MALONE O'REGAN
CONSULTING ENGINEERS

SOCIAL HOUSING BUNDLE 4

DEVELOPMENT AT COLLINS AVENUE, WHITEHALL

ENGINEERING REPORT

DUBLIN CITY COUNCIL

July 2024

Job: 23006

Contents Amendment Record

2B Richview Office Park, Clonskeagh, Dublin 14
Tel: +353-1-260 2655 Fax: +353-1-260 2660 E-mail: info@MORce.ie

MALONE O'REGAN

Title: **SOCIAL HOUSING BUNDLE 4**
DEVELOPMENT AT COLLINS AVENUE, WHITEHALL
Engineering Report / Dublin City Council

Job Number: **23006**

Prepared By: **Kezia Adanza** **Signed:** Kezia Adanza

Checked By: **Douglas Weir** **Signed:**

Approved By: **Douglas Weir** **Signed:**

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1 INTRODUCTION

1.1 Introduction

The development is for the proposed development of new social housing on a brownfield site at Collins Avenue, within the townlands of Whitehall, North Dublin. Development at the site will consist of the following:

- The demolition of the existing office building, sheds, warehouses and garages and site clearance works.
- Three apartment blocks comprising a total of 106 residential units and 375 sqm of community, arts and cultural space.
    - Block A ranges from 3 to 6 storeys and consists of 50 no. residential units (22 no. 1 bed, 20 no. 2 bed and 8 no. 3 bed units) and 275 sqm of community, arts and cultural facilities at ground floor level.
    - Block B ranges from 4 to 6 storeys and consists of 38 no. residential units (17 no. 1 bed, 9 no. 2 bed and 12 no. 3 bed units) and 100 sqm of community, arts and cultural facilities at ground floor level.
    - Block C ranges from 4 to 5 storeys and consists of 18 no. residential units (10 no. 1 bed and 8 no. 2 bed units).
- 183 no. long-stay and 63 no. short-stay bicycle parking space, 57 no. car parking spaces and 5 no. motorcycle parking spaces.
- 1,925 sqm of public open space and 3,140 sqm of communal open space.
- One signalised vehicular access is proposed via Collins Avenue and Collins Avenue Extension.
- Provision of pedestrian and cyclist access at northern boundary to allow for future link via Shanowen Business Estate and the Shanowen Hall and Square
- Boundary treatments and planting, public lighting, site drainage works, internal road surfacing and footpath, ESB meter rooms, stores, bin and cycle storage, plant rooms, landscaping; and
- All ancillary site services and development works above and below ground.

The purpose of this document is to describe the engineering proposals associated with the new development. These proposals are indicated on the drawings prepared by Malone O'Regan which accompany the planning submission. Where reference is made to drawings and drawing numbers within this report these should be taken as meaning those drawings produced by Malone O'Regan unless specifically stated otherwise.

1.2 Site Description

The location of the proposed development is illustrated in Figure 1-1 below. The site is situated in the residential area of Whitehall, approximately 4.4km from Dublin city centre. The lands to the north of the site have undergone recent development and are now apartments in the planning phase. There is existing two storey houses bordering the development on the southwest and southeast of the site. the very northeast section of the site borders an existing parkland area. The proximity of the site to natural watercourses is outlined in Figure 1-2 below.

Figure 1-1 – Site location

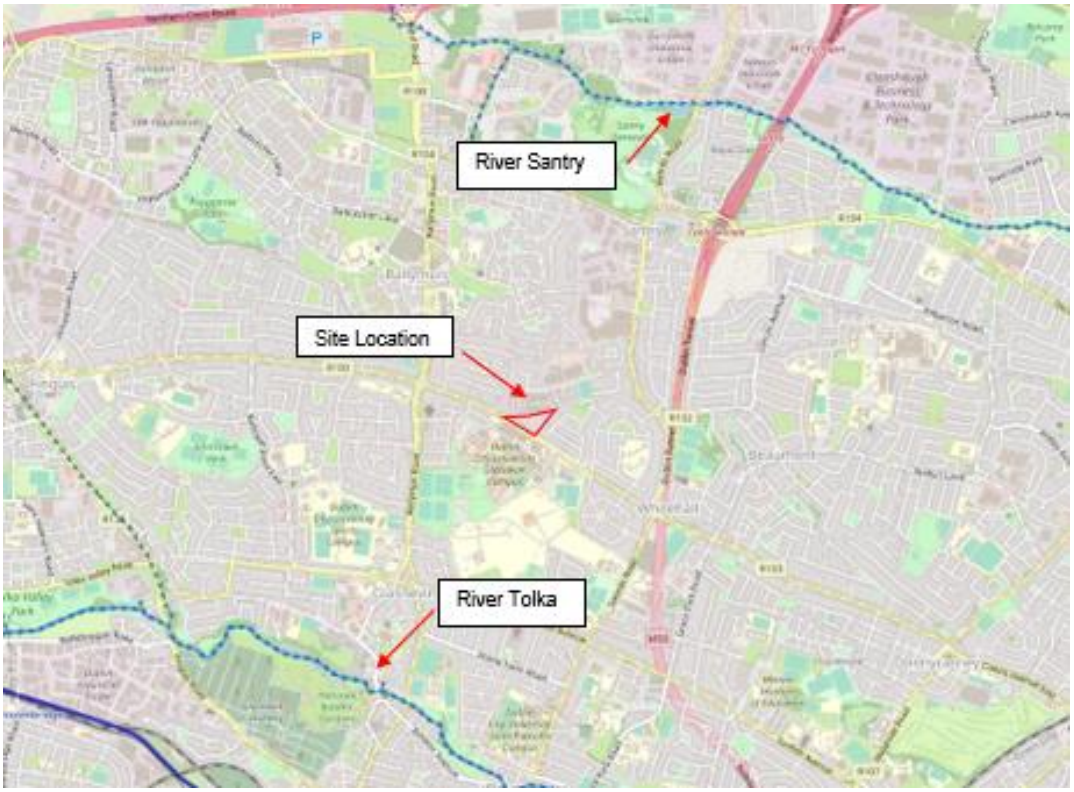


Figure 1-2 – Surrounding Watercourse (Extract from the EPA Maps)

2 SURFACE WATER DRAINAGE DESIGN

2.1 Introduction

This chapter follows the guidelines set out in Greater Dublin Strategic Drainage Study (GDSDS) and the CIRIA 2015 SuDS Manual.

The aim of any SuDS strategy is to ensure that a new development does not negatively affect surrounding watercourse systems, existing surface water networks and groundwater systems. This SuDS strategy will achieve these aims by using a variety of SuDS measures within the site. These measures include water interception, treatment, infiltration and attenuation.

The SuDS strategy will be developed with the following steps:

1. The existing greenfield run-off of the development site will be calculated and used as the minimum benchmark for the SuDS design. This run-off calculation is based on the drained area of the new development. The post development run-off will not exceed the greenfield run-off.
2. A set of SuDS measures will be chosen based on their applicability and usage for the site.
3. A "FLOW" model will be created to analyse the rainfall on the site and the effectiveness of the proposed SuDS measures.
4. If effective, these SuDS measures will be incorporated into the proposed design.

Table 2-1 outlines the parameters adopted in the design of the surface water drainage infrastructure.

Parameter Description	Assigned Value
Surface Water Drainage Pipework Design Return Period	2 years (Ref IS EN 752 Table 2 for 'Residential areas')
Attenuation Design Return Period	100 years
Allowance for climate change	20% (Ref. OPW Flood Risk Management Climate Change Sectoral Adaptation Plan, Mid-Range Future Scenario)
M5-60	16.0mm (Met Eireann data)
M5-2D	57.8mm (Met Eireann data)
Ratio, r	0.28
Time of Entry	4 min
Pipe roughness, Ks	0.6mm (Ref. GDSDS Volume 2, Table 6.4)
Minimum velocity	1.0 m/s (Ref. GDSDS Volume 2, Table 6.4)

Table 2-1 - Surface Water Design Parameters

2.2 Existing Services

An existing network of drainage runs around the perimeter of the site on one side. These underground drains carry surface water runoff towards existing catchment areas in the north Dublin area. Due to the relative levels of the existing drainage within the road and the proposed site levels, it is possible to achieve a gravity connection to the surface water drainage pipework installed. There is a 1050mm concrete sewer running parallel to the northern boundary, this is a culvert of the Wad Stream.

2.3 Proposed Services

The proposed surface water drainage system is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'. CIRIA Design Manuals C753, C697 and C609 have also been used to design the surface water drainage system within the site.

The proposed surface water drainage layout for the development is indicated on Malone O'Regan drawings SHB4-CAD-DR-MOR-CS-P3-130, 150 and 151. Surface water runoff from new internal road surfaces, footpaths, other areas of hardstanding and the roofs of buildings will be collected within a gravity drainage network and directed towards an attenuation storage system. The attenuation storage is sized to cater for a 1 in 100-year storm event.

The outfall from each attenuation storage system will be restricted to the applicable 'greenfield' runoff rate using a Hydrobrake flow control device.

A number of sustainable drainage systems (SuDS) are proposed in order to minimise the volume and rate of runoff from the site. Further details on these SuDS measures are provided in Section 2.5.

All surface water drainage will be designed and installed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

The runoff coefficients used in the calculations are as outlined in the Table 2-2.

Type of Areas	CV
Landscaping (Grass / Soft)	0.2
Intensive Green Roof	0.6
Extensive Green Roof	0.6
Blue Roof	0.6
Permeable Paving	0.5
Impermeable Surface (Incl. tree pits)	0.9
Standard Roof (Impermeable)	0.95

Table 2-2 - Runoff Coefficients

Calculations for the Surface Water Pipe Network are provided in Appendix C.

2.4 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, $QBAR_{rural}$, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation,

$$QBAR_{rural} = 0.00108[Area^{0.89}] \times [SAAR^{1.17}] \times [Soil^{2.17}]$$

Where:

$QBAR_{rural}$	Mean annual flood flow from a rural catchment in m^3/s
Area	Area of the catchment in km^2
SAAR	Standard Average Annual Rainfall in mm.
Soil	Soil index

For catchments smaller than 50 hectares, $QBAR_{rural}$ is first calculated assuming an area of 50ha and then $QBAR_{rural}$ for the site area is calculated on a pro rata basis.

Standard Average Annual Rainfall for the site in Collins Avenue was taken from the Flood Studies Report as 933mm.

Flood Studies Report indicated to Soil Type 4, which has a corresponding Standard Percentage Runoff (SPR) coefficient of 0.47. Soil Type 4 is typically described as highly organic soils such as peat and other unsatisfactory soils as found in swampy marshy areas. From the site investigation of the soil within the site, the soil was described to be Clay or loamy soils with a high runoff potential and therefore, represents a soil type 4.

In February 2024 IGSL completed a comprehensive programme of site investigations for the site. These investigations showed that ground conditions varied considerably across the site. Generally, made ground consisted of concrete or tarmacadam surfaces over engineered gravel hardcore or grey to brownish grey clayey angular gravel with cobbles and concrete fragments for a depth of 1-1.3m. This made ground layer contained some buried plastic rubbish. This fill layer extended up to 1.5m in the northern area of the site due to infill of the old watercourse over time. In some locations the near surface subsoils organic remnants were found containing firm and grey brown to grey silt/clay to depths extending from 0.9-1.3m below ground level. Generally soft and soft to firm grey brown soils up to 2.8m below ground level were logged. The glacial deposits consist of a gradual change from firm to stiff brown grey mottled clay to that of the underlying very stiff dark grey sandy gravelly clay with cobbles and boulders appearing from 0.7-2.5m below ground level.to the northeast of the site this layer appears at 1.9m below ground level. This very stiff clay was found to persist to rockhead at circa 19m below ground level. Recovered cores were logged as fresh to slightly weathered weak to strong medium to thinly bedded light to dark grey black fine-grained limestone.

3 no. infiltration tests were conducted across the site. The results of these tests varied significantly which would be expected given the non-uniform nature of the ground conditions. Infiltration rate of $f=6.569 \times 10^{-7}$ m/s was achieved in SA01but, at the other two test locations, the water level dropped too slowly to allow calculation of the soil infiltration rate. The report prepared by IGSL concludes that the site is not suitable for soakaway design.

When this equation is applied to the proposed development, the following value for $QBAR_{rural}$ is obtained.

For 50ha area $QBAR_{rural}$ = $0.00108 [0.5]^{0.89} \times [933]^{1.17} \times [0.47]^{2.17}$

= $0.338\ m^3/s$

= 338.0 l/s (for 50ha)

$QBAR_{rural}$ = 6.656 l/s for area 1

= 1.698 l/s for area 2

= 2.715 l/s for area 3

For the purposes of surface water attenuation design, the site is dealt with as three catchments as shown in Figure 2-1 and is draining to an existing catchment/treatment system via existing public sewers. A breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coefficients is provided in Table 2.3 to Table 2-8 below.

Figure 2-1 - Surface Water Drainage Catchment Areas

Area 1 – Overall Drainage

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable Area sq.m	Urban Creep Allowance (10%)	Overall Impermeable Area ha
9850.83	Roof - Block A Apartments	Standard - 10%	136.38	0.92	125.47	138.01	3883.23
		Green/Blue Roof - 90%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		3241.74	0.50	1620.87	1782.96	
ha	Landscaped Areas inc. areas from hardstanding		4195.59	0.20	839.12	923.03	ha
0.99							0.39
	Hardstanding		1049.73	0.90	944.75	1039.23	

Table 2-3 - Breakdown of Impermeable Area for Catchment Area 1

Area 1 – Blue/Green Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
1363.78	Roof - Apartments	Standard - 10%		0.92	0.0	0.0	810.1
		Green/Blue Roof - 90%	1227.40	0.60	736.4	810.1	
	Permeable Paving inc. areas from hardstanding			0.50	0.0	0.0	
ha	Landscaped Areas inc. areas from hardstanding			0.20	0.0	0.0	ha
0.14							0.1
	Hardstanding			0.90	0.0	0.0	

Table 2-4 - Breakdown of Impermeable Area for Catchment Area 1 – Blue/Green Roof

Area 2 – Overall Drainage

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable Area sq.m	Urban Creep Allowance (10%)	Overall Impermeable Area ha
2512.73	Roof - Block B Apartments	Standard - 15%	136.18	0.92	125.29	137.81	568.5
		Green/Blue Roof - 85%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding			0.50	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		1504.11	0.20	300.82	330.90	ha
0.25							0.1
	Hardstanding		100.75	0.90	90.68	99.74	

Table 2-5 - Breakdown of Impermeable Area for Catchment Area 2

Area 2 – Blue/Green Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
907.86	Roof - Apartments	Standard - 15%		0.92	0.0	0.0	509.3
		Green/ Blue Roof - 85%	771.68	0.60	463.0	509.3	
	Permeable Paving inc. areas from hardstanding			0.50	0.0	0.0	
ha	Landscaped Areas inc. areas from hardstanding			0.20	0.0	0.0	ha
0.09							0.1
	Hardstanding			0.90	0.0	0.0	

Table 2-6 - Breakdown of Impermeable Area for Catchment Area 2 – Blue/Green Roof

Area 3 – Overall Drainage

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable Area sq.m	Urban Creep Allowance (10%)	Overall Impermeable Area ha
4018.015	Roof - Block C Apartments	Standard - 15%	58.90	0.92	54.19	59.60	1193.1
		Green/Blue Roof - 85%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		774.89	0.50	387.44	426.19	
ha	Landscaped Areas inc. areas from hardstanding		2746.36	0.20	549.27	604.20	ha
0.40							0.1
	Hardstanding		104.12	0.90	93.71	103.08	

Table 2-7 - Breakdown of Impermeable Area for Catchment Area 3

Area 3 – Blue/Green Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
392.647	Roof - Apartments	Standard - 15%		0.92	0.0	0.0	337.8
		Green/Blue Roof - 85%	333.75	0.92	307.0	337.8	
	Permeable Paving inc. areas from hardstanding			0.50	0.0	0.0	
ha	Landscaped Areas inc. areas from hardstanding			0.20	0.0	0.0	ha
0.04							0.0
	Hardstanding			0.90	0.0	0.0	

Table 2-8 - Breakdown of Impermeable Area for Catchment Area 3 – Blue/Green Roof

2.5 Sustainable Drainage Systems (SuDS)

The proposed development will be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS) and will significantly reduce run-off rates and improve storm water quality discharging to the public storm water system. The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimize the impact of urbanisation by replicating the run-off characteristics of the greenfield site. The criteria provide a consistent approach to addressing the increase in both rate and volume of run-off, as well as ensuring the environment is protected from any pollution from roads and buildings. These drainage design criteria are as follows:

- Criterion 1 – River Water Quality Protection
- Criterion 2 – River Regime Protection
- Criterion 3 – Flood Risk Assessment
- Criterion 4 – River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (commonly addressed in interception storage)
- Attenuation storage
- Long term storage (not applicable if growth factors are not applied to Qbar when designing attenuation storage)

2.5.1 Compliance with the principles of the CIRIA C753 SuDS Manual

The C753 SuDS Manual explains that the primary function of SuDS measures is to protect watercourses from any impact due to the new development. However, SuDS can also improve the quality of life in a new development and urban spaces by making them more vibrant, visually attractive, sustainable and more resilient to change. This document explains the wider social context of SuDS and how SuDS can deliver high quality drainage while supporting urban areas to cope better with sever rainfall both in present and future.

