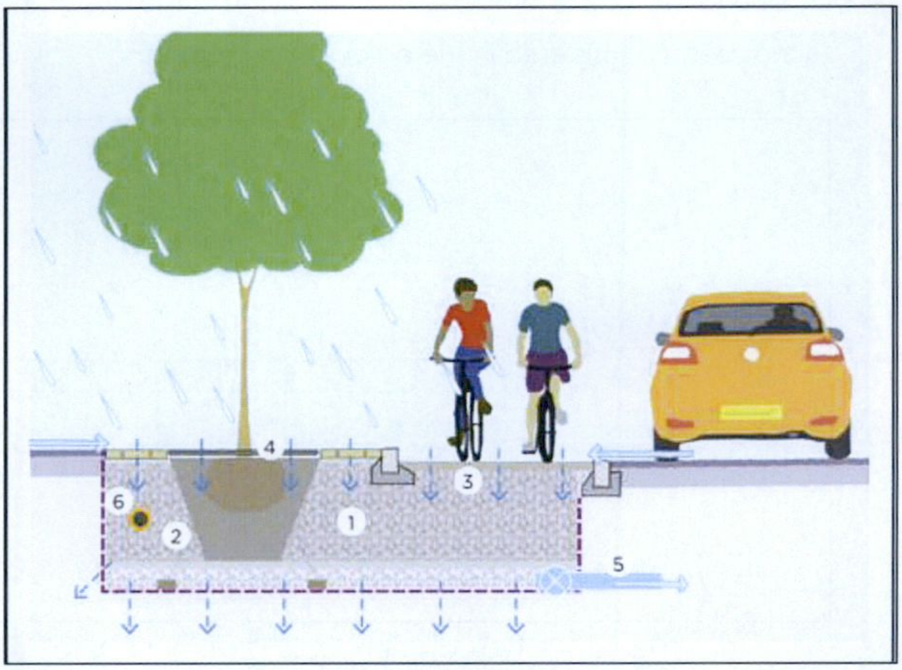


Figure 9– SUDS Tree Pit Detail
(Source: SDCC SUDS Explanatory Design & Evaluation guide)

4.3.4 Pervious Pavements

Pervious pavements provide a pavement suitable for pedestrian and /or vehicular traffic while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before use, infiltration to the ground or controlled discharge downstream depending on the site conditions.

Pervious surfaces in combination with their associated substructures, are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of the runoff and providing a treatment medium. Concrete Block Permeable Paving has been proposed for all parking bays across the scheme, representing a total area of 350m² providing 56m³ of storage. Due to the lack of information at this stage of the design infiltration has not been considered in the calculation process.

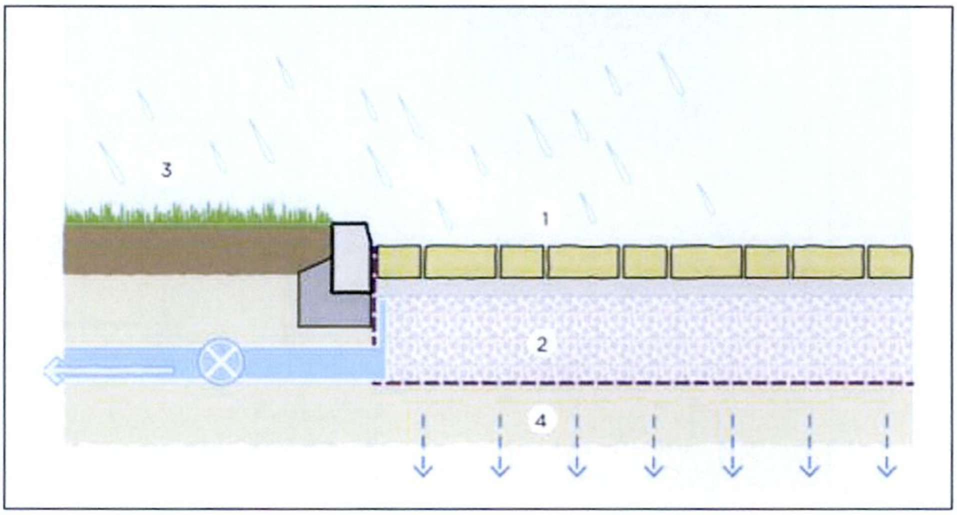


Figure 10– Typical Permeable Pavement Detail
(*Source:* SDCC SUDS Explanatory Design & Evaluation guide)

### 4.3.5 Detention Basins

Detention basins are dry basins that attenuate stormwater runoff during heavy rainfalls by providing temporary storage with flow control of the attenuated runoff. Detention basins are applicable to most type of developments. As they are normally dry, they can often function as a recreational facility enhancing the site's amenity.

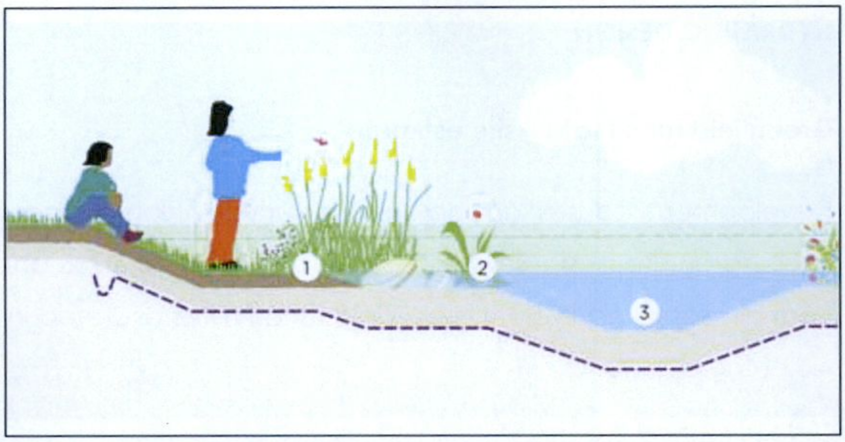


Figure 11– Typical Detention Basin Detail
(*Source*: SDCC SUDS Explanatory Design & Evaluation guide)

# 5.0 HYDRAULIC DESIGN

## 5.1 Greenfield runoff rate – site estimate

Development causes an increase in runoff which increases the risk of flooding on site and elsewhere. SDCC requires that SUDS attenuate runoff from all sites to equivalent greenfield runoff rates as stated in Sub-Criterion 4.3 of the GDSDS.

Greenfield runoff rate is usually calculated as the peak rate of runoff for a specific period due to a rainfall falling on a given area of vegetated land. The calculation of the greenfield runoff rate for the subject site has been carried out using the IH124 equation which predicts a greenfield peak flow rate estimate for the mean annual flood called Qbar (a return period of approximately 1:2.3 years). This value is then factored by a growth rate parameter to give a flow rate for other return periods. The equation uses the site area, the SAAR and the Soil Type as an input in order to determine the flow rates. For calculation purpose a SAAR value of 824mm has been considered. The SAAR has been obtained from https://www.met.ie/climate/services and the Soil Type from the Flood Studies Reports Maps. Additional details of the methodology and input values can be found on Appendix A of this document. The discharge from the development has been limited to 2.0l/s. Refer to Appendix C for further information about online controls.

The below Table 1 summarises the flow rates for different return periods:

Table 1 – Greenfield Runoff Rates

| Return Period | Greenfield runoff rate (l/s/ha) | Attenuation Rate (l/s/ha) |
|---|---|---|
| Qbar (1 in 2.3 year) | 2.16 | 2.0 |
| 1 in 30 year | 4.6 | 2.0 |
| 1 in 100 year | 5.64 | 2.0 |

## 5.2 Storage of Runoff & Discharge

Runoff is attenuated throughout the site as it passes through or is stored in SUDS components which have been chosen to collect, convey and store water based on site and hydraulic requirements.