There are four main categories of benefits that can be achieved by SuDS:

1. Water Quantity (mitigate flood risk & protect natural water cycle)
2. Water Quality (manage the quality of the runoff to prevent pollution)
3. Amenity (create and sustain better places for people)
4. Biodiversity (create and sustain better places for nature)

Table 2-9 includes a list of all current SuDS measures which would typically be considered when designing a new residential development such as that which is now proposed. This table also outlines the rationale behind the selection of SuDS measures and why other measures would not be appropriate.

The runoff generated from the catchment will be attenuated in storage structures within and below ground and in the blue roof attenuation systems. The proposed attenuation systems

are explained in section 2.5. A wide range of SuDS measures are proposed across the site to maximise interception and treatment.

SUDS Measure	Measure Adopted?	Rationale for Selecting / Not Selecting Measure
Bioretention Swales *Shallow landscaped depressions that serve to reduce runoff rates / volumes as well as providing interception storage, treatment of runoff and encouraging biodiversity*	Yes	Bioretention swales are proposed in areas beside roads and green spaces within the site.
Tree pits *Attenuate surface water runoff by utilising voids within the root zone*	Yes	Tree pits have been specified in suitable areas beside the development roads and car parking.
Green Roofs *Vegetated roofs used to reduce the rate and volume of runoff as well as encouraging biodiversity*	Yes	It is proposed to provide green roofs for flat roofs above apartment and duplex buildings.
Blue Roofs *Provide attenuation storage, reducing requirement for storage elsewhere on site*	Yes	It is proposed to provide blue roofs in areas where the building structure is appropriate to support such roofs. Refer to 'Green Roofs' above.
Green Living Walls *Planted walls which improve air quality and encourage biodiversity*	No	Green walls are not considered appropriate given the proposed residential building use.
Rain Gardens *Localised depressions in the ground that allow infiltration and absorption*	Yes	The proposed residential development aims to provide rain gardens, particularly in green spaces beside roads.
Rainwater harvesting *Runoff captured from roofs is reused for non-potable purposes, thereby reducing overall runoff volume.*	No	In the case of the proposed residential development, it is not considered viable to gather the water for grey water use.
Permeable paving *Allows runoff to percolate into the subsoil, reducing overall runoff volume*	Yes	Permeable paving is proposed within the development in homezones, driveways and car parking spaces.
Porous asphalt *Allows runoff to percolate into the subsoil, reducing overall runoff volume*	No	Porous asphalt is not considered suitable for use in roads within the development as it does not comply with the Local Authority roads standards.
Integrated Constructed Wetlands (ICWs) *System of shallow ponds, planted to treat water, removing nutrients and harmful impurities*	No	ICWs are considered appropriate in the communal open spaces available.
Dry Ponds *Depressed area of site for water infiltration, planted to treat water, removing harmful impurities and provide attenuation*	Yes	Detention Basins are considered appropriate in the communal open spaces available.

Table 2-9 - Proposed SuDS Features

Further details of the principal SuDS features proposed for this development are provided in the following sections

2.5.2 Bioretention Swales

It is proposed to provide a number of discrete, shallow landscaped areas, adjacent to the paved surfaces in the central area of the apartment developments and adjacent to footpaths and roads. Runoff from the surface will be directed towards these bioretention swales. Refer to the details on drawings SHB4-CAD-DR-MOR-CS-P3-150 and 151. These features will provide a level of storage to attenuate the runoff flows and also permit settlement of coarse silts. As described in Section 2.3 above, the permeability of the underlying soils varies across the site. However, it is anticipated that runoff from minor rainfall events will be able to percolate directly into the soil. An overflow from the swales will be provided. This will take the form of a manhole with an open-grated access cover. During larger storm events, the water in the bioretention areas will be able to overflow through the grated access cover and will then drain towards the attenuation system.

The bioretention swales will be planted in order to promote settlement of silt particles. Runoff will also be treated through the adsorption of particles by vegetation or by soil, and by biological activity. Swales can reduce the runoff rates and volumes of surface water. They are very effective in delivering interception and treatment storage.

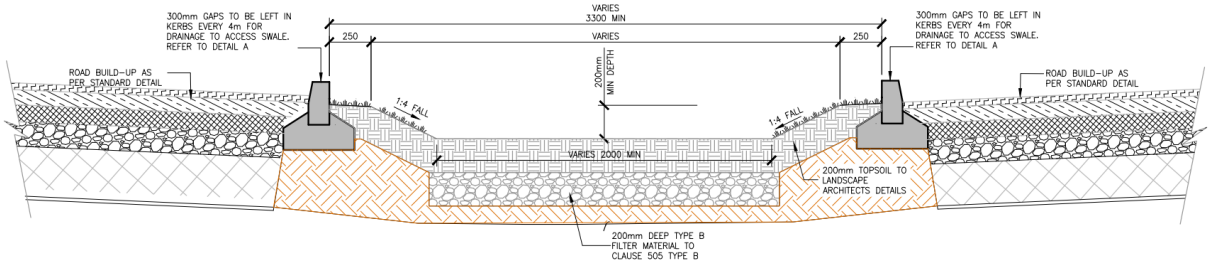


Figure 2-2 - Bio-Retention Area Detail

2.5.3 Tree Pits

It is proposed to provide a number of tree pits adjacent to car parking and footpaths where feasible within the development. Runoff from the roads and footpaths will be directed towards these tree pits. Refer to the details on drawings SHB4-CAD-DR-MOR-CS-P3-150 and 151. These features will provide a level of storage to attenuate the runoff flows. It is anticipated that runoff from minor rainfall events will be able to percolate directly into the soil. An overflow from the tree pits will be provided. During larger storm events, the water in the bioretention areas will be able to overflow and drain towards the attenuation system.

The bioretention areas will be planted in order to promote biodiversity. Runoff will also be treated through the absorption of particles by vegetation or by soil, and by biological activity. Tree pits can reduce the runoff rates and volumes of surface water although the area contributing is small. They are effective in delivering interception and treatment storage.

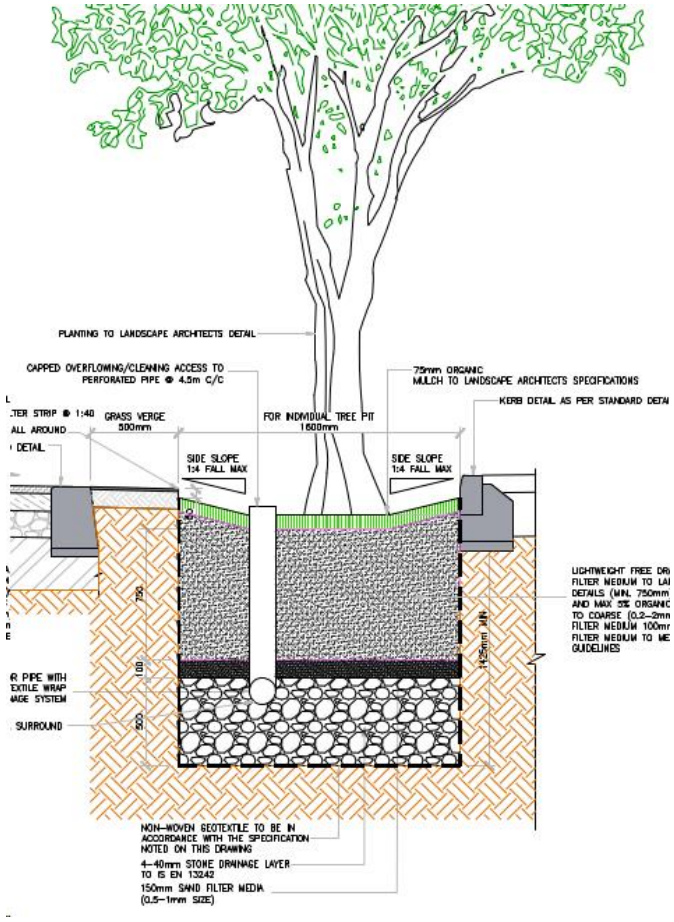


Figure 2-3 – Tree Pit

2.5.4 Green Roofs

Extensive green roofs will be installed above the apartment flat roof buildings. These roofs will provide initial storage of rainwater, while also reducing the rate at which rainwater from heavier rainfall events discharges to the public sewers. They can also help to filter the run-off, removing pollutants and resulting in a higher quality of water discharging into the drainage system and receiving watercourse. Refer to the Malone O'Regan SuDS detail drawing no. SHB4-CAD-DR-MOR-CS-P3-151 for typical roof details.

Extensive roofs have low substrate depths and therefore low loadings on the building structure, they are lightweight and have a low cost to maintain. These systems cover the entire roof area with hardy, slow growing, drought resistant, low maintenance plants and vegetation, such as sedums. The planting usually matures slowly, with the long-term biodiverse benefits being the sought-after results. These roofs are typically only accessed for maintenance and are usually comprised of between 80mm – 150mm overall total depth of growth medium.

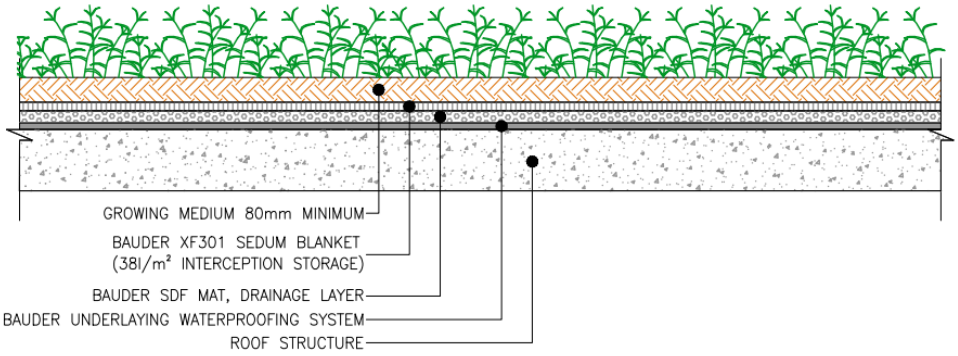


Figure 2-4 – Green Roof Typical Build-up

Extensive green roofs have the effect of providing some initial storage of rainwater, while also reducing the rate at which rainwater from heavier rainfall events will discharge to the main attenuation system. It can also help to filter the run-off, removing any pollutants and resulting in a higher quality of water discharging to the drainage system. A typical extensive green roof system can intercept and retain over 30 litres/m² (i.e., 30 mm) depending on the build-up. Since these roofs are exposed to the Irish climate, there is a high probability that the roof will not be completely dry, and the storage capacity will be compromised on any given rainfall event. Thus, the more conservative estimate of 12 litres/m² (12mm) interception storage will be assumed.

2.5.5 Blue Roofs

Blue roofs will be installed above the apartment flat roof buildings. These roofs will provide initial storage of rainwater, while also reducing the rate at which rainwater from heavier rainfall events discharges to the attenuation systems. They can also help to filter the run-off, removing pollutants and resulting in a higher quality of water discharging into the drainage system and receiving watercourse.

However, it is important to note that a blue roof allows for water storage on the roof in a void which sits above the waterproofing layer and beneath a surface finish such as vegetated green roof or hard landscaping. Flow restrictor outlets are critical to the good working of the roof system. Maintenance requirements are higher for blue roofs to ensure all outlets remain free from debris, silt, leaves etc.

Refer to the Malone O'Regan SuDS detail drawing no. SHB4-CAD-DR-MOR-CS-P3-151 for typical roof details.

The implementation of blue roofs will have considerable loading implications for the roof structure and the waterproofing materials. The normal loads are increased for the planting materials and the increased water storage volume.

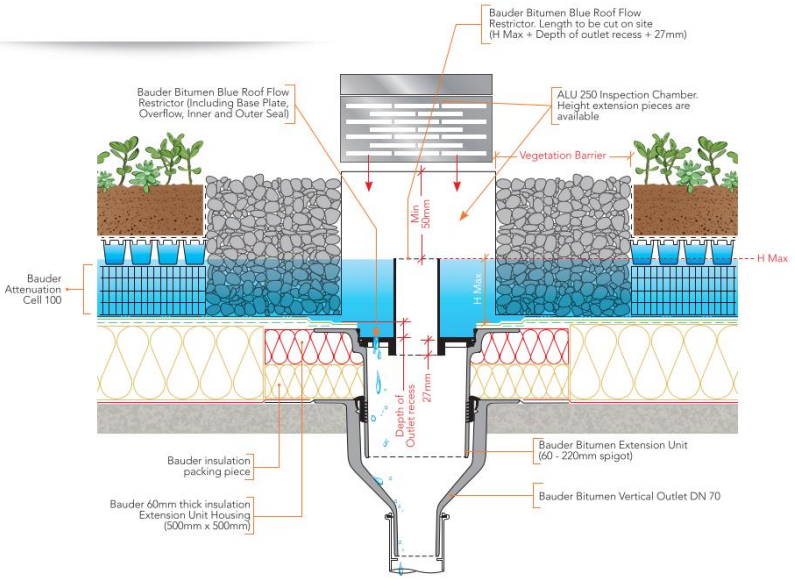


Figure 2-5 – Blue Roof

2.5.6 Rain Garden / Bioretention Area

It is proposed to provide a number of discrete, shallow landscaped areas in grass verges beside the roads and around the open spaces. Runoff from the roofs will be directed towards these bioretention gardens. Refer to the details on drawing SHB5-CAD-DR-MOR-CS-P1-130, 150 and 151. These features will provide a level of storage to attenuate the runoff flows. It is anticipated that runoff from minor rainfall events will be able to percolate directly into the soil. An overflow from the rain gardens will be provided. During larger storm events, the water in the bioretention areas will be able to overflow and drain towards the attenuation system.

The bioretention areas will be planted in order to promote biodiversity. Runoff will also be treated through the adsorption of particles by vegetation or by soil, and by biological activity. Rain gardens can reduce the runoff rates and volumes of surface water. They are very effective in delivering interception and treatment storage.

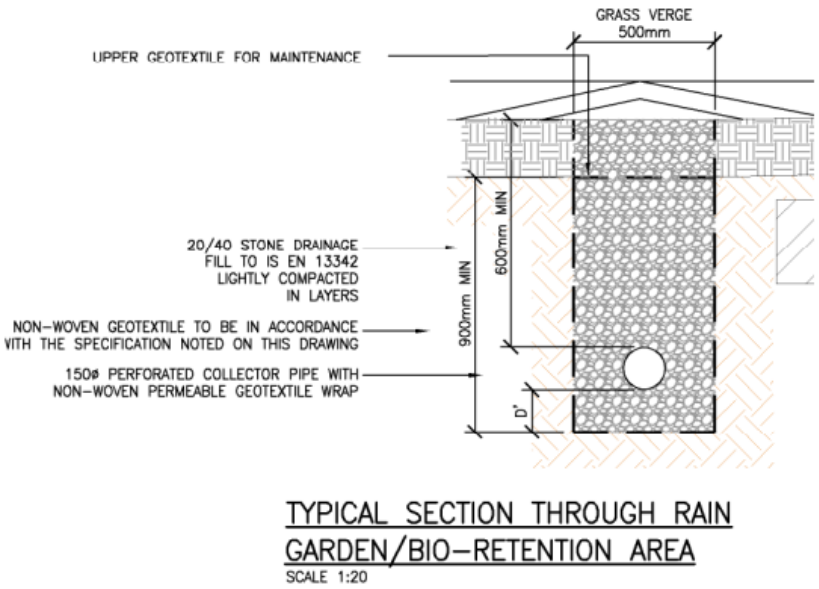


Figure 2-6 - Rain Garden

2.5.7 Permeable Paving

It is proposed to use permeable paving to surface the parking spaces and the hard surfaced communal spaces in the development. It is anticipated that most of the rainwater will be able to percolate through the permeable paving and infiltrate into the underlying soils. However, it is proposed to provide a number of overflow outlets within the permeable paving build-up which will ensure the parking area is not flooded during severe rainfall events. The outlet from the permeable paving areas will be raised 100-150mm above formation level to provide interception storage within the stone sub-base; this gives 30mm interception storage @ 30% voids in the gravel.

These permeable surfaces, together with their associated substructures, are an efficient means of managing surface water runoff close to source – intercepting runoff, reducing the volume and frequency of runoff, and providing treatment medium. Refer to the Malone O'Regan SuDS detail drawing no. SHB4-CAD-DR-MOR-CS-P3-151 for typical permeable paving details.

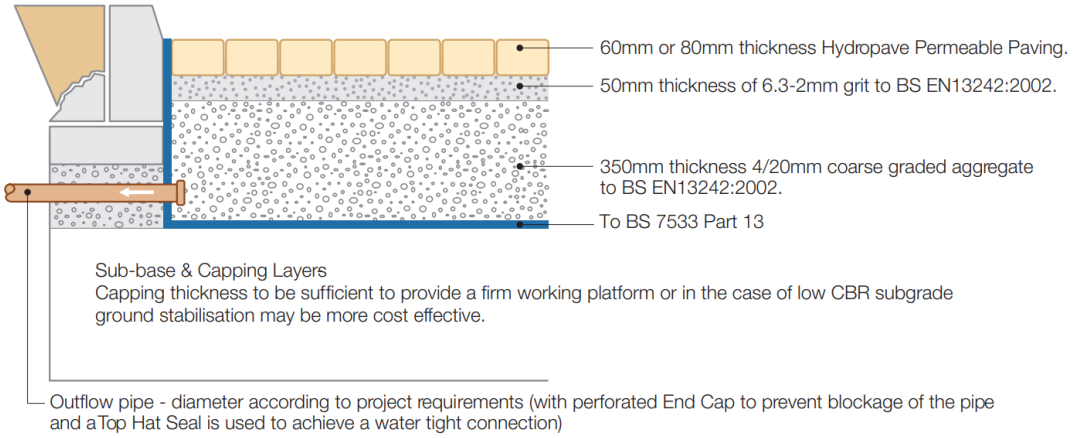


Figure 2-7 - Typical Section Through Permeable Paving in Parking Spaces

2.6 Interception Storage

To prevent pollutants or sediments discharging into watercourses the GDSDS requires "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on 5-10mm of rainfall depth from 80% of the runoff from impermeable areas as defined in GDSDS. The interception volume attributable to each SuDS feature consists of the volume of water that can infiltrate to the ground, the quantity that evaporates into the atmosphere and the volume lost through transpiration in plants and vegetation. Additionally, there will be some loses of water due to absorption and wetting of stone and soil media.

The required interception storage and provided interception storage is provided in Appendix B.

2.7 Attenuation Design

Attenuation storage is provided on the site using an attenuation storage system. For the purposes of surface water attenuation design, the site is divided into three catchment areas as shown in Figure 2-1 draining to the storage systems. The volume of surface water storage required has been calculated in accordance with the SuDS Manual Ciria C697, taking account of design invert levels, ground levels and allowable discharge rate. Calculations for the attenuation storage system is provided in Appendix B.

Surface water runoff from site area 1 will drain by gravity to an attenuation storage system under the central open space in the central southern end of the site. Surface water runoff from site area 2 will drain by gravity to a detention basin located in the top northern central half of the site and runoff from site area 3 will drain by gravity to a detention basin located in the outer eastern area.

The attenuation volumes have been calculated accommodating a 20% increase in future rainfall intensities as a result of climate change allowing for 10% urban creep. The attenuation storage has been assessed using the average annual peak flow rate QBAR. Based on those calculations, the volume runoff water that will be generated during the 1 in 100-year storm event for the site and the value at which the flow control device will restrict the flow is shown in the table below.

	Calculated Storage Capacity (m^3)	**1:100-year flood event Calculated (m^3)**	**QBARrural (l/s)**
Area 1 Attenuation Tank	112.60	103.89	6.656
Area 2 Detention Basin	19.57	12.13	1.698
Area 3 Detention Basin	32.61	28.50	2.715

Table 2-10 – Attenuation volumes

2.8 GDSDS Criterion Compliance

2.8.1 Criterion 1 River Water Quality Protection

Run-off from natural greenfield areas contributes very little pollution and sediment to rivers and for most rainfall events direct run-off from greenfield sites to rivers does not take place as rainfall percolates into the ground. By contrast, urban run-off, when drained by pipe systems, results in run-off from virtually every rainfall event with high levels of pollution, particularly in the first phase of run-off, with little rainfall percolating to the ground. To prevent this happening, Criterion 1 requires that interception storage and/or treatment storage is provided, thereby replicating the run-off characteristics of the pre-development greenfield site.

2.8.2 Criterion 3 Site Flooding

The GDSDS requires that no flooding should occur on site for storms up to and including the 1 in 30-year event. The pipe network and the attenuation storage volumes should, therefore, be checked for such storms to ensure that no site flooding occurs although partial surcharging of the system is allowed if it does not threaten to flood.

For the 1 in 100-year event, the pipe network can fully surcharge and cause site flooding, but the top water level due to any such flooding must be at least 500mm below any vulnerable internal floor levels, and the flood waters should be contained within the site. In addition, the top water level in any attenuation device during the 100-year storm must be at least 500mm below any vulnerable internal floor levels.

Surface water drains have been sized to ensure the following:

- The system does not surcharge for the 1-year event.
- The system surcharges but does not flood for the 30-year event.
- The system surcharges but does not flood for the 100-year event.

Detailed modelling of the surface water sewer network has been carried out using Causeway Flow software to confirm the above criteria is adequately met. The outputs are appended to this report.

2.8.3 Criterion 2 & 4 River Regime & Flood Protection

Regardless of the rainfall event, unchecked run-off from the developed site through traditional pipe networks will discharge into receiving waters at rates that are an order of magnitude greater than that prior to development. This can cause flash flow in the outfall river / stream that can cause scour, erosion & downstream flooding. Attenuation storage is provided to prevent this occurring by limiting the rate of run-off to that which took place from the pre-development greenfield site. In practice, the rate of run-off needs to be appropriately low for most rainfall events, and attenuation storage volumes should be provided for the 1 and 100-year storm event + 20% for climate change. The rate of outflow from such storage should be controlled so that it does not exceed the greenfield run-off rate of QBAR, which can be factored upwards by factors appropriate to the various return periods (given in the Flood Studies Report) if long term storage is provided. Notwithstanding that significant long-term storage will be provided in the form of interception storage, this does not equate to full long-term storage volume provision and so growth factors will not be applied to QBAR when calculating the attenuation storage volume required.

Qbar for the site has been calculated in accordance with the IH124 method as 11.07 l/s, based on the drained areas of the site. As the surface runoff flow rate discharged from the site does not exceed Qbar, there is a requirement for long-term storage to limit the impact on the receiving watercourse. Please refer to section 2.3.2 of this report for the Qbar calculation.

Criterion 4 is intended to prevent flooding of the receiving system / watercourse by either.

- limiting the volume of run-off to the pre-development greenfield volume using ‘long-term

storage’ (Option 1) or by

- limiting the rate of run-off for the 1 in 100-year storm to QBAR without applying growth

factors using ‘extended attenuation storage’ (Option 2).

Significant long-term storage will be provided in the form of interception storage. This does not, however, equate to full long term storage volumes and it is not feasible to provide additional storage areas elsewhere on site to achieve the required volume.

Option (2) has therefore been used to comply with Criterion 4 and an attenuation volume will be provided in the proposed detention basin to limit the rate of discharge in the 1 in 100-year storm +20% event to QBAR without growth factors applied. Refer to Appendix B for surface water network design calculations.

2.9 Enhanced Biodiversity

Bioretention areas will be included as part of the proposed development. Biodiversity has been carefully considered when determining both the location and the detailed design of these elements. The proposed bioretention area offers the opportunity to create a planted vegetation zone for plants and animals which will encourage biodiversity on the site. The encouragement of biodiverse environments within urban environments is incredibly important. The SuDS measures must not only replicate the pre-development surface water runoff systems and treatment for rainfall, but they should also aim to replicate the existing habitats from the pre- development stage.
By incorporating large, landscaped areas, green/blue roofs throughout the site and the bio-retention areas, biodiversity on site is promoted

2.10 SuDS CIRIA Pillars of Design

2.10.1 Water Quantity

The “Water Quantity” design objective is to ensure that the surface water runoff from a developed site does not have a detrimental impact on people, property, or the environment, it is important to control:

- How fast the runoff is discharged from the site (i.e., the peak runoff rate) and
- How much runoff is discharged from the site (i.e., the runoff volume)

2.10.2 Water Quality

The “Water Quality” design objective seeks to ensure the surface water runoff from the site does not compromise the groundwater or surrounding water courses relating to the site.

2.10.3 Amenity

The “Amenity” design objective aims to deliver attractive, pleasant, useful and above all liveable urban environments. SuDS measures should be designed to replicate the existing natural environment and blend in with the urban development.

MOR have worked closely with the landscaping architect throughout the SuDS strategy design process to ensure that the measures which have been suggested and incorporated have a high sense of public use. Throughout the site, there are green roofs, bio-retention areas and tree pits.

2.10.4 SuDS Conclusion

This section of the report has comprehensively discussed the various SuDS measures which can be applied to the site and then selected the applicable systems, based on the site layout. A wide range of measures have been employed.

Finally, the chosen SuDS measures have been analysed for various rainfall scenarios to ensure that all the SuDS design criteria are met an extensive range of SuDS measures are proposed with extensive coverage of the developed area of the site. These measures will be effective in treating rainfall on the site to meet GDSDS and CIRIA.

2.11 Maintenance and Management Plan

Refer to appendix E for details of maintenance requirements for individual SuDS drainage measures on the site.

2.12 Potential Future Expansion

No future expansion has been considered for the proposed drainage networks for the development.

3 FOUL WATER DRAINAGE DESIGN

3.1 General

The foul water drainage infrastructure has been designed in accordance with Irish Water Technical Standard for Wastewater Gravity Sewers (Document Number: IW-TEC-800-01) and the Irish Water Code of Practice for Wastewater Infrastructure (Document Number: IW-CDS-5030-03).

On 12th December 2023, a Pre-Connection Enquiry Form was submitted to Irish Water in respect of this development. Irish Water provided a Confirmation of Feasibility letter which confirms that, subject to a valid connection agreement being put in place, the proposed connection to the public sewer network can be facilitated. The letter further notes that Irish Water have reviewed the wastewater characteristics and hydraulic discharge load and determined that no upgrades are required to the Irish Water network or municipal wastewater treatment plant.

A Copy of the Irish Water Confirmation of Feasibility Letter is provided in Appendix A.

Table 3-1 outlines the parameters adopted in the design of the foul and process water drainage infrastructure.

Parameter Description	Assigned Value
Hydraulic Loading (Foul associated with domestic)	150 litres / person / day
Pipe Friction	1.5 mm
Minimum Velocity	0.7 m/s
Maximum Velocity	3.0 m/s
Peaking Factor (for domestic foul flows only)	6.0

Table 3-1 - Foul Water Design Parameters

Hydraulic loading for the foul drainage i.e. domestic foul flows from toilets, sinks etc. have been calculated in accordance with the Irish Water Code of Practice for Wastewater Infrastructure which gives a flow rate of 150 litres per person per day for domestic dwellings.

Calculations for the foul and process water pipe networks are provided in Appendix D.

3.2 Existing Services

An existing network of drainage runs around the perimeter of the site on two sides. These underground drains carry foul water towards existing treatment areas in the north Dublin area. Due to the relative levels of the existing drainage within the road and the proposed site levels, it is possible to achieve a gravity connection to the foul water drainage pipework installed. There is a 150mm clay sewer running from Crestfield Park parallel to number 43 boundary on the northeastern end of the site. There is a 225mm concrete sewer running on Collins Avenue which crosses the entrance road into the site on the southern end of the site.

3.3 Proposed Services

The proposed foul water drainage system is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'.

The proposed foul water drainage layout for the development is indicated on Malone O'Regan drawings SHB4-CAD-DR-MOR-CS-P3-130. Foul water from new housing units will be collected within a gravity drainage network and directed towards the existing public sewer system.

3.4 Potential Future Expansion

No future expansion has been considered for the proposed drainage networks for the development.