The GDSDS requires that attenuation storage will be sized for the 100 year event with an allowance of 20% due to the effects of Climate Change, limiting the flows exiting the site to the ones shown in the table above.

The UKSUDS website tool - Surface water storage requirements for sites - has been used for an initial estimate of the site storage requirements. This value has been used as a starting point which has allowed CS Consulting deciding the SUDS strategy and sizing the attenuation structures. Further information about the parameters and the calculation process can be found in Appendix B of this document.

Table 2 – Attenuation Volumes – UKSUDS initial estimate

| Return Period | Attenuation Storage ($m^3$) |
|---|---|
| 1 in 100 year | 556 |

Refer to CS Consulting drawing **D092-CSC-XX-XX-DR-C-0003_Drainage Layout** and Table 3 below for the attenuation storage provided by each drainage element on site.

Table 3 – Attenuation Volumes – MicroDrainage Results

| Drainage Component | Attenuation Storage ($m^3$) |
|---|---|
| Pervious Pavement | 56 |
| Detention Basin | 155 |
| Stormtech Tank | 260 |
| Bioretention Areas | 54.85 |
| Sewers | 13.15 |
| **TOTAL** | 539 |

Additionally, CS Consulting has carried out a hydraulic simulation using MicroDrainage 2020.1 to ensure that there is no flooding in the 1 in 100 year event plus an allowance of 20% due to the effects of the climate change in line with the industry standards. Refer to Appendix C for a summary of the results of the hydraulic simulation for further information.

Final discharge from the proposed development will be to the existing surface water sewer on Greenhills Road.

## 6.0 WATER QUALITY

### 6.1 Water Quality Requirements.

Proposals for the site will comprise residential development and therefore considered to be low risk. Treatment provision is described as follows.

- Roof only runoff – removal of solids. All roofed areas will pass through at least one stage of treatment as per the drainage layout.
- Roads used for vehicular movement. The SUDS management train make provision for collection of runoff through a range of techniques described in the previous sections.

Analysis of the effectiveness of chosen SUDS components to achieve water quality criteria follows the 'Simple Index Approach' described in Chapter 26 of the Ciria C753 SuDS Manual.

| TABLE 26.2 | Pollution hazard indices for different land use classifications | | | | |
|---|---|---|---|---|---|
| | **Land use** | **Pollution hazard level** | **Total suspended solids (TSS)** | **Metals** | **Hydro-carbons** |
| | Residential roofs | Very low | 0.2 | 0.2 | 0.05 |
| | Other roofs (typically commercial/ industrial roofs) | Low | 0.3 | 0.2 (up to 0.8 where there is potential for metals to leach from the roof) | 0.05 |
| | Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day | Low | 0.5 | 0.4 | 0.4 |
| | Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1] | Medium | 0.7 | 0.6 | 0.7 |
| | Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1] | High | 0.8[2] | 0.8[2] | 0.9[2] |

Figure 12– Pollution Hazard Indices for different land use classification
*(Source: CIRIA C753 The SuDS Manual)*

As per the simple index approach, each SuDS component is assigned a 'mitigation index' relative to the three primary sources of pollution listed above; TSS, metals and hydrocarbons. Mitigation indices are added together and water quality criteria are met if the mitigation index is greater than the risk index. Secondary / further stages in the treatment train are assigned treatment indices 50% of stated value identified by SuDS Manual (as per advice provided by SuDS Manual).

As demonstrated in the Table below, the total of the mitigation indices is greater than the risk indices for both types of development on site, so water quality requirements are deemed to have been met. It is noted that tree pits will act similarly to bioretention so have been included a single component for a conservative water quality assessment.

Table 4 – SUDS Mitigation Indices

| Type of SUDS Component | TSS | Metals | Hydrocarbons |
|---|---|---|---|
| Bioretention | 0.8 | 0.8 | 0.8 |
| Permeable Pavement | 0.35 | 0.3 | 0.35 |
| Detention basin | 0.25 | 0.25 | 0.3 |
| TOTAL | 1.4 | 1.35 | 1.45 |

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## Appendix A: Greenfield Runoff Rate Calculations

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

| | |
|---|---|
| Calculated by: | Marc Montrull |
| Site name: | D092 - Greenhills |
| Site location: | Tallaght, Dublin 24 |

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

**Site Details**

| | |
|---|---|
| Latitude: | 53.28947° N |
| Longitude: | 6.35899° W |
| Reference: | 3416841418 |
| Date: | Nov 25 2022 11:13 |

**Runoff estimation approach** IH124

**Site characteristics**

Total site area (ha): 0.98

**Methodology**

| | |
|---|---|
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

| Soil characteristics | Default | Edited |
|---|---|---|
| SOIL type: | 2 | 2 |
| HOST class: | N/A | N/A |
| SPR/SPRHOST: | 0.3 | 0.3 |

| Hydrological characteristics | Default | Edited |
|---|---|---|
| SAAR (mm): | 1015 | 824 |
| Hydrological region: | 12 | 12 |
| Growth curve factor 1 year: | 0.85 | 0.85 |
| Growth curve factor 30 years: | 2.13 | 2.13 |
| Growth curve factor 100 years: | 2.61 | 2.61 |
| Growth curve factor 200 years: | 2.86 | 2.86 |

**Notes**

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

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

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

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

**(3) Is SPR/SPRHOST ≤ 0.3?**

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

| Greenfield runoff rates | Default | Edited |
|---|---|---|
| $Q_{BAR}$ (l/s): | 2.76 | 2.16 |
| 1 in 1 year (l/s): | 2.34 | 1.84 |
| 1 in 30 years (l/s): | 5.88 | 4.6 |
| 1 in 100 year (l/s): | 7.2 | 5.64 |
| 1 in 200 years (l/s): | 7.89 | 6.18 |

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## Appendix B: Attenuation Storage calculations

Print Close Report

HR Wallingford
Working with water

# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

| | |
|---|---|
| Calculated by: | Marc Montrull |
| Site name: | D092 - Greenhills |
| Site location: | Tallaght |

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

**Site Details**

| | |
|---|---|
| Latitude: | 53.28939° N |
| Longitude: | 6.35874° W |
| Reference: | 1253333531 |
| Date: | Nov 23 2022 12:25 |

## Site characteristics

| | |
|---|---|
| Total site area (ha): | 0.98 |
| Significant public open space (ha): | 0.212 |
| Area positively drained (ha): | 0.768 |
| Impermeable area (ha): | 0.545 |
| Percentage of drained area that is impermeable (%): | 71 |
| Impervious area drained via infiltration (ha): | 0 |
| Return period for infiltration system design (year): | 10 |
| Impervious area drained to rainwater harvesting (ha): | 0 |
| Return period for rainwater harvesting system (year): | 10 |
| Compliance factor for rainwater harvesting system (%): | 66 |
| Net site area for storage volume design (ha): | 0.77 |
| Net impermable area for storage volume design (ha): | 0.57 |
| Pervious area contribution to runoff (%): | 30 |

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of $Q_{BAR}$ and other flow rates will have been reduced accordingly.