4 WATER SUPPLY

4.1 General

The Proposed Development will use mains water. The proposed water supply infrastructure has been designed in accordance with the Irish Water Code of Practice for Water Infrastructure (Document Number: IW-CDS-5020-03).

On 12th December 2023, a Pre-Connection Enquiry Form was submitted to Irish Water in respect of this development. Irish Water provided a Confirmation of Feasibility (CoF) letter which confirms that, subject to a valid connection agreement being put in place, the proposed connection to the public water supply network can be facilitated.

A Copy of the Irish Water Confirmation of Feasibility Letter is provided in Appendix A.

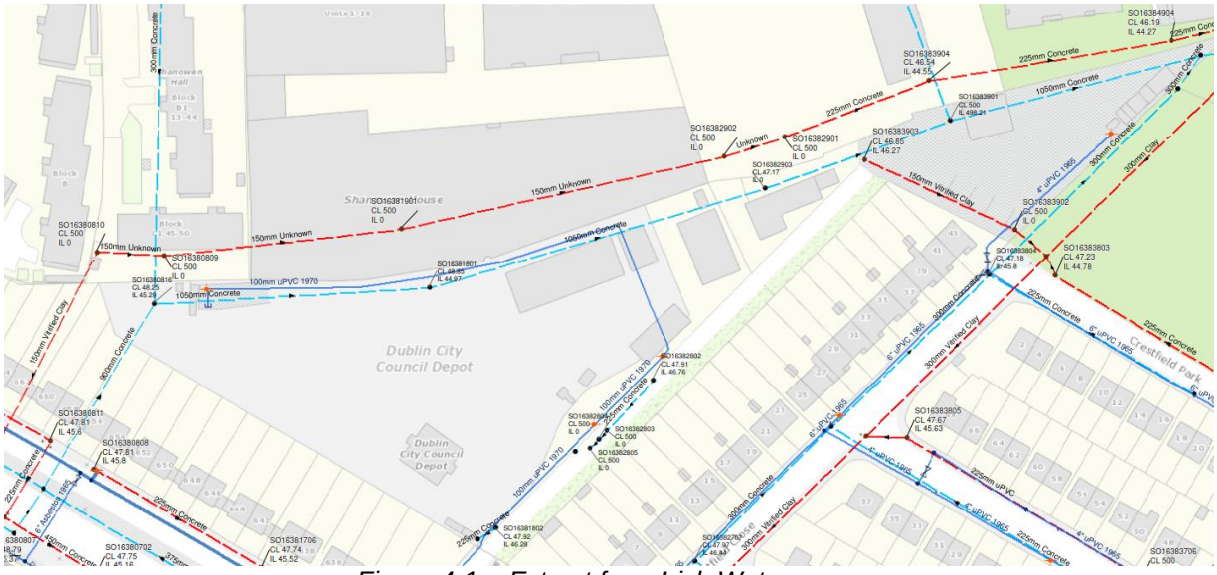


Figure 4-1 – Extract from Irish Water maps

4.2 Existing & Proposed Services

A 100mm diameter watermain is located on the site coming in from Collins Avenue entrance road, travelling along the southeastern boundary to the centre of the site before crossing to the northern boundary. This watermain then travels a distance towards the northwestern corner of the site before terminating.

The proposed watermain layout is indicated on drawing SHB4-CAD-DR-MOR-CS-P3-140 which accompanies this planning application.

4.3 Water Demand Calculations

Average and peak water demand rates have been calculated as follows, in accordance with the Irish Water Code of Practice for Water Infrastructure:

Domestic Water Demand

Total no. residents = 348

Irish Water Code of Practice for Water Infrastructure gives flow rate for Domestic Dwellings' as 150 litres per person per day.

Total Daily Water Demand = 348 people x 150 litres per day per person
= 52,200 litres/day

Average Hour Demand = 52,200 litres/day / (24hr x 60min x 60sec)
= 0.604 litres/sec

The average day, peak week demand is taken as 1.25 times the average daily domestic demand.

Average Day / Peak Week Demand = 0.604 litres/sec x 1.25
= 0.755 litres/sec

The above figures were provided to Irish Water within the Pre-Connection Enquiry Form dated 12th December 2023. Irish Water's response to the Pre-Connection Enquiry, outlined in their Confirmation of Feasibility Letter, is therefore based on these figures.

APPENDIX A – IRISH WATER CONFIRMATION OF FEASIBILITY

CONFIRMATION OF FEASIBILITY

Ray O'Connor

2B Richview Office Park
Clonskeagh
Dublin 14
Dublin
D14 XT57

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

13 March 2024

Our Ref: CDS24000425 Pre-Connection Enquiry
New Apartments at Collins Avenue, Whitehall, Dublin 9, Dublin

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 41 unit(s) at New Apartments at Collins Avenue, Whitehall, Dublin 9, Dublin, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection**
  - Feasible without infrastructure upgrade by Irish Water
  - It is noted that proposed development requires the diversion of existing infrastructure that traverses the site. If this infrastructure is owned by Irish Water the customer will be required to enter into a diversion agreement with Irish Water to divert these assets. To facilitate your requirements and avoid delays the customer is advised to engage with Irish Water as early as possible
- **Wastewater Connection**
  - Feasible without infrastructure upgrade by Irish Water
  - It is noted that proposed development requires the diversion of existing infrastructure that traverses the site. If this infrastructure is owned by Irish Water the customer will be required to enter into a

diversion agreement with Irish Water to divert these assets. To facilitate your requirements and avoid delays the customer is advised to engage with Irish Water as early as possible

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

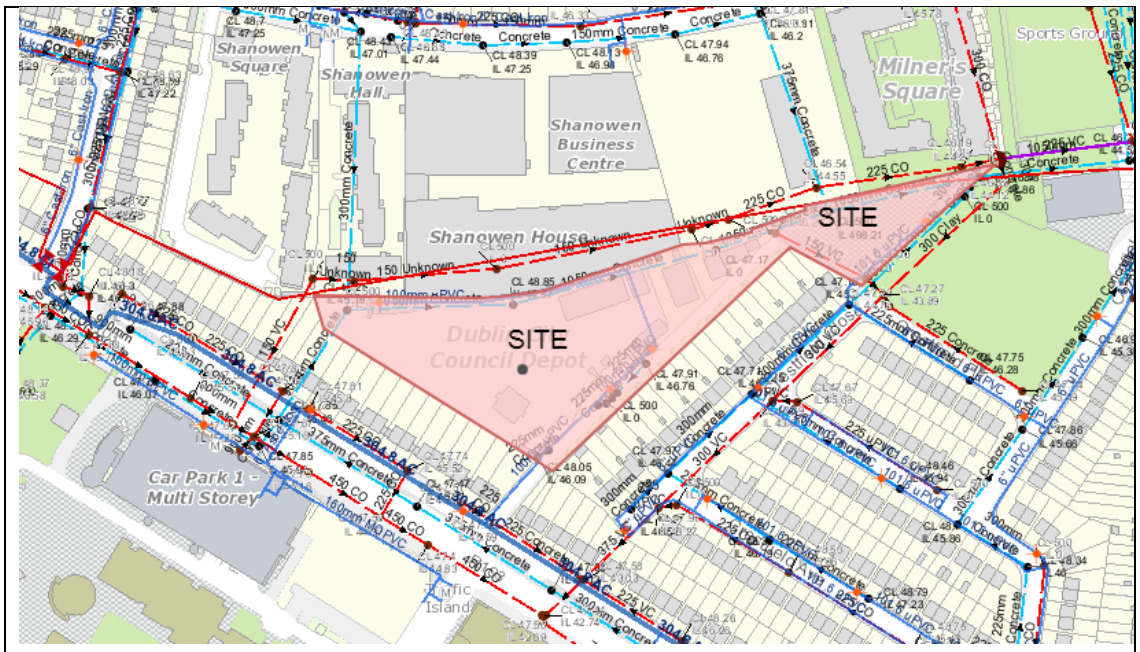
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie



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Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann's underground network(s) 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.

APPENDIX B – ATTENUATION VOLUME CALCULATIONS

Job Title	Collins Ave - Area 1	Job no.	23006
By:	Kezia Adanza	Checked by:	
Date		Rev number	

Part 1 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16
M5-2D (2 days - 5 years) mm		57.8
Ratio "r" (M5-60/ M5-2D)		0.28
SAAR mm		933
Soil/ SPR mm		0.47

Soil Type 4 - Based on Site Investigation - Clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.338	m^3/s
For 0.99 Ha Area ~ QBARrural =		6.757	l/s/ha
For 0.99 Ha Area ~ QBARrural =		6.656	l/s

Part 2 Impermeable Area

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable Area sq.m	Urban Creep Allowance (10%)	Overall Impermeable Area ha
9850.83	Roof - Block A Apartments	Standard - 10%	136.38	0.92	125.47	138.01	3883.23
		Green/Blue Roof - 90%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		3241.74	0.50	1620.87	1782.96	
ha	Landscaped Areas inc. areas from hardstanding		4195.59	0.20	839.12	923.03	ha
0.99							0.39
	Hardstanding		1049.73	0.90	944.75	1039.23	

Part 3 **Attenuation Volume Required**

1 in 10 Years

Time	%	M5	Growth Factor (10 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.15	1	2.194	8.518	0.399369642	8.119
2min	5.7	3.3	1.16	1	3.822	14.841	0.798739284	14.042
5 min	10.3	6.0	1.18	1	7.025	27.280	1.996848209	25.283
10 min	14.8	8.6	1.18	1	10.094	39.198	3.993696418	35.204
15 min	17.7	10.2	1.18	1	12.072	46.879	5.990544626	40.888
30 min	23.3	13.5	1.18	1	15.892	61.710	11.98108925	49.729
60 min	30	17.3	1.17	1	20.288	78.782	23.96217851	54.820
2 hour	38	22.0	1.16	1	25.478	98.938	47.92435701	51.014
4 hour	48	27.7	1.15	1	31.906	123.897	95.84871402	28.048
6 hour	55	31.8	1.14	1	36.241	140.731	143.773071	-3.042
12 hour	68	39.3	1.14	1	44.807	173.994	287.5461421	-113.552
24 hour	85	49.1	1.13	1	55.517	215.585	575.0922841	-359.507
48 hour	106	61.3	1.12	1	68.620	266.468	1150.184568	-883.717
Size of Attenuation for 1 in 10 year flood event m³								**54.820**

1 in 30 Years

Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.39	1	2.651	10.296	0.399369642	9.896
2min	5.7	3.3	1.41	1	4.645	18.039	0.798739284	17.240
5 min	10.3	6.0	1.44	1	8.573	33.291	1.996848209	31.294
10 min	14.8	8.6	1.46	1	12.489	48.499	3.993696418	44.506
15 min	17.7	10.2	1.48	1	15.141	58.797	5.990544626	52.807
30 min	23.3	13.5	1.49	1	20.066	77.923	11.98108925	65.941
60 min	30	17.3	1.48	1	25.663	99.656	23.96217851	75.694
2 hour	38	22.0	1.47	1	32.287	125.378	47.92435701	77.454
4 hour	48	27.7	1.45	1	40.229	156.218	95.84871402	60.369
6 hour	55	31.8	1.44	1	45.778	177.765	143.773071	33.992
12 hour	68	39.3	1.42	1	55.812	216.730	287.5461421	-70.817
24 hour	85	49.1	1.38	1	67.799	263.281	575.0922841	-311.812
48 hour	106	61.3	1.34	1	82.099	318.810	1150.184568	-831.375
Size of Attenuation for 1 in 30 year flood event m³								**77.454**

1 in 100 Years

Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.87	1	3.567	13.851	0.399369642	13.451
2min	5.7	3.3	1.88	1	6.194	24.052	0.798739284	23.253
5 min	10.3	6.0	1.97	1	11.728	45.543	1.996848209	43.546
10 min	14.8	8.6	1.98	1	16.938	65.773	3.993696418	61.779
15 min	17.7	10.2	1.95	1	19.950	77.469	5.990544626	71.479
30 min	23.3	13.5	1.91	1	25.723	99.887	11.98108925	87.906
60 min	30	17.3	1.85	1	32.079	124.570	23.96217851	100.608
2 hour	38	22.0	1.78	1	39.096	151.818	47.92435701	103.894
4 hour	48	27.7	1.73	1	47.997	186.384	95.84871402	90.535
6 hour	55	31.8	1.71	1	54.361	211.096	143.773071	67.323
12 hour	68	39.3	1.62	1	63.672	247.255	287.5461421	-40.291
24 hour	85	49.1	1.58	1	77.625	301.437	575.0922841	-273.655
48 hour	106	61.3	1.53	1	93.740	364.014	1150.184568	-786.170
Size of Attenuation for 1 in 100 year flood event m³								**103.894**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 3883.2 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 18.64 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	1043.0	m²	
	Stone Layer 100mm deep	0.1	m	
	Void Ratio	30%		
	Storage Volume	31.29	m³	*Storage depth will depend on your site

Swale	Area	246.4	m²
	*75mm	0.075	m
	Storage Volume	18.48	m³

Bio-Retention Area/ Raingarden	Area	310.6	m²
	Depth of subgrade	0.1	m
	Storage Volume	31.06	m³

Total interception volume provided for the overall site 80.83 m³

which exceeds the required volume calculated of 18.64 m³

Job Title	Area 1 - Blue/Green Roof	Job no.	23006
By:	Kezia Adanza	Checked by:	
Date		Rev number	

Part 1 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16
M5-2D (2 days - 5 years) mm		57.8
Ratio "r" (M5-60/ M5-2D)		0.28
SAAR mm		933
Soil/ SPR mm		0.47

Soil Type 4 - Based on Site Investigation - Clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.338	m^3/s
For 0.14 Ha Area ~ QBARrural =	6.757	l/s/ha
For 0.14 Ha Area ~ QBARrural =	0.921	l/s

Part 2 Impermeable Area

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
1363.78	Roof - Apartments	Standard - 10%		0.92	0.0	0.0	810.1
		Green/Blue Roof - 90%	1227.40	0.60	736.4	810.1	
	Permeable Paving inc. areas from hardstanding			0.50	0.0	0.0	
ha	Landscaped Areas inc. areas from hardstanding			0.20	0.0	0.0	ha
0.14							0.1
	Hardstanding			0.90	0.0	0.0	

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Time	%	M5	Growth Factor (10 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.15	1	2.194	1.777	0.055289907	1.722
2min	5.7	3.3	1.16	1	3.822	3.096	0.110579814	2.985
5 min	10.3	6.0	1.18	1	7.025	5.691	0.276449536	5.414
10 min	14.8	8.6	1.18	1	10.094	8.177	0.552899071	7.624
15 min	17.7	10.2	1.18	1	12.072	9.779	0.829348607	8.950
30 min	23.3	13.5	1.18	1	15.892	12.873	1.658697214	11.215
60 min	30	17.3	1.17	1	20.288	16.435	3.317394429	13.117
2 hour	38	22.0	1.16	1	25.478	20.640	6.634788857	14.005
4 hour	48	27.7	1.15	1	31.906	25.846	13.26957771	12.577
6 hour	55	31.8	1.14	1	36.241	29.358	19.90436657	9.454
12 hour	68	39.3	1.14	1	44.807	36.297	39.80873314	-3.512
24 hour	85	49.1	1.13	1	55.517	44.973	79.61746629	-34.644
48 hour	106	61.3	1.12	1	68.620	55.588	159.2349326	-103.647
Size of Attenuation for 1 in 10 year flood event m³								**14.005**