## Design criteria

| | |
|---|---|
| Climate change allowance factor: | 1.2 |
| Urban creep allowance factor: | 1.0 |
| Volume control approach | Use long term storage |
| Interception rainfall depth (mm): | 5 |
| Minimum flow rate (l/s): | 2 |

## Methodology

| | |
|---|---|
| esti | IH124 |
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| SOIL type: | 2 | 2 |
| SPR: | 0.3 | 0.3 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| Rainfall 100 yrs 6 hrs: | -- | 84.1 |
| Rainfall 100 yrs 12 hrs: | -- | 106.2 |
| FEH / FSR conversion factor: | 1 | 1.45 |
| SAAR (mm): | 1015 | 824 |
| M5-60 Rainfall Depth (mm): | 14 | 17 |
| 'r' Ratio M5-60/M5-2 day: | 0.3 | 0.3 |
| Hydological region: | 12 | 12 |
| Growth curve factor 1 year: | 0.85 | 0.85 |
| Growth curve factor 10 year: | 1.72 | 1.72 |
| Growth curve factor 30 year: | 2.13 | 2.13 |
| Growth curve factor 100 years: | 2.61 | 2.61 |
| $Q_{BAR}$ for total site area (l/s): | 2.76 | 2.16 |
| $Q_{BAR}$ for net site area (l/s): | 2.16 | 1.69 |

| Site discharge rates | Default | Edited |
| --- | --- | --- |
| 1 in 1 year (l/s): | 2 | 2 |
| 1 in 30 years (l/s): | 4.6 | 3.6 |
| 1 in 100 year (l/s): | 5.6 | 4.4 |

| Estimated storage volumes | Default | Edited |
| --- | --- | --- |
| Attenuation storage 1/100 years ($m^3$): | 159 | 452 |
| Long term storage 1/100 years ($m^3$): | 95 | 104 |
| Total storage 1/100 years ($m^3$): | 254 | 556 |

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## Appendix C: Hydraulic simulation results

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

| | | | |
|---|---|---|---|
| Return Period (years) | 100 | PIMP (%) | 100 |
| M5-60 (mm) | 18.500 | Add Flow / Climate Change (%) | 0 |
| Ratio R | 0.264 | Minimum Backdrop Height (m) | 0.200 |
| Maximum Rainfall (mm/hr) | 50 | Maximum Backdrop Height (m) | 1.500 |
| Maximum Time of Concentration (mins) | 30 | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha) | 0.000 | Min Vel for Auto Design only (m/s) | 1.00 |
| Volumetric Runoff Coeff. | 0.750 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Time Area Diagram for Storm

| Time (mins) | Area (ha) | Time (mins) | Area (ha) |
|---|---|---|---|
| 0-4 | 0.230 | 4-8 | 0.290 |

Total Area Contributing (ha) = 0.520

Total Pipe Volume (m³) = 13.156

### Network Design Table for Storm

« - Indicates pipe capacity < flow

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | 10.319 | 0.176 | 58.6 | 0.022 | 4.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.001 | 13.346 | 0.219 | 61.0 | 0.018 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.002 | 8.094 | 0.081 | 99.4 | 0.015 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.003 | 15.068 | 0.152 | 99.4 | 0.023 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.004 | 9.351 | 0.094 | 99.4 | 0.019 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.005 | 19.179 | 0.331 | 58.0 | 0.020 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S2.000 | 25.771 | 0.441 | 58.5 | 0.010 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S3.000 | 4.535 | 0.078 | 58.5 | 0.035 | 4.00 | 0.0 | 0.600 | o | 100 | Pipe/Conduit | |

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | 50.00 | 4.13 | 89.325 | 0.022 | 0.0 | 0.0 | 0.0 | 1.32 | 23.3 | 2.9 |
| S1.001 | 50.00 | 4.30 | 89.149 | 0.040 | 0.0 | 0.0 | 0.0 | 1.29 | 22.8 | 5.4 |
| S1.002 | 50.00 | 4.44 | 88.930 | 0.055 | 0.0 | 0.0 | 0.0 | 1.01 | 17.8 | 7.4 |
| S1.003 | 50.00 | 4.69 | 88.849 | 0.077 | 0.0 | 0.0 | 0.0 | 1.01 | 17.8 | 10.5 |
| S1.004 | 50.00 | 4.81 | 88.622 | 0.096 | 0.0 | 0.0 | 0.0 | 1.31 | 52.1 | 13.0 |
| S1.005 | 50.00 | 4.99 | 88.528 | 0.116 | 0.0 | 0.0 | 0.0 | 1.72 | 68.4 | 15.7 |
| S2.000 | 50.00 | 4.25 | 88.763 | 0.010 | 0.0 | 0.0 | 0.0 | 1.71 | 68.1 | 1.4 |
| S3.000 | 50.00 | 4.07 | 88.750 | 0.035 | 0.0 | 0.0 | 0.0 | 1.01 | 7.9 | 4.7 |

## Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.006 | 22.526 | 0.134 | 168.2 | 0.024 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.000 | 13.953 | 0.239 | 58.5 | 0.046 | 4.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S4.001 | 15.636 | 0.158 | 99.0 | 0.091 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S4.002 | 8.283 | 0.143 | 58.0 | 0.009 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.007 | 12.595 | 0.052 | 241.9 | 0.049 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.008 | 21.197 | 0.088 | 241.9 | 0.006 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S5.000 | 11.246 | 0.192 | 58.6 | 0.005 | 4.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S5.001 | 15.506 | 0.154 | 100.7 | 0.005 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S5.002 | 5.002 | 0.050 | 100.7 | 0.005 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.009 | 8.641 | 0.036 | 241.9 | 0.017 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.010 | 7.472 | 0.031 | 241.9 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.011 | 14.222 | 0.059 | 241.9 | 0.005 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.012 | 12.832 | 0.053 | 241.9 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.013 | 10.529 | 0.044 | 241.9 | 0.048 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.014 | 6.721 | 0.028 | 241.9 | 0.050 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.015 | 29.321 | 0.121 | 241.9 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.006 | 50.00 | 5.36 | 88.198 | 0.185 | 0.0 | 0.0 | 0.0 | 1.01 | 40.0 | 25.0 |
| S4.000 | 50.00 | 4.18 | 89.100 | 0.046 | 0.0 | 0.0 | 0.0 | 1.32 | 23.3 | 6.3 |
| S4.001 | 50.00 | 4.43 | 89.000 | 0.137 | 0.0 | 0.0 | 0.0 | 1.01 | 17.8« | 18.5 |
| S4.002 | 50.00 | 4.51 | 88.767 | 0.146 | 0.0 | 0.0 | 0.0 | 1.72 | 68.4 | 19.7 |
| S1.007 | 50.00 | 5.57 | 87.989 | 0.380 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 51.4 |
| S1.008 | 50.00 | 5.92 | 87.937 | 0.386 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 52.2 |
| S5.000 | 50.00 | 4.14 | 88.600 | 0.005 | 0.0 | 0.0 | 0.0 | 1.32 | 23.3 | 0.6 |
| S5.001 | 50.00 | 4.40 | 88.408 | 0.010 | 0.0 | 0.0 | 0.0 | 1.00 | 17.7 | 1.3 |
| S5.002 | 50.00 | 4.48 | 88.254 | 0.014 | 0.0 | 0.0 | 0.0 | 1.00 | 17.7 | 2.0 |
| S1.009 | 50.00 | 6.07 | 87.849 | 0.417 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 56.4 |
| S1.010 | 50.00 | 6.19 | 87.813 | 0.417 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 56.4 |
| S1.011 | 50.00 | 6.43 | 87.782 | 0.422 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 57.1 |
| S1.012 | 50.00 | 6.64 | 87.724 | 0.422 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 57.1 |
| S1.013 | 50.00 | 6.81 | 87.671 | 0.470 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 63.6 |
| S1.014 | 50.00 | 6.92 | 87.627 | 0.520 | 0.0 | 0.0 | 0.0 | 1.01 | 71.1 | 70.4 |
| S1.015 | 50.00 | 7.51 | 87.599 | 0.520 | 0.0 | 0.0 | 0.0 | 0.84 | 33.2« | 70.4 |

## Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIC01 | 89.850 | 0.525 | Open Manhole | 450 | S1.000 | 89.325 | 150 | | | | |
| SIC02 | 89.950 | 0.801 | Open Manhole | 450 | S1.001 | 89.149 | 150 | S1.000 | 89.149 | 150 | |
| SIC03 | 90.050 | 1.120 | Open Manhole | 450 | S1.002 | 88.930 | 150 | S1.001 | 88.930 | 150 | |
| S4 | 90.250 | 1.401 | Open Manhole | 450 | S1.003 | 88.849 | 150 | S1.002 | 88.849 | 150 | |
| SIC04 | 90.250 | 1.628 | Open Manhole | 450 | S1.004 | 88.622 | 225 | S1.003 | 88.697 | 150 | |
| SWMH01 | 90.250 | 1.722 | Open Manhole | 1200 | S1.005 | 88.528 | 225 | S1.004 | 88.528 | 225 | |
| SWMH12 | 89.750 | 0.987 | Open Manhole | 1200 | S2.000 | 88.763 | 225 | | | | |
| SPP1 | 90.050 | 1.300 | Open Manhole | 1200 | S3.000 | 88.750 | 100 | | | | |
| SWMH02 | 90.000 | 1.802 | Open Manhole | 1200 | S1.006 | 88.198 | 225 | S1.005 | 88.198 | 225 | |
| | | | | | | | | S2.000 | 88.323 | 225 | 125 |
| | | | | | | | | S3.000 | 88.672 | 100 | 350 |
| SWMH13 | 90.000 | 0.900 | Open Manhole | 1200 | S4.000 | 89.100 | 150 | | | | |
| SDB1 | 90.000 | 1.139 | Open Manhole | 1200 | S4.001 | 89.000 | 150 | S4.000 | 88.861 | 150 | |
| S6 | 90.000 | 1.233 | Open Manhole | 1200 | S4.002 | 88.767 | 225 | S4.001 | 88.842 | 150 | |
| SWMH03 | 89.750 | 1.761 | Open Manhole | 1200 | S1.007 | 87.989 | 300 | S1.006 | 88.064 | 225 | |
| | | | | | | | | S4.002 | 88.624 | 225 | 561 |
| SWMH04 | 89.750 | 1.813 | Open Manhole | 1200 | S1.008 | 87.937 | 300 | S1.007 | 87.937 | 300 | |
| SIC06 | 89.900 | 1.300 | Open Manhole | 450 | S5.000 | 88.600 | 150 | | | | |
| SIC07 | 89.900 | 1.492 | Open Manhole | 450 | S5.001 | 88.408 | 150 | S5.000 | 88.408 | 150 | |
| SIC08 | 89.900 | 1.646 | Open Manhole | 450 | S5.002 | 88.254 | 150 | S5.001 | 88.254 | 150 | |
| SWMH05 | 89.600 | 1.751 | Open Manhole | 1200 | S1.009 | 87.849 | 300 | S1.008 | 87.849 | 300 | |
| | | | | | | | | S5.002 | 88.204 | 150 | 205 |
| SWMH06 | 89.500 | 1.687 | Open Manhole | 1200 | S1.010 | 87.813 | 300 | S1.009 | 87.813 | 300 | |
| SWMH07 | 89.500 | 1.718 | Open Manhole | 1200 | S1.011 | 87.782 | 300 | S1.010 | 87.782 | 300 | |
| SWMH08 | 89.500 | 1.776 | Open Manhole | 1200 | S1.012 | 87.724 | 300 | S1.011 | 87.724 | 300 | |
| SWMH09 | 90.000 | 2.329 | Open Manhole | 1200 | S1.013 | 87.671 | 300 | S1.012 | 87.671 | 300 | |
| SATT1 | 90.000 | 2.373 | Open Manhole | 1200 | S1.014 | 87.627 | 300 | S1.013 | 87.627 | 300 | |
| SWMH11 | 90.000 | 2.401 | Open Manhole | 1200 | S1.015 | 87.599 | 225 | S1.014 | 87.599 | 300 | |
| S | 88.800 | 1.322 | Open Manhole | 1200 | | OUTFALL | | S1.015 | 87.478 | 225 | |

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North) |
|---|---|---|---|---|---|---|
| SIC01 | 709399.903 | 727838.623 | 709399.903 | 727838.623 | Required | |
| SIC02 | 709409.864 | 727835.926 | 709409.864 | 727835.926 | Required | |
| SIC03 | 709422.746 | 727832.439 | 709422.746 | 727832.439 | Required | |
| S4 | 709430.559 | 727830.324 | 709430.559 | 727830.324 | Required | |

## Manhole Schedules for Storm

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North) |
|---|---|---|---|---|---|---|
| SIC04 | 709445.103 | 727826.387 | 709445.103 | 727826.387 | Required | |
| SWMH01 | 709447.551 | 727835.412 | 709447.551 | 727835.412 | Required | |
| SWMH12 | 709404.169 | 727847.180 | 709404.169 | 727847.180 | Required | |
| SPP1 | 709427.798 | 727836.071 | 709427.798 | 727836.071 | Required | |
| SWMH02 | 709429.041 | 727840.433 | 709429.041 | 727840.433 | Required | |
| SWMH13 | 709407.252 | 727872.307 | 709407.252 | 727872.307 | Required | |
| SDB1 | 709410.971 | 727858.859 | 709410.971 | 727858.859 | Required | |
| S6 | 709425.636 | 727864.283 | 709425.636 | 727864.283 | Required | |
| SWMH03 | 709433.719 | 727862.469 | 709433.719 | 727862.469 | Required | |
| SWMH04 | 709440.502 | 727873.081 | 709440.502 | 727873.081 | Required | |
| SIC06 | 709430.722 | 727873.595 | 709430.722 | 727873.595 | Required | |
| SIC07 | 709441.666 | 727876.185 | 709441.666 | 727876.185 | Required | |
| SIC08 | 709456.755 | 727879.756 | 709456.755 | 727879.756 | Required | |
| SWMH05 | 709461.229 | 727877.519 | 709461.229 | 727877.519 | Required | |
| SWMH06 | 709464.875 | 727885.353 | 709464.875 | 727885.353 | Required | |
| SWMH07 | 709465.934 | 727892.750 | 709465.934 | 727892.750 | Required | |
| SWMH08 | 709462.659 | 727906.590 | 709462.659 | 727906.590 | Required | |
| SWMH09 | 709450.171 | 727903.638 | 709450.171 | 727903.638 | Required | |

Manhole Schedules for Storm

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North) |
|---|---|---|---|---|---|---|
| SATT1 | 709447.423 | 727913.802 | 709447.423 | 727913.802 | Required | |
| SWMH11 | 709454.039 | 727914.988 | 709454.039 | 727914.988 | Required | |
| S | 709481.135 | 727926.192 | | | No Entry | |