1 in 30 Years								
Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.39	1	2.651	2.148	0.055289907	2.092
2min	5.7	3.3	1.41	1	4.645	3.763	0.110579814	3.653
5 min	10.3	6.0	1.44	1	8.573	6.945	0.276449536	6.668
10 min	14.8	8.6	1.46	1	12.489	10.117	0.552899071	9.565
15 min	17.7	10.2	1.48	1	15.141	12.266	0.829348607	11.436
30 min	23.3	13.5	1.49	1	20.066	16.255	1.658697214	14.597
60 min	30	17.3	1.48	1	25.663	20.789	3.317394429	17.472
2 hour	38	22.0	1.47	1	32.287	26.155	6.634788857	19.520
4 hour	48	27.7	1.45	1	40.229	32.589	13.26957771	19.319
6 hour	55	31.8	1.44	1	45.778	37.084	19.90436657	17.179
12 hour	68	39.3	1.42	1	55.812	45.212	39.80873314	5.403
24 hour	85	49.1	1.38	1	67.799	54.923	79.61746629	-24.694
48 hour	106	61.3	1.34	1	82.099	66.507	159.2349326	-92.728
Size of Attenuation for 1 in 30 year flood event m³								**19.520**

1 in 100 Years								
Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.87	1	3.567	2.889	0.055289907	2.834
2min	5.7	3.3	1.88	1	6.194	5.018	0.110579814	4.907
5 min	10.3	6.0	1.97	1	11.728	9.501	0.276449536	9.224
10 min	14.8	8.6	1.98	1	16.938	13.721	0.552899071	13.168
15 min	17.7	10.2	1.95	1	19.950	16.161	0.829348607	15.332
30 min	23.3	13.5	1.91	1	25.723	20.838	1.658697214	19.179
60 min	30	17.3	1.85	1	32.079	25.987	3.317394429	22.669
2 hour	38	22.0	1.78	1	39.096	31.671	6.634788857	25.036
4 hour	48	27.7	1.73	1	47.997	38.882	13.26957771	25.612
6 hour	55	31.8	1.71	1	54.361	44.037	19.90436657	24.133
12 hour	68	39.3	1.62	1	63.672	51.580	39.80873314	11.771
24 hour	85	49.1	1.58	1	77.625	62.883	79.61746629	-16.734
48 hour	106	61.3	1.53	1	93.740	75.937	159.2349326	-83.298
Size of Attenuation for 1 in 100 year flood event m³								**25.612**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 810.1 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 3.89 m³

Interception Storage Provided *Only fill in SuDS on your site

Green Roof A 'Bauder Sedume' or equivalent design to retain 30 l/m² of rainwater will be used on roof level	Area	1227.4	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	36.82	m³

Total interception volume provided for the overall site 36.82 m³

which exceeds the required volume calculated of 3.89 m³

Job Title	Collins Ave - Area 2	Job no.	23006
By:	Kezia Adanza	Checked by:	
Date		Rev number	

Part 1 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data	
M5-60 (1 hour - 5 years) mm	16
M5-2D (2 days - 5 years) mm	57.8
Ratio "r" (M5-60/ M5-2D)	0.28
SAAR mm	933
Soil/ SPR mm	0.47

Soil Type 4 - Based on Site Investigation - Clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.338	m^3/s
For 0.25 Ha Area ~ QBARrural =	6.757	l/s/ha
For 0.25 Ha Area ~ QBARrural =	1.698	l/s

Part 2 Impermeable Area

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable Area sq.m	Urban Creep Allowance (10%)	Overall Impermeable Area ha
2512.73	Roof - Block B Apartments	Standard - 15%	136.18	0.92	125.29	137.81	568.5
		Green/Blue Roof - 85%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding			0.50	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		1504.11	0.20	300.82	330.90	ha
0.25							0.1
	Hardstanding		100.75	0.90	90.68	99.74	

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Time	%	M5	Growth Factor (10 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.15	1	2.194	1.247	0.101870399	1.145
2min	5.7	3.3	1.16	1	3.822	2.173	0.203740797	1.969
5 min	10.3	6.0	1.18	1	7.025	3.993	0.509351993	3.484
10 min	14.8	8.6	1.18	1	10.094	5.738	1.018703985	4.719
15 min	17.7	10.2	1.18	1	12.072	6.863	1.528055978	5.334
30 min	23.3	13.5	1.18	1	15.892	9.034	3.056111956	5.978
60 min	30	17.3	1.17	1	20.288	11.533	6.112223912	5.421
2 hour	38	22.0	1.16	1	25.478	14.483	12.22444782	2.259
4 hour	48	27.7	1.15	1	31.906	18.137	24.44889565	-6.312
6 hour	55	31.8	1.14	1	36.241	20.601	36.67334347	-16.072
12 hour	68	39.3	1.14	1	44.807	25.471	73.34668695	-47.876
24 hour	85	49.1	1.13	1	55.517	31.559	146.6933739	-115.134
48 hour	106	61.3	1.12	1	68.620	39.008	293.3867478	-254.379
Size of Attenuation for 1 in 10 year flood event m³								**5.978**

1 in 30 Years								
Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.39	1	2.651	1.507	0.101870399	1.405
2min	5.7	3.3	1.41	1	4.645	2.641	0.203740797	2.437
5 min	10.3	6.0	1.44	1	8.573	4.873	0.509351993	4.364
10 min	14.8	8.6	1.46	1	12.489	7.100	1.018703985	6.081
15 min	17.7	10.2	1.48	1	15.141	8.607	1.528055978	7.079
30 min	23.3	13.5	1.49	1	20.066	11.407	3.056111956	8.351
60 min	30	17.3	1.48	1	25.663	14.589	6.112223912	8.476
2 hour	38	22.0	1.47	1	32.287	18.354	12.22444782	6.130
4 hour	48	27.7	1.45	1	40.229	22.869	24.44889565	-1.580
6 hour	55	31.8	1.44	1	45.778	26.023	36.67334347	-10.650
12 hour	68	39.3	1.42	1	55.812	31.727	73.34668695	-41.620
24 hour	85	49.1	1.38	1	67.799	38.541	146.6933739	-108.152
48 hour	106	61.3	1.34	1	82.099	46.670	293.3867478	-246.716
Size of Attenuation for 1 in 30 year flood event m³								**8.476**

1 in 100 Years								
Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.87	1	3.567	2.028	0.101870399	1.926
2min	5.7	3.3	1.88	1	6.194	3.521	0.203740797	3.317
5 min	10.3	6.0	1.97	1	11.728	6.667	0.509351993	6.158
10 min	14.8	8.6	1.98	1	16.938	9.628	1.018703985	8.610
15 min	17.7	10.2	1.95	1	19.950	11.341	1.528055978	9.813
30 min	23.3	13.5	1.91	1	25.723	14.622	3.056111956	11.566
60 min	30	17.3	1.85	1	32.079	18.236	6.112223912	12.123
2 hour	38	22.0	1.78	1	39.096	22.225	12.22444782	10.000
4 hour	48	27.7	1.73	1	47.997	27.285	24.44889565	2.836
6 hour	55	31.8	1.71	1	54.361	30.902	36.67334347	-5.771
12 hour	68	39.3	1.62	1	63.672	36.195	73.34668695	-37.151
24 hour	85	49.1	1.58	1	77.625	44.127	146.6933739	-102.566
48 hour	106	61.3	1.53	1	93.740	53.288	293.3867478	-240.099
Size of Attenuation for 1 in 100 year flood event m³								**12.123**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 568.5 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 2.73 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	0.00	m²	
	Stone Layer 100mm deep	0.1	m	
	Void Ratio	30%		
	Storage Volume	0.00	m³	*Storage depth will depend on your site

Swale	Area	136.90	m²
	*75mm	0.075	m
	Storage Volume	10.27	m³

Bio-Retention Area/ Raingarden	Area	285.82	m²
	Depth of subgrade	0.1	m
	Storage Volume	28.58	m³

Total interception volume provided for the overall site 38.85 m³

which exceeds the required volume calculated of 2.73 m³

Job Title	Area 2 - Blue/ Green Roof	Job no.	23006
By:	Kezia Adanza	Checked by:	
Date		Rev number	

Part 1 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data	
M5-60 (1 hour - 5 years) mm	16
M5-2D (2 days - 5 years) mm	57.8
Ratio "r" (M5-60/ M5-2D)	0.28
SAAR mm	933
Soil/ SPR mm	0.47

Soil Type 4 - Based on Site Investigation - Clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.338	m^3/s
For 0.09 Ha Area ~ QBARrural =	6.757	l/s/ha
For 0.09 Ha Area ~ QBARrural =	0.613	l/s

Part 2 Impermeable Area

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
907.86	Roof - Apartments	Standard - 15%		0.92	0.0	0.0	509.3
		Green/ Blue Roof - 85%	771.68	0.60	463.0	509.3	
	Permeable Paving inc. areas from hardstanding			0.50	0.0	0.0	
ha	Landscaped Areas inc. areas from hardstanding			0.20	0.0	0.0	**ha**
0.09							0.1
	Hardstanding			0.90	0.0	0.0	

Part 3 **Attenuation Volume Required**

1 in 10 Years

Time	%	M5	Growth Factor (10 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.15	1	2.194	1.117	0.036806369	1.080
2min	5.7	3.3	1.16	1	3.822	1.946	0.073612738	1.873
5 min	10.3	6.0	1.18	1	7.025	3.578	0.184031845	3.394
10 min	14.8	8.6	1.18	1	10.094	5.141	0.36806369	4.773
15 min	17.7	10.2	1.18	1	12.072	6.148	0.552095535	5.596
30 min	23.3	13.5	1.18	1	15.892	8.094	1.104191069	6.990
60 min	30	17.3	1.17	1	20.288	10.333	2.208382138	8.124
2 hour	38	22.0	1.16	1	25.478	12.976	4.416764276	8.560
4 hour	48	27.7	1.15	1	31.906	16.250	8.833528553	7.416
6 hour	55	31.8	1.14	1	36.241	18.458	13.25029283	5.207
12 hour	68	39.3	1.14	1	44.807	22.821	26.50058566	-3.680
24 hour	85	49.1	1.13	1	55.517	28.275	53.00117132	-24.726
48 hour	106	61.3	1.12	1	68.620	34.949	106.0023426	-71.053
Size of Attenuation for 1 in 10 year flood event m³								**8.560**

1 in 30 Years

Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.39	1	2.651	1.350	0.036806369	1.314
2min	5.7	3.3	1.41	1	4.645	2.366	0.073612738	2.292
5 min	10.3	6.0	1.44	1	8.573	4.366	0.184031845	4.182
10 min	14.8	8.6	1.46	1	12.489	6.361	0.36806369	5.993
15 min	17.7	10.2	1.48	1	15.141	7.712	0.552095535	7.160
30 min	23.3	13.5	1.49	1	20.066	10.220	1.104191069	9.116
60 min	30	17.3	1.48	1	25.663	13.071	2.208382138	10.862
2 hour	38	22.0	1.47	1	32.287	16.444	4.416764276	12.027
4 hour	48	27.7	1.45	1	40.229	20.489	8.833528553	11.655
6 hour	55	31.8	1.44	1	45.778	23.315	13.25029283	10.065
12 hour	68	39.3	1.42	1	55.812	28.426	26.50058566	1.925
24 hour	85	49.1	1.38	1	67.799	34.531	53.00117132	-18.470
48 hour	106	61.3	1.34	1	82.099	41.814	106.0023426	-64.188
Size of Attenuation for 1 in 30 year flood event m³								**12.027**

1 in 100 Years

Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.87	1	3.567	1.817	0.036806369	1.780
2min	5.7	3.3	1.88	1	6.194	3.155	0.073612738	3.081
5 min	10.3	6.0	1.97	1	11.728	5.973	0.184031845	5.789
10 min	14.8	8.6	1.98	1	16.938	8.627	0.36806369	8.259
15 min	17.7	10.2	1.95	1	19.950	10.161	0.552095535	9.609
30 min	23.3	13.5	1.91	1	25.723	13.101	1.104191069	11.997
60 min	30	17.3	1.85	1	32.079	16.338	2.208382138	14.130
2 hour	38	22.0	1.78	1	39.096	19.912	4.416764276	15.495
4 hour	48	27.7	1.73	1	47.997	24.445	8.833528553	15.612
6 hour	55	31.8	1.71	1	54.361	27.687	13.25029283	14.436
12 hour	68	39.3	1.62	1	63.672	32.429	26.50058566	5.929
24 hour	85	49.1	1.58	1	77.625	39.536	53.00117132	-13.466
48 hour	106	61.3	1.53	1	93.740	47.743	106.0023426	-58.259
Size of Attenuation for 1 in 100 year flood event m³								**15.612**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 509.3 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 2.44 m³

Interception Storage Provided *Only fill in SuDS on your site

Green Roof A 'Bauder Sedume' or equivalent design to retain 30 l/m² of rainwater will be used on roof level	Area	771.68	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	23.15	m³

Total interception volume provided for the overall site 23.15 m³

which exceeds the required volume calculated of 2.44 m³

Job Title	Area 3 - Overall Drainage	Job no.	23006
By:	Kezia Adanza	Checked by:	
Date	Apr-24	Rev number	

Part 1 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16
M5-2D (2 days - 5 years) mm		57.8
Ratio "r" (M5-60/ M5-2D)		0.28
SAAR mm		933
Soil/ SPR mm		0.47

Soil Type 4 - Based on Site Investigation - Clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.338	m^3/s
For 0.40 Ha Area ~ QBARrural =	6.757	l/s/ha
For 0.40 Ha Area ~ QBARrural =	2.715	l/s

Part 2 Impermeable Area

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable Area sq.m	Urban Creep Allowance (10%)	Overall Impermeable Area ha
4018.015	Roof - Block C Apartments	Standard - 15%	58.90	0.92	54.19	59.60	1193.1
		Green/Blue Roof - 85%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		774.89	0.50	387.44	426.19	
ha	Landscaped Areas inc. areas from hardstanding		2746.36	0.20	549.27	604.20	ha
0.40							0.1
	Hardstanding		104.12	0.90	93.71	103.08	

Part 3 **Attenuation Volume Required**

1 in 10 Years

Time	%	M5	Growth Factor (10 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.15	1	2.194	2.617	0.162897243	2.454
2min	5.7	3.3	1.16	1	3.822	4.560	0.325794486	4.234
5 min	10.3	6.0	1.18	1	7.025	8.381	0.814486215	7.567
10 min	14.8	8.6	1.18	1	10.094	12.043	1.62897243	10.414
15 min	17.7	10.2	1.18	1	12.072	14.403	2.443458645	11.959
30 min	23.3	13.5	1.18	1	15.892	18.960	4.88691729	14.073
60 min	30	17.3	1.17	1	20.288	24.205	9.77383458	14.431
2 hour	38	22.0	1.16	1	25.478	30.397	19.54766916	10.850
4 hour	48	27.7	1.15	1	31.906	38.066	39.09533832	-1.030
6 hour	55	31.8	1.14	1	36.241	43.238	58.64300748	-15.405
12 hour	68	39.3	1.14	1	44.807	53.457	117.286015	-63.829
24 hour	85	49.1	1.13	1	55.517	66.236	234.5720299	-168.336
48 hour	106	61.3	1.12	1	68.620	81.869	469.1440598	-387.275
Size of Attenuation for 1 in 10 year flood event m³								**14.431**

1 in 30 Years

Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.39	1	2.651	3.163	0.162897243	3.000
2min	5.7	3.3	1.41	1	4.645	5.542	0.325794486	5.216
5 min	10.3	6.0	1.44	1	8.573	10.228	0.814486215	9.414
10 min	14.8	8.6	1.46	1	12.489	14.901	1.62897243	13.272
15 min	17.7	10.2	1.48	1	15.141	18.065	2.443458645	15.621
30 min	23.3	13.5	1.49	1	20.066	23.941	4.88691729	19.054
60 min	30	17.3	1.48	1	25.663	30.618	9.77383458	20.844
2 hour	38	22.0	1.47	1	32.287	38.521	19.54766916	18.973
4 hour	48	27.7	1.45	1	40.229	47.996	39.09533832	8.900
6 hour	55	31.8	1.44	1	45.778	54.616	58.64300748	-4.027
12 hour	68	39.3	1.42	1	55.812	66.587	117.286015	-50.699
24 hour	85	49.1	1.38	1	67.799	80.889	234.5720299	-153.683
48 hour	106	61.3	1.34	1	82.099	97.950	469.1440598	-371.194
Size of Attenuation for 1 in 30 year flood event m³								**20.844**

1 in 100 Years

Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 min	3.3	1.9	1.87	1	3.567	4.255	0.162897243	4.093
2min	5.7	3.3	1.88	1	6.194	7.390	0.325794486	7.064
5 min	10.3	6.0	1.97	1	11.728	13.993	0.814486215	13.178
10 min	14.8	8.6	1.98	1	16.938	20.208	1.62897243	18.579
15 min	17.7	10.2	1.95	1	19.950	23.801	2.443458645	21.358
30 min	23.3	13.5	1.91	1	25.723	30.689	4.88691729	25.802
60 min	30	17.3	1.85	1	32.079	38.273	9.77383458	28.499
2 hour	38	22.0	1.78	1	39.096	46.644	19.54766916	27.097
4 hour	48	27.7	1.73	1	47.997	57.264	39.09533832	18.169
6 hour	55	31.8	1.71	1	54.361	64.856	58.64300748	6.213
12 hour	68	39.3	1.62	1	63.672	75.966	117.286015	-41.320
24 hour	85	49.1	1.58	1	77.625	92.613	234.5720299	-141.959
48 hour	106	61.3	1.53	1	93.740	111.839	469.1440598	-357.306
Size of Attenuation for 1 in 100 year flood event m³								**28.499**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 1193.1 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 5.73 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	510.5	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	15.31	m³

*Storage depth will depend on your site

Swale	Area	14.86	m²
	*75mm	0.075	m
	Storage Volume	1.11	m³

Bio-Retention Area/ Raingarden	Area	45.55	m²
	Depth of subgrade	0.1	m
	Storage Volume	4.55	m³

Total interception volume provided for the overall site 20.98 m³

which exceeds the required volume calculated of 5.73 m³

Job Title	Area 3 - Blue/Green Roof	Job no.	23006
By:	Kezia Adanza	Checked by:	
Date		Rev number	

Part 1 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16
M5-2D (2 days - 5 years) mm		57.8
Ratio "r" (M5-60/ M5-2D)		0.28
SAAR mm		933
Soil/ SPR mm		0.47

Soil Type 4 - Based on Site Investigation - Clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.338	m^3/s
For 0.04 Ha Area ~ QBARrural =	6.757	l/s/ha
For 0.04Ha Area ~ QBARrural =	0.265	l/s

Part 2 Impermeable Area

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
392.647	Roof - Apartments	Standard - 15%		0.92	0.0	0.0	337.8
		Green/Blue Roof - 85%	333.75	0.92	307.0	337.8	
	Permeable Paving inc. areas from hardstanding			0.50	0.0	0.0	
ha	Landscaped Areas inc. areas from hardstanding			0.20	0.0	0.0	ha
0.04							0.0
	Hardstanding			0.90	0.0	0.0	

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Time	%	M5	Growth Factor (10 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.15	1	2.194	0.741	0.015918585	0.725
2min	5.7	3.3	1.16	1	3.822	1.291	0.03183717	1.259
5 min	10.3	6.0	1.18	1	7.025	2.373	0.079592926	2.293
10 min	14.8	8.6	1.18	1	10.094	3.409	0.159185851	3.250
15 min	17.7	10.2	1.18	1	12.072	4.077	0.238778777	3.839
30 min	23.3	13.5	1.18	1	15.892	5.367	0.477557553	4.890
60 min	30	17.3	1.17	1	20.288	6.852	0.955115107	5.897
2 hour	38	22.0	1.16	1	25.478	8.605	1.910230214	6.695
4 hour	48	27.7	1.15	1	31.906	10.776	3.820460428	6.956
6 hour	55	31.8	1.14	1	36.241	12.240	5.730690641	6.510
12 hour	68	39.3	1.14	1	44.807	15.134	11.46138128	3.672
24 hour	85	49.1	1.13	1	55.517	18.751	22.92276257	-4.172
48 hour	106	61.3	1.12	1	68.620	23.177	45.84552513	-22.669
Size of Attenuation for 1 in 10 year flood event m³								**6.956**

1 in 30 Years								
Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.39	1	2.651	0.895	0.015918585	0.880
2min	5.7	3.3	1.41	1	4.645	1.569	0.03183717	1.537
5 min	10.3	6.0	1.44	1	8.573	2.896	0.079592926	2.816
10 min	14.8	8.6	1.46	1	12.489	4.218	0.159185851	4.059
15 min	17.7	10.2	1.48	1	15.141	5.114	0.238778777	4.875
30 min	23.3	13.5	1.49	1	20.066	6.778	0.477557553	6.300
60 min	30	17.3	1.48	1	25.663	8.668	0.955115107	7.713
2 hour	38	22.0	1.47	1	32.287	10.905	1.910230214	8.995
4 hour	48	27.7	1.45	1	40.229	13.587	3.820460428	9.767
6 hour	55	31.8	1.44	1	45.778	15.462	5.730690641	9.731
12 hour	68	39.3	1.42	1	55.812	18.851	11.46138128	7.389
24 hour	85	49.1	1.38	1	67.799	22.900	22.92276257	-0.023
48 hour	106	61.3	1.34	1	82.099	27.729	45.84552513	-18.116
Size of Attenuation for 1 in 30 year flood event m³								**9.767**

1 in 100 Years								
Time	%	M5	Growth Factor (30 Years)	Area Factor	MT Factor	Inflow "I"	Outflow "O"	Capacity Required "I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	1.9	1.87	1	3.567	1.205	0.015918585	1.189
2min	5.7	3.3	1.88	1	6.194	2.092	0.03183717	2.060
5 min	10.3	6.0	1.97	1	11.728	3.961	0.079592926	3.882
10 min	14.8	8.6	1.98	1	16.938	5.721	0.159185851	5.562
15 min	17.7	10.2	1.95	1	19.950	6.738	0.238778777	6.499
30 min	23.3	13.5	1.91	1	25.723	8.688	0.477557553	8.210
60 min	30	17.3	1.85	1	32.079	10.835	0.955115107	9.880
2 hour	38	22.0	1.78	1	39.096	13.205	1.910230214	11.295
4 hour	48	27.7	1.73	1	47.997	16.211	3.820460428	12.391
6 hour	55	31.8	1.71	1	54.361	18.361	5.730690641	12.630
12 hour	68	39.3	1.62	1	63.672	21.506	11.46138128	10.044
24 hour	85	49.1	1.58	1	77.625	26.218	22.92276257	3.296
48 hour	106	61.3	1.53	1	93.740	31.661	45.84552513	-14.184
Size of Attenuation for 1 in 100 year flood event m³								**12.630**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 337.8 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 1.62 m³

Interception Storage Provided *Only fill in SuDS on your site

Green Roof A 'Bauder Sedume' or equivalent design to retain 30 l/m² of rainwater will be used on roof level	Area	333.75	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	10.01	m³

Total interception volume provided for the overall site 10.01 m³

which exceeds the required volume calculated of 1.62 m³

APPENDIX C – SURFACE WATER PIPE NETWORK CALCULATIONS

Drainage Design Report

Flow+

v10.8

Network	Storm Network - Area 1
Filename	
Username	Kezia Adanza (kadanza@morce.ie)
Last analysed	23/07/2024 12:52:37
Report produced on	23/07/2024 13:02:29

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

http://support.causeway.com

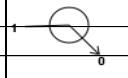
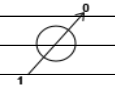
Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.000
Ratio-R	0.280
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.000
Include Intermediate Ground	Yes
Enforce best practice design rules	Yes

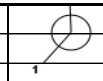
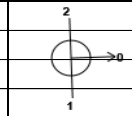
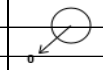
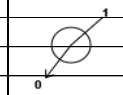
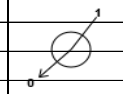
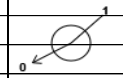
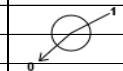
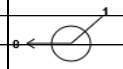
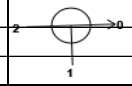
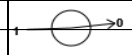
	Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Sump (m)	Easting (m)	Northing (m)	Depth (m)	Notes
✓	SW01 - AREA 1	0.019	4.00		48.225	Manhole	Adoptable	1200			716079.986	738855.419	1.225	
✓	SW02 - AREA 1	0.019	4.00		48.225	Manhole	Adoptable	1200			716079.403	738872.101	1.324	
✓	SW03 - AREA 1	0.019	4.00		48.225	Manhole	Adoptable	1200			716072.223	738875.436	1.371	
✓	SW04 - AREA 1	0.019	4.00		48.450	Manhole	Adoptable	1200			716042.024	738874.382	1.774	
✓	SW05 - AREA 1	0.019	4.00		48.450	Manhole	Adoptable	1200			716029.577	738880.070	1.855	
✓	SW06 - AREA 1	0.019	4.00		48.540	Manhole	Adoptable	1200			716028.722	738904.754	2.091	
✓	SW07 - AREA 1	0.019	4.00		48.100	Manhole	Adoptable	1200			716113.214	738907.681	2.149	
✓	SW08 - AREA 1	0.019	4.00		48.090	Manhole	Adoptable	1200			716117.253	738903.334	2.174	
✓	SW09 - AREA 1		4.00		47.300	Manhole	Adoptable	1200			716090.043	738797.997	1.025	
✓	SW10 - AREA 1	0.019	4.00		47.780	Manhole	Adoptable	1200			716114.260	738827.761	1.731	
✓	SW11 - AREA 1	0.019	4.00		47.875	Manhole	Adoptable	1200			716119.657	738834.395	1.877	
✓	SW12 - AREA 1	0.019	4.00		47.940	Manhole	Adoptable	1200			716118.205	738876.029	2.188	
✓	SW13 - AREA 1	0.019	4.00		47.280	Manhole	Adoptable	1200			716219.793	738936.485	0.825	
✓	SW14 - AREA 1	0.019	4.00		47.580	Manhole	Adoptable	1200			716197.735	738915.185	1.278	
✓	SW15 - AREA 1	0.019	4.00		47.680	Manhole	Adoptable	1200			716191.064	738905.741	1.436	
✓	SW16 - AREA 1	0.019	4.00		47.980	Manhole	Adoptable	1200			716169.537	738884.954	1.886	
✓	SW17 - AREA 1	0.019	4.00		48.070	Manhole	Adoptable	1200			716162.674	738881.085	2.015	
✓	SW18 - AREA 1	0.019	4.00		47.970	Manhole	Adoptable	1200			716135.542	738854.885	2.104	
✓	SW19 - AREA 1	0.019	4.00		47.980	Manhole	Adoptable	1350			716125.789	738854.885	2.163	
✓	SW20 - AREA 1				48.200	Manhole	Adoptable	1350			716125.042	738876.282	2.494	
✓	SW21 - AREA 1				48.300	Manhole	Adoptable	1350			716127.954	738876.383	2.603	
✓	SW22 - AREA 1				48.300	Manhole	Adoptable	1200			716145.453	738878.465	2.675	
✓	SW23 HB - AREA 1				48.090	Manhole	Adoptable	1200			716157.819	738878.465	2.516	
✓	SW24 - AREA 1				48.070	Manhole	Adoptable	1200			716162.769	738883.245	2.525	
✓	SW25 - AREA 1				47.980	Manhole	Adoptable	1200			716169.632	738887.114	2.468	
✓	SW26 - AREA 1				47.680	Manhole	Adoptable	1200			716191.673	738908.398	2.294	
✓	SW27 - AREA 1				47.580	Manhole	Adoptable	1200			716199.055	738918.464	2.245	
✓	SW28 - AREA 1				46.990	Manhole	Adoptable	1200			716212.457	738931.470	1.732	
✓	EXSW MH				46.700	Manhole	Adoptable	1200			716203.106	738941.154	1.497	