## PIPELINE SCHEDULES for Storm

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S1.000 | o | 150 | SIC01 | 89.850 | 89.325 | 0.375 | Open Manhole | 450 |
| S1.001 | o | 150 | SIC02 | 89.950 | 89.149 | 0.651 | Open Manhole | 450 |
| S1.002 | o | 150 | SIC03 | 90.050 | 88.930 | 0.970 | Open Manhole | 450 |
| S1.003 | o | 150 | S4 | 90.250 | 88.849 | 1.251 | Open Manhole | 450 |
| S1.004 | o | 225 | SIC04 | 90.250 | 88.622 | 1.403 | Open Manhole | 450 |
| S1.005 | o | 225 | SWMH01 | 90.250 | 88.528 | 1.497 | Open Manhole | 1200 |
| S2.000 | o | 225 | SWMH12 | 89.750 | 88.763 | 0.762 | Open Manhole | 1200 |
| S3.000 | o | 100 | SPP1 | 90.050 | 88.750 | 1.200 | Open Manhole | 1200 |
| S1.006 | o | 225 | SWMH02 | 90.000 | 88.198 | 1.577 | Open Manhole | 1200 |
| S4.000 | o | 150 | SWMH13 | 90.000 | 89.100 | 0.750 | Open Manhole | 1200 |
| S4.001 | o | 150 | SDB1 | 90.000 | 89.000 | 0.850 | Open Manhole | 1200 |
| S4.002 | o | 225 | S6 | 90.000 | 88.767 | 1.008 | Open Manhole | 1200 |
| S1.007 | o | 300 | SWMH03 | 89.750 | 87.989 | 1.461 | Open Manhole | 1200 |
| S1.008 | o | 300 | SWMH04 | 89.750 | 87.937 | 1.513 | Open Manhole | 1200 |
| S5.000 | o | 150 | SIC06 | 89.900 | 88.600 | 1.150 | Open Manhole | 450 |
| S5.001 | o | 150 | SIC07 | 89.900 | 88.408 | 1.342 | Open Manhole | 450 |
| S5.002 | o | 150 | SIC08 | 89.900 | 88.254 | 1.496 | Open Manhole | 450 |
| S1.009 | o | 300 | SWMH05 | 89.600 | 87.849 | 1.451 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S1.000 | 10.319 | 58.6 | SIC02 | 89.950 | 89.149 | 0.651 | Open Manhole | 450 |
| S1.001 | 13.346 | 61.0 | SIC03 | 90.050 | 88.930 | 0.970 | Open Manhole | 450 |
| S1.002 | 8.094 | 99.4 | S4 | 90.250 | 88.849 | 1.251 | Open Manhole | 450 |
| S1.003 | 15.068 | 99.4 | SIC04 | 90.250 | 88.697 | 1.403 | Open Manhole | 450 |
| S1.004 | 9.351 | 99.4 | SWMH01 | 90.250 | 88.528 | 1.497 | Open Manhole | 1200 |
| S1.005 | 19.179 | 58.0 | SWMH02 | 90.000 | 88.198 | 1.577 | Open Manhole | 1200 |
| S2.000 | 25.771 | 58.5 | SWMH02 | 90.000 | 88.323 | 1.452 | Open Manhole | 1200 |
| S3.000 | 4.535 | 58.5 | SWMH02 | 90.000 | 88.672 | 1.228 | Open Manhole | 1200 |
| S1.006 | 22.526 | 168.2 | SWMH03 | 89.750 | 88.064 | 1.461 | Open Manhole | 1200 |
| S4.000 | 13.953 | 58.5 | SDB1 | 90.000 | 88.861 | 0.989 | Open Manhole | 1200 |
| S4.001 | 15.636 | 99.0 | S6 | 90.000 | 88.842 | 1.008 | Open Manhole | 1200 |
| S4.002 | 8.283 | 58.0 | SWMH03 | 89.750 | 88.624 | 0.901 | Open Manhole | 1200 |
| S1.007 | 12.595 | 241.9 | SWMH04 | 89.750 | 87.937 | 1.513 | Open Manhole | 1200 |
| S1.008 | 21.197 | 241.9 | SWMH05 | 89.600 | 87.849 | 1.451 | Open Manhole | 1200 |
| S5.000 | 11.246 | 58.6 | SIC07 | 89.900 | 88.408 | 1.342 | Open Manhole | 450 |
| S5.001 | 15.506 | 100.7 | SIC08 | 89.900 | 88.254 | 1.496 | Open Manhole | 450 |
| S5.002 | 5.002 | 100.7 | SWMH05 | 89.600 | 88.204 | 1.246 | Open Manhole | 1200 |
| S1.009 | 8.641 | 241.9 | SWMH06 | 89.500 | 87.813 | 1.387 | Open Manhole | 1200 |

## PIPELINE SCHEDULES for Storm

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S1.010 | o | 300 | SWMH06 | 89.500 | 87.813 | 1.387 | Open Manhole | 1200 |
| S1.011 | o | 300 | SWMH07 | 89.500 | 87.782 | 1.418 | Open Manhole | 1200 |
| S1.012 | o | 300 | SWMH08 | 89.500 | 87.724 | 1.476 | Open Manhole | 1200 |
| S1.013 | o | 300 | SWMH09 | 90.000 | 87.671 | 2.029 | Open Manhole | 1200 |
| S1.014 | o | 300 | SATT1 | 90.000 | 87.627 | 2.073 | Open Manhole | 1200 |
| S1.015 | o | 225 | SWMH11 | 90.000 | 87.599 | 2.176 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S1.010 | 7.472 | 241.9 | SWMH07 | 89.500 | 87.782 | 1.418 | Open Manhole | 1200 |
| S1.011 | 14.222 | 241.9 | SWMH08 | 89.500 | 87.724 | 1.476 | Open Manhole | 1200 |
| S1.012 | 12.832 | 241.9 | SWMH09 | 90.000 | 87.671 | 2.029 | Open Manhole | 1200 |
| S1.013 | 10.529 | 241.9 | SATT1 | 90.000 | 87.627 | 2.073 | Open Manhole | 1200 |
| S1.014 | 6.721 | 241.9 | SWMH11 | 90.000 | 87.599 | 2.101 | Open Manhole | 1200 |
| S1.015 | 29.321 | 241.9 | S | 88.800 | 87.478 | 1.097 | Open Manhole | 1200 |