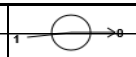
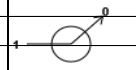
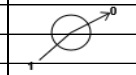
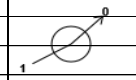
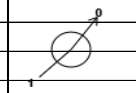
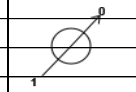
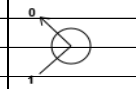
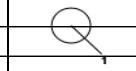
	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Con Offset (m)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
✓	1.000	SW01 - AREA 1	SW02 - AREA 1	16.692	0.600	Colebrook-White	47.000	46.901	0.099	168.6	225	Circular	4.28	50.0					
✓	1.001	SW02 - AREA 1	SW03 - AREA 1	7.917	0.600	Colebrook-White	46.901	46.854	0.047	168.4	225	Circular	4.41	50.0					
✓	1.002	SW03 - AREA 1	SW04 - AREA 1	30.217	0.600	Colebrook-White	46.854	46.676	0.178	169.8	225	Circular	4.91	48.9					
✓	1.003	SW04 - AREA 1	SW05 - AREA 1	13.685	0.600	Colebrook-White	46.676	46.595	0.081	169.0	225	Circular	5.14	48.1					
✓	1.004	SW05 - AREA 1	SW06 - AREA 1	24.699	0.600	Colebrook-White	46.595	46.449	0.146	169.2	225	Circular	5.55	46.7					
✓	1.005	SW06 - AREA 1	SW07 - AREA 1	84.543	0.600	Colebrook-White	46.449	45.951	0.498	169.8	225	Circular	6.96	42.6					
✓	1.006	SW07 - AREA 1	SW08 - AREA 1	5.934	0.600	Colebrook-White	45.951	45.916	0.035	169.5	225	Circular	7.06	42.3					
✓	1.007	SW08 - AREA 1	SW12 - AREA 1	27.322	0.600	Colebrook-White	45.916	45.752	0.164	166.6	225	Circular	7.51	41.2					
?	2.000	SW09 - AREA 1	SW10 - AREA 1	38.371	0.600	Colebrook-White	46.275	46.049	0.226	169.8	225	Circular	4.64	49.9					
✓	2.001	SW10 - AREA 1	SW11 - AREA 1	8.552	0.600	Colebrook-White	46.049	45.998	0.051	167.7	225	Circular	4.78	49.4					
✓	2.002	SW11 - AREA 1	SW12 - AREA 1	41.659	0.600	Colebrook-White	45.998	45.752	0.246	169.3	225	Circular	5.47	46.9					
?	1.008	SW12 - AREA 1	SW20 - AREA 1	6.842	0.600	Colebrook-White	45.752	45.706	0.046	150.0	300	Circular	7.60	41.0					
?	3.000	SW13 - AREA 1	SW14 - AREA 1	30.663	0.600	Colebrook-White	46.455	46.302	0.153	200.0	225	Circular	4.56	50.0					
?	3.001	SW14 - AREA 1	SW15 - AREA 1	11.562	0.600	Colebrook-White	46.302	46.244	0.058	200.0	225	Circular	4.76	49.4					
?	3.002	SW15 - AREA 1	SW16 - AREA 1	29.925	0.600	Colebrook-White	46.244	46.094	0.150	200.0	225	Circular	5.31	47.5					
?	3.003	SW16 - AREA 1	SW17 - AREA 1	7.878	0.600	Colebrook-White	46.094	46.055	0.039	200.0	225	Circular	5.45	47.0					
?	3.004	SW17 - AREA 1	SW18 - AREA 1	37.717	0.600	Colebrook-White	46.055	45.866	0.189	200.0	225	Circular	6.13	44.9					
?	3.005	SW18 - AREA 1	SW19 - AREA 1	9.753	0.600	Colebrook-White	45.866	45.817	0.049	200.0	225	Circular	6.31	44.3					
?	3.006	SW19 - AREA 1	SW20 - AREA 1	21.410	0.600	Colebrook-White	45.817	45.706	0.111	192.9	375	Circular	6.58	43.6					
?	1.009	SW20 - AREA 1	SW21 - AREA 1	2.914	0.600	Colebrook-White	45.706	45.697	0.009	323.8	375	Circular	7.65	40.9					
?	1.010	SW21 - AREA 1	SW22 - AREA 1	17.622	0.600	Colebrook-White	45.697	45.625	0.072	244.8	300	Circular	7.94	40.2					
?	1.011	SW22 - AREA 1	SW23 HB - AREA 1	12.366	0.600	Colebrook-White	45.625	45.574	0.051	242.5	300	Circular	8.14	39.8					
?	1.012	SW23 HB - AREA 1	SW24 - AREA 1	6.881	0.600	Colebrook-White	45.574	45.545	0.029	237.3	300	Circular	8.26	39.5					
?	1.013	SW24 - AREA 1	SW25 - AREA 1	7.878	0.600	Colebrook-White	45.545	45.512	0.033	238.7	300	Circular	8.39	39.2					
?	1.014	SW25 - AREA 1	SW26 - AREA 1	30.640	0.600	Colebrook-White	45.512	45.386	0.126	243.2	300	Circular	8.90	38.2					
✓	1.015	SW26 - AREA 1	SW27 - AREA 1	12.485	0.600	Colebrook-White	45.386	45.335	0.051	244.8	300	Circular	9.10	37.8					
✓	1.016	SW27 - AREA 1	SW28 - AREA 1	18.676	0.600	Colebrook-White	45.335	45.258	0.077	242.5	300	Circular	9.41	37.2					
✓	1.017	SW28 - AREA 1	EXSW MH	13.462	0.600	Colebrook-White	45.258	45.203	0.055	244.8	300	Circular	9.64	36.8					

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)	Notes
✓	1.000	SW01 - AREA 1	SW02 - AREA 1	1.004	39.9	2.6	1.000	1.099	1.000	1.099	0.019	0.0	38	0.564	
✓	1.001	SW02 - AREA 1	SW03 - AREA 1	1.004	39.9	5.1	1.099	1.146	1.099	1.146	0.038	0.0	54	0.693	
✓	1.002	SW03 - AREA 1	SW04 - AREA 1	1.000	39.8	7.6	1.146	1.549	1.146	1.549	0.057	0.0	66	0.774	
✓	1.003	SW04 - AREA 1	SW05 - AREA 1	1.003	39.9	9.9	1.549	1.630	1.549	1.630	0.076	0.0	76	0.834	
✓	1.004	SW05 - AREA 1	SW06 - AREA 1	1.002	39.8	12.0	1.630	1.866	1.630	1.866	0.095	0.0	85	0.881	
✓	1.005	SW06 - AREA 1	SW07 - AREA 1	1.000	39.8	13.2	1.866	1.924	1.866	1.924	0.114	0.0	89	0.901	
✓	1.006	SW07 - AREA 1	SW08 - AREA 1	1.001	39.8	15.3	1.924	1.949	1.924	1.949	0.133	0.0	96	0.935	
✓	1.007	SW08 - AREA 1	SW12 - AREA 1	1.010	40.2	17.0	1.949	1.963	1.949	1.963	0.152	0.0	102	0.970	Fall increased to remove backdrop
?	2.000	SW09 - AREA 1	SW10 - AREA 1	1.000	39.8	0.0	0.800	1.506	0.800	1.506	0.000	0.0	0	0.000	Upstream Depth is less than the specified minimum
✓	2.001	SW10 - AREA 1	SW11 - AREA 1	1.007	40.0	2.5	1.506	1.652	1.506	1.652	0.019	0.0	38	0.566	
✓	2.002	SW11 - AREA 1	SW12 - AREA 1	1.002	39.8	4.8	1.652	1.963	1.652	1.963	0.038	0.0	52	0.678	
?	1.008	SW12 - AREA 1	SW20 - AREA 1	1.281	90.6	23.2	1.888	2.194	1.888	2.194	0.209	0.0	103	1.079	Downstream Depth is more than twice the specified minimum
?	3.000	SW13 - AREA 1	SW14 - AREA 1	0.921	36.6	2.6	0.600	1.053	0.600	1.053	0.019	0.0	40	0.531	Velocity is less than the specified minimum | Upstream Depth is less than the specified minimum
?	3.001	SW14 - AREA 1	SW15 - AREA 1	0.921	36.6	5.1	1.053	1.211	1.053	1.211	0.038	0.0	57	0.652	Velocity is less than the specified minimum
?	3.002	SW15 - AREA 1	SW16 - AREA 1	0.921	36.6	7.3	1.211	1.661	1.211	1.661	0.057	0.0	68	0.722	Velocity is less than the specified minimum
?	3.003	SW16 - AREA 1	SW17 - AREA 1	0.921	36.6	9.7	1.661	1.790	1.661	1.790	0.076	0.0	79	0.779	Velocity is less than the specified minimum
?	3.004	SW17 - AREA 1	SW18 - AREA 1	0.921	36.6	11.6	1.790	1.879	1.790	1.879	0.095	0.0	87	0.817	Velocity is less than the specified minimum
?	3.005	SW18 - AREA 1	SW19 - AREA 1	0.921	36.6	13.7	1.879	1.938	1.879	1.938	0.114	0.0	95	0.856	Velocity is less than the specified minimum
?	3.006	SW19 - AREA 1	SW20 - AREA 1	1.301	143.7	15.7	1.788	2.119	1.788	2.119	0.133	0.0	83	0.864	Fall increased to remove backdrop | Downstream Depth is more than twice the specified minimum
?	1.009	SW20 - AREA 1	SW21 - AREA 1	1.001	110.6	37.9	2.119	2.226	2.119	2.228	0.342	0.0	151	0.911	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.010	SW21 - AREA 1	SW22 - AREA 1	1.000	70.7	37.3	2.303	2.375	2.303	2.375	0.342	0.0	155	1.013	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.011	SW22 - AREA 1	SW23 HB - AREA 1	1.005	71.0	36.9	2.375	2.216	2.216	2.375	0.342	0.0	153	1.014	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.012	SW23 HB - AREA 1	SW24 - AREA 1	1.016	71.8	36.6	2.216	2.225	2.216	2.225	0.342	0.0	152	1.022	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.013	SW24 - AREA 1	SW25 - AREA 1	1.013	71.6	36.4	2.225	2.168	2.168	2.225	0.342	0.0	151	1.017	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.014	SW25 - AREA 1	SW26 - AREA 1	1.004	70.9	35.4	2.168	1.994	1.994	2.168	0.342	0.0	150	1.003	Upstream Depth is more than twice the specified minimum
✓	1.015	SW26 - AREA 1	SW27 - AREA 1	1.000	70.7	35.0	1.994	1.945	1.945	1.994	0.342	0.0	149	0.998	
✓	1.016	SW27 - AREA 1	SW28 - AREA 1	1.005	71.0	34.5	1.945	1.432	1.432	1.945	0.342	0.0	147	0.998	
✓	1.017	SW28 - AREA 1	EXSW MH	1.000	70.7	34.1	1.432	1.197	1.197	1.432	0.342	0.0	147	0.991	

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type
1.000	16.692	168.6	225	Circular	48.225	47.000	1.000	48.225	46.901	1.099	SW01 - AREA 1	1200			Manhole	Adoptable	SW02 - AREA 1	1200			Manhole	Adoptable
1.001	7.917	168.4	225	Circular	48.225	46.901	1.099	48.225	46.854	1.146	SW02 - AREA 1	1200			Manhole	Adoptable	SW03 - AREA 1	1200			Manhole	Adoptable
1.002	30.217	169.8	225	Circular	48.225	46.854	1.146	48.450	46.676	1.549	SW03 - AREA 1	1200			Manhole	Adoptable	SW04 - AREA 1	1200			Manhole	Adoptable
1.003	13.685	169.0	225	Circular	48.450	46.676	1.549	48.450	46.595	1.630	SW04 - AREA 1	1200			Manhole	Adoptable	SW05 - AREA 1	1200			Manhole	Adoptable
1.004	24.699	169.2	225	Circular	48.450	46.595	1.630	48.540	46.449	1.866	SW05 - AREA 1	1200			Manhole	Adoptable	SW06 - AREA 1	1200			Manhole	Adoptable
1.005	84.543	169.8	225	Circular	48.540	46.449	1.866	48.100	45.951	1.924	SW06 - AREA 1	1200			Manhole	Adoptable	SW07 - AREA 1	1200			Manhole	Adoptable
1.006	5.934	169.5	225	Circular	48.100	45.951	1.924	48.090	45.916	1.949	SW07 - AREA 1	1200			Manhole	Adoptable	SW08 - AREA 1	1200			Manhole	Adoptable
1.007	27.322	166.6	225	Circular	48.090	45.916	1.949	47.940	45.752	1.963	SW08 - AREA 1	1200			Manhole	Adoptable	SW12 - AREA 1	1200			Manhole	Adoptable
2.000	38.371	169.8	225	Circular	47.300	46.275	0.800	47.780	46.049	1.506	SW09 - AREA 1	1200			Manhole	Adoptable	SW10 - AREA 1	1200			Manhole	Adoptable
2.001	8.552	167.7	225	Circular	47.780	46.049	1.506	47.875	45.998	1.652	SW10 - AREA 1	1200			Manhole	Adoptable	SW11 - AREA 1	1200			Manhole	Adoptable
2.002	41.659	169.3	225	Circular	47.875	45.998	1.652	47.940	45.752	1.963	SW11 - AREA 1	1200			Manhole	Adoptable	SW12 - AREA 1	1200			Manhole	Adoptable
1.008	6.842	150.0	300	Circular	47.940	45.752	1.888	48.200	45.706	2.194	SW12 - AREA 1	1200			Manhole	Adoptable	SW20 - AREA 1	1350			Manhole	Adoptable
3.000	30.663	200.0	225	Circular	47.280	46.455	0.600	47.580	46.302	1.053	SW13 - AREA 1	1200			Manhole	Adoptable	SW14 - AREA 1	1200			Manhole	Adoptable
3.001	11.562	200.0	225	Circular	47.580	46.302	1.053	47.680	46.244	1.211	SW14 - AREA 1	1200			Manhole	Adoptable	SW15 - AREA 1	1200			Manhole	Adoptable
3.002	29.925	200.0	225	Circular	47.680	46.244	1.211	47.980	46.094	1.661	SW15 - AREA 1	1200			Manhole	Adoptable	SW16 - AREA 1	1200			Manhole	Adoptable
3.003	7.878	200.0	225	Circular	47.980	46.094	1.661	48.070	46.055	1.790	SW16 - AREA 1	1200			Manhole	Adoptable	SW17 - AREA 1	1200			Manhole	Adoptable
3.004	37.717	200.0	225	Circular	48.070	46.055	1.790	47.970	45.866	1.879	SW17 - AREA 1	1200			Manhole	Adoptable	SW18 - AREA 1	1200			Manhole	Adoptable
3.005	9.753	200.0	225	Circular	47.970	45.866	1.879	47.980	45.817	1.938	SW18 - AREA 1	1200			Manhole	Adoptable	SW19 - AREA 1	1350			Manhole	Adoptable
3.006	21.410	192.9	375	Circular	47.980	45.817	1.788	48.200	45.706	2.119	SW19 - AREA 1	1350			Manhole	Adoptable	SW20 - AREA 1	1350			Manhole	Adoptable
1.009	2.914	323.8	375	Circular	48.200	45.706	2.119	48.300	45.697	2.228	SW20 - AREA 1	1350			Manhole	Adoptable	SW21 - AREA 1	1350			Manhole	Adoptable
1.010	17.622	244.8	300	Circular	48.300	45.697	2.303	48.300	45.625	2.375	SW21 - AREA 1	1350			Manhole	Adoptable	SW22 - AREA 1	1200			Manhole	Adoptable
1.011	12.366	242.5	300	Circular	48.300	45.625	2.375	48.090	45.574	2.216	SW22 - AREA 1	1200			Manhole	Adoptable	SW23 HB - AREA 1	1200			Manhole	Adoptable
1.012	6.881	237.3	300	Circular	48.090	45.574	2.216	48.070	45.545	2.225	SW23 HB - AREA 1	1200			Manhole	Adoptable	SW24 - AREA 1	1200			Manhole	Adoptable
1.013	7.878	238.7	300	Circular	48.070	45.545	2.225	47.980	45.512	2.168	SW24 - AREA 1	1200			Manhole	Adoptable	SW25 - AREA 1	1200			Manhole	Adoptable
1.014	30.640	243.2	300	Circular	47.980	45.512	2.168	47.680	45.386	1.994	SW25 - AREA 1	1200			Manhole	Adoptable	SW26 - AREA 1	1200			Manhole	Adoptable
1.015	12.485	244.8	300	Circular	47.680	45.386	1.994	47.580	45.335	1.945	SW26 - AREA 1	1200			Manhole	Adoptable	SW27 - AREA 1	1200			Manhole	Adoptable
1.016	18.676	242.5	300	Circular	47.580	45.335	1.945	46.990	45.258	1.432	SW27 - AREA 1	1200			Manhole	Adoptable	SW28 - AREA 1	1200			Manhole	Adoptable
1.017	13.462	244.8	300	Circular	46.990	45.258	1.432	46.700	45.203	1.197	SW28 - AREA 1	1200			Manhole	Adoptable	EXSW MH	1200			Manhole	Adoptable