## Area Summary for Storm

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | User | - | 100 | 0.016 | 0.016 | 0.016 |
| | User | - | 100 | 0.005 | 0.005 | 0.022 |
| 1.001 | User | - | 100 | 0.015 | 0.015 | 0.015 |
| | User | - | 100 | 0.004 | 0.004 | 0.018 |
| 1.002 | User | - | 100 | 0.015 | 0.015 | 0.015 |
| 1.003 | User | - | 100 | 0.018 | 0.018 | 0.018 |
| | User | - | 100 | 0.005 | 0.005 | 0.023 |
| 1.004 | User | - | 100 | 0.012 | 0.012 | 0.012 |
| | User | - | 100 | 0.005 | 0.005 | 0.018 |
| | User | - | 20 | 0.007 | 0.001 | 0.019 |
| 1.005 | User | - | 100 | 0.013 | 0.013 | 0.013 |
| | User | - | 100 | 0.006 | 0.006 | 0.018 |
| | User | - | 20 | 0.007 | 0.001 | 0.020 |
| 2.000 | User | - | 100 | 0.010 | 0.010 | 0.010 |
| 3.000 | User | - | 100 | 0.022 | 0.022 | 0.022 |
| | User | - | 100 | 0.006 | 0.006 | 0.028 |
| | User | - | 100 | 0.006 | 0.006 | 0.035 |
| 1.006 | User | - | 100 | 0.015 | 0.015 | 0.015 |
| | User | - | 20 | 0.045 | 0.009 | 0.024 |
| 4.000 | User | - | 100 | 0.046 | 0.046 | 0.046 |
| 4.001 | User | - | 20 | 0.212 | 0.042 | 0.042 |
| | User | - | 20 | 0.028 | 0.006 | 0.048 |
| | User | - | 20 | 0.056 | 0.011 | 0.059 |
| | User | - | 100 | 0.029 | 0.029 | 0.088 |
| | User | - | 20 | 0.015 | 0.003 | 0.091 |
| 4.002 | User | - | 100 | 0.009 | 0.009 | 0.009 |
| 1.007 | User | - | 90 | 0.023 | 0.021 | 0.021 |
| | User | - | 100 | 0.026 | 0.026 | 0.046 |
| | User | - | 20 | 0.005 | 0.001 | 0.047 |
| | User | - | 20 | 0.010 | 0.002 | 0.049 |
| 1.008 | User | - | 100 | 0.006 | 0.006 | 0.006 |
| 5.000 | User | - | 100 | 0.005 | 0.005 | 0.005 |
| 5.001 | User | - | 100 | 0.005 | 0.005 | 0.005 |
| 5.002 | User | - | 100 | 0.005 | 0.005 | 0.005 |
| 1.009 | User | - | 100 | 0.015 | 0.015 | 0.015 |
| | User | - | 20 | 0.010 | 0.002 | 0.017 |
| 1.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.011 | User | - | 20 | 0.025 | 0.005 | 0.005 |
| 1.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.013 | User | - | 100 | 0.048 | 0.048 | 0.048 |
| 1.014 | User | - | 100 | 0.029 | 0.029 | 0.029 |
| | User | - | 20 | 0.106 | 0.021 | 0.050 |
| 1.015 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| | | | | Total | Total | Total |
| | | | | 0.944 | 0.520 | 0.520 |

## Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| S1.015 | S | 88.800 | 87.478 | 87.478 | 1200 | 0 |

## Simulation Criteria for Storm

| | | | |
|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Additional Flow - % of Total Flow | 0.000 |
| Areal Reduction Factor | 1.000 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start (mins) | 0 | Inlet Coeffiecient | 0.800 |
| Hot Start Level (mm) | 0 | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins) | 60 |
| Foul Sewage per hectare (l/s) | 0.000 | Output Interval (mins) | 1 |

| | | | | | |
|---|---|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Offline Controls | 0 | Number of Time/Area Diagrams | 0 |
| Number of Online Controls | 2 | Number of Storage Structures | 3 | Number of Real Time Controls | 0 |

## Synthetic Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Profile Type | Summer |
| Return Period (years) | 100 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 18.500 | Storm Duration (mins) | 30 |
| Ratio R | 0.264 | | |

## Online Controls for Storm

### Hydro-Brake® Optimum Manhole: S6, DS/PN: S4.002, Volume (m³): 1.6

| | |
|---|---|
| Unit Reference | MD-SHE-0052-1500-1500-1500 |
| Design Head (m) | 1.500 |
| Design Flow (l/s) | 1.5 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 52 |
| Invert Level (m) | 88.842 |
| Minimum Outlet Pipe Diameter (mm) | 75 |
| Suggested Manhole Diameter (mm) | 1200 |

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

### Hydro-Brake® Optimum Manhole: SWMH11, DS/PN: S1.015, Volume (m³): 3.1

| | |
|---|---|
| Unit Reference | MD-SHE-0059-2000-1728-2000 |
| Design Head (m) | 1.728 |
| Design Flow (l/s) | 2.0 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 59 |
| Invert Level (m) | 87.599 |
| Minimum Outlet Pipe Diameter (mm) | 75 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.728 | 2.0 | Kick-Flo® | 0.526 | 1.2 |
| Flush-Flo™ | 0.258 | 1.4 | Mean Flow over Head Range | - | 1.5 |

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

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 1.2 | 0.400 | 1.4 | 0.800 | 1.4 | 1.400 | 1.8 | 2.000 | 2.1 |
| 0.200 | 1.4 | 0.500 | 1.2 | 1.000 | 1.6 | 1.600 | 1.9 | 2.200 | 2.2 |
| 0.300 | 1.4 | 0.600 | 1.2 | 1.200 | 1.7 | 1.800 | 2.0 | 2.400 | 2.3 |

Hydro-Brake® Optimum Manhole: SWMH11, DS/PN: S1.015, Volume (m³): 3.1

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2.600 | 2.4 | 4.000 | 2.9 | 5.500 | 3.4 | 7.000 | 3.8 | 8.500 | 4.2 |
| 3.000 | 2.6 | 4.500 | 3.1 | 6.000 | 3.5 | 7.500 | 3.9 | 9.000 | 4.3 |
| 3.500 | 2.8 | 5.000 | 3.3 | 6.500 | 3.7 | 8.000 | 4.1 | 9.500 | 4.4 |

## Storage Structures for Storm

### Porous Car Park Manhole: SPP1, DS/PN: S3.000

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 4.8 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 45.0 |
| Max Percolation (l/s) | 60.0 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.40 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 89.650 | Membrane Depth (mm) | 0 |

### Infiltration Basin Manhole: SDB1, DS/PN: S4.001

| | | | |
|---|---|---|---|
| Invert Level (m) | 89.000 | Safety Factor | 2.0 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 1.00 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | | |

| **Depth (m)** | **Area (m²)** | **Depth (m)** | **Area (m²)** | **Depth (m)** | **Area (m²)** |
|---|---|---|---|---|---|
| 0.000 | 246.0 | 0.500 | 336.5 | 1.000 | 441.1 |

### Tank or Pond Manhole: SATT1, DS/PN: S1.014

Invert Level (m) 87.627

| **Depth (m)** | **Area (m²)** | **Depth (m)** | **Area (m²)** | **Depth (m)** | **Area (m²)** |
|---|---|---|---|---|---|
| 0.000 | 152.9 | 1.700 | 152.9 | 1.701 | 1.0 |

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.264 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | SIC01 | 15 Summer | 1 | +0% | 100/15 Summer | | | | 89.362 | -0.113 |
| S1.001 | SIC02 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 89.198 | -0.101 |
| S1.002 | SIC03 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 88.997 | -0.083 |
| S1.003 | S4 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 88.927 | -0.071 |
| S1.004 | SIC04 | 15 Winter | 1 | +0% | 30/2160 Winter | | | | 88.699 | -0.148 |
| S1.005 | SWMH01 | 15 Winter | 1 | +0% | 30/1440 Winter | | | | 88.598 | -0.155 |
| S2.000 | SWMH12 | 15 Winter | 1 | +0% | 100/15 Winter | | | | 88.786 | -0.202 |
| S3.000 | SPP1 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 88.811 | -0.039 |
| S1.006 | SWMH02 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 88.318 | -0.104 |
| S4.000 | SWMH13 | 15 Summer | 1 | +0% | 100/15 Summer | | | | 89.155 | -0.095 |
| S4.001 | SDB1 | 480 Winter | 1 | +0% | 30/180 Winter | | | | 89.069 | -0.081 |
| S4.002 | S6 | 480 Winter | 1 | +0% | 1/15 Winter | | | | 89.065 | 0.073 |
| S1.007 | SWMH03 | 1440 Winter | 1 | +0% | 30/15 Summer | | | | 88.226 | -0.063 |
| S1.008 | SWMH04 | 1440 Winter | 1 | +0% | 30/15 Summer | | | | 88.225 | -0.012 |
| S5.000 | SIC06 | 15 Winter | 1 | +0% | 30/1440 Winter | | | | 88.617 | -0.133 |
| S5.001 | SIC07 | 15 Winter | 1 | +0% | 30/480 Winter | | | | 88.434 | -0.124 |
| S5.002 | SIC08 | 15 Winter | 1 | +0% | 30/240 Winter | | | | 88.288 | -0.116 |
| S1.009 | SWMH05 | 1440 Winter | 1 | +0% | 1/720 Winter | | | | 88.224 | 0.075 |
| S1.010 | SWMH06 | 1440 Winter | 1 | +0% | 1/600 Winter | | | | 88.223 | 0.110 |
| S1.011 | SWMH07 | 1440 Winter | 1 | +0% | 1/480 Winter | | | | 88.223 | 0.140 |
| S1.012 | SWMH08 | 1440 Winter | 1 | +0% | 1/360 Winter | | | | 88.222 | 0.198 |
| S1.013 | SWMH09 | 1440 Winter | 1 | +0% | 1/240 Winter | | | | 88.221 | 0.250 |
| S1.014 | SATT1 | 1440 Winter | 1 | +0% | 1/180 Summer | | | | 88.220 | 0.293 |
| S1.015 | SWMH11 | 1440 Winter | 1 | +0% | 1/60 Summer | | | | 88.233 | 0.409 |

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

| PN | US/MH Name | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | SIC01 | 0.000 | 0.14 | | | 2.9 | OK | |
| S1.001 | SIC02 | 0.000 | 0.23 | | | 4.8 | OK | |
| S1.002 | SIC03 | 0.000 | 0.41 | | | 6.4 | OK | |
| S1.003 | S4 | 0.000 | 0.53 | | | 8.7 | OK | |
| S1.004 | SIC04 | 0.000 | 0.25 | | | 10.7 | OK | |
| S1.005 | SWMH01 | 0.000 | 0.21 | | | 12.9 | OK | |
| S2.000 | SWMH12 | 0.000 | 0.02 | | | 1.4 | OK | |
| S3.000 | SPP1 | 0.000 | 0.61 | | 5 | 4.2 | OK | |
| S1.006 | SWMH02 | 0.000 | 0.55 | | | 19.9 | OK | |
| S4.000 | SWMH13 | 0.000 | 0.29 | | | 6.2 | OK | |
| S4.001 | SDB1 | 0.000 | 0.07 | | 221 | 1.2 | OK | |
| S4.002 | S6 | 0.000 | 0.02 | | | 1.1 | SURCHARGED | |
| S1.007 | SWMH03 | 0.000 | 0.06 | | | 3.6 | OK | |
| S1.008 | SWMH04 | 0.000 | 0.06 | | | 3.7 | OK | |
| S5.000 | SIC06 | 0.000 | 0.03 | | | 0.6 | OK | |
| S5.001 | SIC07 | 0.000 | 0.07 | | | 1.2 | OK | |
| S5.002 | SIC08 | 0.000 | 0.12 | | | 1.7 | OK | |
| S1.009 | SWMH05 | 0.000 | 0.07 | | | 4.0 | SURCHARGED | |
| S1.010 | SWMH06 | 0.000 | 0.07 | | | 3.9 | SURCHARGED | |
| S1.011 | SWMH07 | 0.000 | 0.07 | | | 4.0 | SURCHARGED | |
| S1.012 | SWMH08 | 0.000 | 0.07 | | | 4.0 | SURCHARGED | |
| S1.013 | SWMH09 | 0.000 | 0.08 | | | 4.5 | SURCHARGED | |
| S1.014 | SATT1 | 0.000 | 0.08 | | | 4.1 | SURCHARGED | |
| S1.015 | SWMH11 | 0.000 | 0.05 | | | 1.4 | SURCHARGED | |

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.264 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | SIC01 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 89.382 | -0.093 |
| S1.001 | SIC02 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 89.261 | -0.038 |
| S1.002 | SIC03 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 89.194 | 0.114 |
| S1.003 | S4 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 89.113 | 0.114 |
| S1.004 | SIC04 | 2880 Winter | 30 | +0% | 30/2160 Winter | | | | 88.890 | 0.043 |
| S1.005 | SWMH01 | 2880 Winter | 30 | +0% | 30/1440 Winter | | | | 88.890 | 0.137 |
| S2.000 | SWMH12 | 2880 Winter | 30 | +0% | 100/15 Winter | | | | 88.890 | -0.099 |
| S3.000 | SPP1 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 88.939 | 0.089 |
| S1.006 | SWMH02 | 2880 Winter | 30 | +0% | 30/15 Summer | | | | 88.890 | 0.467 |
| S4.000 | SWMH13 | 15 Summer | 30 | +0% | 100/15 Summer | | | | 89.188 | -0.062 |
| S4.001 | SDB1 | 600 Winter | 30 | +0% | 30/180 Winter | | | | 89.171 | 0.021 |
| S4.002 | S6 | 600 Winter | 30 | +0% | 1/15 Winter | | | | 89.167 | 0.175 |
| S1.007 | SWMH03 | 2880 Winter | 30 | +0% | 30/15 Summer | | | | 88.889 | 0.600 |
| S1.008 | SWMH04 | 2880 Winter | 30 | +0% | 30/15 Summer | | | | 88.888 | 0.651 |
| S5.000 | SIC06 | 2880 Winter | 30 | +0% | 30/1440 Winter | | | | 88.886 | 0.136 |
| S5.001 | SIC07 | 2880 Winter | 30 | +0% | 30/480 Winter | | | | 88.886 | 0.328 |
| S5.002 | SIC08 | 2880 Winter | 30 | +0% | 30/240 Winter | | | | 88.886 | 0.482 |
| S1.009 | SWMH05 | 2880 Winter | 30 | +0% | 1/720 Winter | | | | 88.886 | 0.737 |
| S1.010 | SWMH06 | 2880 Winter | 30 | +0% | 1/600 Winter | | | | 88.885 | 0.772 |
| S1.011 | SWMH07 | 2880 Winter | 30 | +0% | 1/480 Winter | | | | 88.884 | 0.802 |
| S1.012 | SWMH08 | 2880 Winter | 30 | +0% | 1/360 Winter | | | | 88.883 | 0.860 |
| S1.013 | SWMH09 | 2880 Winter | 30 | +0% | 1/240 Winter | | | | 88.882 | 0.911 |
| S1.014 | SATT1 | 2880 Winter | 30 | +0% | 1/180 Summer | | | | 88.881 | 0.954 |
| S1.015 | SWMH11 | 2880 Winter | 30 | +0% | 1/60 Summer | | | | 88.896 | 1.072 |

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

| PN | US/MH Name | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | SIC01 | 0.000 | 0.31 | | | 6.4 | OK | |
| S1.001 | SIC02 | 0.000 | 0.54 | | | 11.3 | OK | |
| S1.002 | SIC03 | 0.000 | 1.01 | | | 15.6 | SURCHARGED | |
| S1.003 | S4 | 0.000 | 1.32 | | | 21.6 | SURCHARGED | |
| S1.004 | SIC04 | 0.000 | 0.03 | | | 1.2 | SURCHARGED | |
| S1.005 | SWMH01 | 0.000 | 0.02 | | | 1.4 | SURCHARGED | |
| S2.000 | SWMH12 | 0.000 | 0.00 | | | 0.1 | OK | |
| S3.000 | SPP1 | 0.000 | 1.44 | | 4 | 9.9 | SURCHARGED | |
| S1.006 | SWMH02 | 0.000 | 0.06 | | | 2.3 | SURCHARGED | |
| S4.000 | SWMH13 | 0.000 | 0.64 | | | 13.8 | OK | |
| S4.001 | SDB1 | 0.000 | 0.07 | | 485 | 1.1 | SURCHARGED | |
| S4.002 | S6 | 0.000 | 0.02 | | | 1.1 | SURCHARGED | |
| S1.007 | SWMH03 | 0.000 | 0.07 | | | 3.9 | SURCHARGED | |
| S1.008 | SWMH04 | 0.000 | 0.06 | | | 4.0 | SURCHARGED | |
| S5.000 | SIC06 | 0.000 | 0.00 | | | 0.1 | SURCHARGED | |
| S5.001 | SIC07 | 0.000 | 0.01 | | | 0.1 | SURCHARGED | |
| S5.002 | SIC08 | 0.000 | 0.01 | | | 0.2 | SURCHARGED | |
| S1.009 | SWMH05 | 0.000 | 0.08 | | | 4.3 | SURCHARGED | |
| S1.010 | SWMH06 | 0.000 | 0.08 | | | 4.2 | SURCHARGED | |
| S1.011 | SWMH07 | 0.000 | 0.07 | | | 4.3 | SURCHARGED | |
| S1.012 | SWMH08 | 0.000 | 0.07 | | | 4.2 | SURCHARGED | |
| S1.013 | SWMH09 | 0.000 | 0.08 | | | 4.8 | SURCHARGED | |
| S1.014 | SATT1 | 0.000 | 0.14 | | | 6.9 | SURCHARGED | |
| S1.015 | SWMH11 | 0.000 | 0.06 | | | 1.7 | SURCHARGED | |

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.264 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | SIC01 | 15 Winter | 100 | +20% | 100/15 Summer | | | | 89.829 | 0.354 |
| S1.001 | SIC02 | 15 Winter | 100 | +20% | 100/15 Summer | | | | 89.806 | 0.507 |
| S1.002 | SIC03 | 15 Winter | 100 | +20% | 30/15 Summer | | | | 89.727 | 0.647 |
| S1.003 | S4 | 15 Winter | 100 | +20% | 30/15 Summer | | | | 89.624 | 0.625 |
| S1.004 | SIC04 | 2160 Winter | 100 | +20% | 30/2160 Winter | | | | 89.333 | 0.485 |
| S1.005 | SWMH01 | 2160 Winter | 100 | +20% | 30/1440 Winter | | | | 89.332 | 0.579 |
| S2.000 | SWMH12 | 2160 Winter | 100 | +20% | 100/15 Winter | | | | 89.331 | 0.342 |
| S3.000 | SPP1 | 2160 Winter | 100 | +20% | 30/15 Summer | | | | 89.332 | 0.482 |
| S1.006 | SWMH02 | 2160 Winter | 100 | +20% | 30/15 Summer | | | | 89.331 | 0.908 |
| S4.000 | SWMH13 | 2160 Winter | 100 | +20% | 100/15 Summer | | | | 89.348 | 0.098 |
| S4.001 | SDB1 | 2160 Winter | 100 | +20% | 30/180 Winter | | | | 89.347 | 0.197 |
| S4.002 | S6 | 2160 Winter | 100 | +20% | 1/15 Winter | | | | 89.345 | 0.353 |
| S1.007 | SWMH03 | 2160 Winter | 100 | +20% | 30/15 Summer | | | | 89.328 | 1.039 |
| S1.008 | SWMH04 | 2160 Winter | 100 | +20% | 30/15 Summer | | | | 89.327 | 1.091 |
| S5.000 | SIC06 | 2160 Winter | 100 | +20% | 30/1440 Winter | | | | 89.326 | 0.576 |
| S5.001 | SIC07 | 2160 Winter | 100 | +20% | 30/480 Winter | | | | 89.326 | 0.768 |
| S5.002 | SIC08 | 2160 Winter | 100 | +20% | 30/240 Winter | | | | 89.326 | 0.922 |
| S1.009 | SWMH05 | 2160 Winter | 100 | +20% | 1/720 Winter | | | | 89.326 | 1.177 |
| S1.010 | SWMH06 | 2160 Winter | 100 | +20% | 1/600 Winter | | | | 89.325 | 1.212 |
| S1.011 | SWMH07 | 2160 Winter | 100 | +20% | 1/480 Winter | | | | 89.324 | 1.242 |
| S1.012 | SWMH08 | 2160 Winter | 100 | +20% | 1/360 Winter | | | | 89.323 | 1.299 |
| S1.013 | SWMH09 | 2160 Winter | 100 | +20% | 1/240 Winter | | | | 89.322 | 1.351 |
| S1.014 | SATT1 | 2160 Winter | 100 | +20% | 1/180 Summer | | | | 89.321 | 1.394 |
| S1.015 | SWMH11 | 2160 Winter | 100 | +20% | 1/60 Summer | | | | 89.336 | 1.512 |

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

| PN | US/MH Name | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | SIC01 | 0.000 | 0.38 | | | 8.0 | FLOOD RISK | |
| S1.001 | SIC02 | 0.000 | 0.65 | | | 13.5 | FLOOD RISK | |
| S1.002 | SIC03 | 0.000 | 1.21 | | | 18.7 | SURCHARGED | |
| S1.003 | S4 | 0.000 | 1.67 | | | 27.4 | SURCHARGED | |
| S1.004 | SIC04 | 0.000 | 0.05 | | | 2.1 | SURCHARGED | |
| S1.005 | SWMH01 | 0.000 | 0.04 | | | 2.4 | SURCHARGED | |
| S2.000 | SWMH12 | 0.000 | 0.00 | | | 0.2 | SURCHARGED | |
| S3.000 | SPP1 | 0.000 | 0.11 | | 1204 | 0.8 | SURCHARGED | |
| S1.006 | SWMH02 | 0.000 | 0.10 | | | 3.7 | SURCHARGED | |
| S4.000 | SWMH13 | 0.000 | 0.05 | | | 1.0 | SURCHARGED | |
| S4.001 | SDB1 | 0.000 | 0.06 | | 951 | 1.1 | SURCHARGED | |
| S4.002 | S6 | 0.000 | 0.02 | | | 1.1 | SURCHARGED | |
| S1.007 | SWMH03 | 0.000 | 0.10 | | | 5.7 | SURCHARGED | |
| S1.008 | SWMH04 | 0.000 | 0.09 | | | 5.8 | SURCHARGED | |
| S5.000 | SIC06 | 0.000 | 0.00 | | | 0.1 | SURCHARGED | |
| S5.001 | SIC07 | 0.000 | 0.01 | | | 0.2 | SURCHARGED | |
| S5.002 | SIC08 | 0.000 | 0.02 | | | 0.3 | SURCHARGED | |
| S1.009 | SWMH05 | 0.000 | 0.12 | | | 6.3 | FLOOD RISK | |
| S1.010 | SWMH06 | 0.000 | 0.12 | | | 6.3 | FLOOD RISK | |
| S1.011 | SWMH07 | 0.000 | 0.11 | | | 6.3 | FLOOD RISK | |
| S1.012 | SWMH08 | 0.000 | 0.11 | | | 6.3 | FLOOD RISK | |
| S1.013 | SWMH09 | 0.000 | 0.13 | | | 7.3 | SURCHARGED | |
| S1.014 | SATT1 | 0.000 | 0.06 | | | 3.2 | SURCHARGED | |
| S1.015 | SWMH11 | 0.000 | 0.06 | | | 2.0 | SURCHARGED | |