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	Connections		Link	IL (m)	Dia (mm)	Link Type
SW01 - AREA 1	716079.986	738855.419	48.225	1.225	1200			Manhole	Adoptable						
											0	1.000	47.000	225	Circular
SW02 - AREA 1	716079.403	738872.101	48.225	1.324	1200			Manhole	Adoptable		1	1.000	46.901	225	Circular
															
											0	1.001	46.901	225	Circular
SW03 - AREA 1	716072.223	738875.436	48.225	1.371	1200			Manhole	Adoptable		1	1.001	46.854	225	Circular
															
											0	1.002	46.854	225	Circular
SW04 - AREA 1	716042.024	738874.382	48.450	1.774	1200			Manhole	Adoptable		1	1.002	46.676	225	Circular
															
											0	1.003	46.676	225	Circular
SW05 - AREA 1	716029.577	738880.070	48.450	1.855	1200			Manhole	Adoptable		1	1.003	46.595	225	Circular
											0	1.004	46.595	225	Circular
SW06 - AREA 1	716028.722	738904.754	48.540	2.091	1200			Manhole	Adoptable		1	1.004	46.449	225	Circular
															
											0	1.005	46.449	225	Circular
SW07 - AREA 1	716113.214	738907.681	48.100	2.149	1200			Manhole	Adoptable		1	1.005	45.951	225	Circular
															
											0	1.006	45.951	225	Circular
SW08 - AREA 1	716117.253	738903.334	48.090	2.174	1200			Manhole	Adoptable		1	1.006	45.916	225	Circular
															
											0	1.007	45.916	225	Circular
SW09 - AREA 1	716090.043	738797.997	47.300	1.025	1200			Manhole	Adoptable						
															
											0	2.000	46.275	225	Circular
SW10 - AREA 1	716114.260	738827.761	47.780	1.731	1200			Manhole	Adoptable		1	2.000	46.049	225	Circular
															
											0	2.001	46.049	225	Circular
SW11 - AREA 1	716119.657	738834.395	47.875	1.877	1200			Manhole	Adoptable		1	2.001	45.998	225	Circular

															
											0	2.002	45.998	225	Circular
SW12 - AREA 1	716118.205	738876.029	47.940	2.188	1200			Manhole	Adoptable		1	2.002	45.752	225	Circular
											2	1.007	45.752	225	Circular
											0	1.008	45.752	300	Circular
SW13 - AREA 1	716219.793	738936.485	47.280	0.825	1200			Manhole	Adoptable						
															
											0	3.000	46.455	225	Circular
SW14 - AREA 1	716197.735	738915.185	47.580	1.278	1200			Manhole	Adoptable		1	3.000	46.302	225	Circular
															
											0	3.001	46.302	225	Circular
SW15 - AREA 1	716191.064	738905.741	47.680	1.436	1200			Manhole	Adoptable		1	3.001	46.244	225	Circular
															
											0	3.002	46.244	225	Circular
SW16 - AREA 1	716169.537	738884.954	47.980	1.886	1200			Manhole	Adoptable		1	3.002	46.094	225	Circular
															
											0	3.003	46.094	225	Circular
SW17 - AREA 1	716162.674	738881.085	48.070	2.015	1200			Manhole	Adoptable		1	3.003	46.055	225	Circular
															
											0	3.004	46.055	225	Circular
SW18 - AREA 1	716135.542	738854.885	47.970	2.104	1200			Manhole	Adoptable		1	3.004	45.866	225	Circular
															
											0	3.005	45.866	225	Circular
SW19 - AREA 1	716125.789	738854.885	47.980	2.163	1350			Manhole	Adoptable		1	3.005	45.817	225	Circular
											0	3.006	45.817	375	Circular
SW20 - AREA 1	716125.042	738876.282	48.200	2.494	1350			Manhole	Adoptable		1	3.006	45.706	375	Circular
											2	1.008	45.706	300	Circular
															
											0	1.009	45.706	375	Circular
SW21 - AREA 1	716127.954	738876.383	48.300	2.603	1350			Manhole	Adoptable		1	1.009	45.697	375	Circular
															
											0	1.010	45.697	300	Circular
SW22 - AREA 1	716145.453	738878.465	48.300	2.675	1200			Manhole	Adoptable		1	1.010	45.625	300	Circular

															
											0	1.011	45.625	300	Circular
SW23 HB - AREA 1	716157.819	738878.465	48.090	2.516	1200			Manhole	Adoptable		1	1.011	45.574	300	Circular
											0	1.012	45.574	300	Circular
SW24 - AREA 1	716162.769	738883.245	48.070	2.525	1200			Manhole	Adoptable		1	1.012	45.545	300	Circular
											0	1.013	45.545	300	Circular
SW25 - AREA 1	716169.632	738887.114	47.980	2.468	1200			Manhole	Adoptable		1	1.013	45.512	300	Circular
											0	1.014	45.512	300	Circular
SW26 - AREA 1	716191.673	738908.398	47.680	2.294	1200			Manhole	Adoptable		1	1.014	45.386	300	Circular
											0	1.015	45.386	300	Circular
SW27 - AREA 1	716199.055	738918.464	47.580	2.245	1200			Manhole	Adoptable		1	1.015	45.335	300	Circular
											0	1.016	45.335	300	Circular
SW28 - AREA 1	716212.457	738931.470	46.990	1.732	1200			Manhole	Adoptable		1	1.016	45.258	300	Circular
											0	1.017	45.258	300	Circular
EXSW MH	716203.106	738941.154	46.700	1.497	1200			Manhole	Adoptable		1	1.017	45.203	300	Circular

Rainfall Methodology	FSR		Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
FSR Region	Scotland and Ireland		2	20	0	0
M5-60 (mm)	16.000		30	20	0	0
Ratio-R	0.280		100	20	0	0
Summer CV	0.750					
Winter CV	0.840					
Analysis Speed	Normal					
Skip Steady State	No					
Drain Down Time (mins)	240					
Additional Storage (m³/ha)	20.0					
Storm Durations (mins)	15					
	30					
	60					
	120					
	180					
	240					
	360					
	480					
	600					
	720					
	960					
	1440					
	2160					
	2880					
	4320					
	5760					
	7200					
	8640					
	10080					
Check Discharge Rate(s)	No					
Check Discharge Volume	No					
100 year 360 minute (m³)						

Depth/Area/Inf Area									
Node	**Base Inf Coefficient (m/hr)**	**Side Inf Coefficient (m/hr)**	**Safety Factor**	**Porosity**	**Invert Level (m)**	**Time to half empty (mins)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
SW21 - AREA 1	0.00000	0.00000	2.0	1.00	45.697	0	0.000	171.0	0.0
							0.800	171.0	0.0
							0.801	0.0	0.0

Default Values			**Overrides**					
Entry Loss (manhole)	0.250		**Link**	**Entry Loss**	**Exit Loss**		**Node**	**Flood Risk (m)**
Exit Loss (manhole)	0.250							
Entry Loss (junction)	0.000							
Exit Loss (junction)	0.000							
Apply Recommended Losses	No							
Flood Risk (m)	0.300							

Node Size	Yes
Node Losses	Yes
Link Size	Yes
Minimum Diameter (mm)	150
Link Length	Yes
Maximum Length (m)	100.000
Coordinates	Yes
Accuracy (m)	1.000
Crossings	Yes
Cover Depth	Yes
Minimum Cover Depth (m)	
Maximum Cover Depth (m)	3.000
Backdrops	Yes
Minimum Backdrop Height (m)	
Maximum Backdrop Height (m)	1.500
Full Bore Velocity	Yes
Minimum Full Bore Velocity (m/s)	
Maximum Full Bore Velocity (m/s)	3.000
Proportional Velocity	Yes
Return Period (years)	
Minimum Proportional Velocity (m/s)	0.750
Maximum Proportional Velocity (m/s)	3.000
Surcharged Depth	Yes
Return Period (years)	
Maximum Surcharged Depth (m)	0.100
Flooding	Yes
Return Period (years)	30
Time to Half Empty	No
Return Period (years)	
Discharge Rates	Yes
Discharge Volume	Yes
100 year 360 minute (m^3)	

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +20% CC 15 minute summer	125.076	35.392
2 year +20% CC 15 minute winter	87.773	35.392
2 year +20% CC 30 minute summer	85.296	24.136
2 year +20% CC 30 minute winter	59.857	24.136
2 year +20% CC 60 minute summer	60.447	15.974
2 year +20% CC 60 minute winter	40.160	15.974
2 year +20% CC 120 minute summer	39.259	10.375
2 year +20% CC 120 minute winter	26.083	10.375
2 year +20% CC 180 minute summer	30.986	7.974
2 year +20% CC 180 minute winter	20.142	7.974
2 year +20% CC 240 minute summer	25.068	6.625
2 year +20% CC 240 minute winter	16.654	6.625
2 year +20% CC 360 minute summer	19.895	5.120
2 year +20% CC 360 minute winter	12.932	5.120
2 year +20% CC 480 minute summer	16.078	4.249
2 year +20% CC 480 minute winter	10.682	4.249
2 year +20% CC 600 minute summer	13.442	3.677
2 year +20% CC 600 minute winter	9.184	3.677
2 year +20% CC 720 minute summer	12.188	3.267
2 year +20% CC 720 minute winter	8.191	3.267
2 year +20% CC 960 minute summer	10.295	2.711
2 year +20% CC 960 minute winter	6.820	2.711
2 year +20% CC 1440 minute summer	7.780	2.085
2 year +20% CC 1440 minute winter	5.229	2.085
2 year +20% CC 2160 minute summer	5.787	1.599
2 year +20% CC 2160 minute winter	3.987	1.599
2 year +20% CC 2880 minute summer	4.939	1.324
2 year +20% CC 2880 minute winter	3.320	1.324
2 year +20% CC 4320 minute summer	3.880	1.015
2 year +20% CC 4320 minute winter	2.555	1.015

2 year +20% CC 5760 minute summer	3.280	0.840
2 year +20% CC 5760 minute winter	2.123	0.840
2 year +20% CC 7200 minute summer	2.837	0.724
2 year +20% CC 7200 minute winter	1.831	0.724
2 year +20% CC 8640 minute summer	2.512	0.641
2 year +20% CC 8640 minute winter	1.621	0.641
2 year +20% CC 10080 minute summer	2.267	0.578
2 year +20% CC 10080 minute winter	1.463	0.578
30 year +20% CC 15 minute summer	229.581	64.964
30 year +20% CC 15 minute winter	161.110	64.964
30 year +20% CC 30 minute summer	157.518	44.572
30 year +20% CC 30 minute winter	110.539	44.572
30 year +20% CC 60 minute summer	109.995	29.068
30 year +20% CC 60 minute winter	73.078	29.068
30 year +20% CC 120 minute summer	69.900	18.472
30 year +20% CC 120 minute winter	46.440	18.472
30 year +20% CC 180 minute summer	54.666	14.067
30 year +20% CC 180 minute winter	35.534	14.067
30 year +20% CC 240 minute summer	43.793	11.573
30 year +20% CC 240 minute winter	29.095	11.573
30 year +20% CC 360 minute summer	34.080	8.770
30 year +20% CC 360 minute winter	22.153	8.770
30 year +20% CC 480 minute summer	27.227	7.195
30 year +20% CC 480 minute winter	18.089	7.195
30 year +20% CC 600 minute summer	22.551	6.168
30 year +20% CC 600 minute winter	15.408	6.168
30 year +20% CC 720 minute summer	20.288	5.437
30 year +20% CC 720 minute winter	13.635	5.437
30 year +20% CC 960 minute summer	16.917	4.455
30 year +20% CC 960 minute winter	11.206	4.455
30 year +20% CC 1440 minute summer	12.545	3.362
30 year +20% CC 1440 minute winter	8.431	3.362
30 year +20% CC 2160 minute summer	9.180	2.537

30 year +20% CC 2160 minute winter	6.325	2.537
30 year +20% CC 2880 minute summer	7.747	2.076
30 year +20% CC 2880 minute winter	5.207	2.076
30 year +20% CC 4320 minute summer	5.982	1.564
30 year +20% CC 4320 minute winter	3.940	1.564
30 year +20% CC 5760 minute summer	4.995	1.279
30 year +20% CC 5760 minute winter	3.233	1.279
30 year +20% CC 7200 minute summer	4.286	1.093
30 year +20% CC 7200 minute winter	2.766	1.093
30 year +20% CC 8640 minute summer	3.771	0.962
30 year +20% CC 8640 minute winter	2.434	0.962
30 year +20% CC 10080 minute summer	3.384	0.863
30 year +20% CC 10080 minute winter	2.184	0.863
100 year +20% CC 15 minute summer	297.434	84.163
100 year +20% CC 15 minute winter	208.725	84.163
100 year +20% CC 30 minute summer	205.553	58.164
100 year +20% CC 30 minute winter	144.248	58.164
100 year +20% CC 60 minute summer	143.033	37.800
100 year +20% CC 60 minute winter	95.028	37.800
100 year +20% CC 120 minute summer	90.194	23.836
100 year +20% CC 120 minute winter	59.923	23.836
100 year +20% CC 180 minute summer	70.128	18.046
100 year +20% CC 180 minute winter	45.585	18.046
100 year +20% CC 240 minute summer	55.935	14.782
100 year +20% CC 240 minute winter	37.162	14.782
100 year +20% CC 360 minute summer	43.239	11.127
100 year +20% CC 360 minute winter	28.106	11.127
100 year +20% CC 480 minute summer	34.371	9.083
100 year +20% CC 480 minute winter	22.836	9.083
100 year +20% CC 600 minute summer	28.355	7.756
100 year +20% CC 600 minute winter	19.374	7.756
100 year +20% CC 720 minute summer	25.426	6.814
100 year +20% CC 720 minute winter	17.088	6.814

100 year +20% CC 960 minute summer	21.089	5.553
100 year +20% CC 960 minute winter	13.970	5.553
100 year +20% CC 1440 minute summer	15.523	4.160
100 year +20% CC 1440 minute winter	10.432	4.160
100 year +20% CC 2160 minute summer	11.275	3.116
100 year +20% CC 2160 minute winter	7.769	3.116
100 year +20% CC 2880 minute summer	9.462	2.536
100 year +20% CC 2880 minute winter	6.359	2.536
100 year +20% CC 4320 minute summer	7.246	1.894
100 year +20% CC 4320 minute winter	4.772	1.894
100 year +20% CC 5760 minute summer	6.012	1.539
100 year +20% CC 5760 minute winter	3.891	1.539
100 year +20% CC 7200 minute summer	5.133	1.309
100 year +20% CC 7200 minute winter	3.313	1.309
100 year +20% CC 8640 minute summer	4.498	1.147
100 year +20% CC 8640 minute winter	2.903	1.147
100 year +20% CC 10080 minute summer	4.022	1.026
100 year +20% CC 10080 minute winter	2.596	1.026

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 99.13%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
15 minute winter	SW01 - AREA 1	10	47.043	0.043	3.2	0.0616	0.0000	OK	15 minute winter	1.000	SW02 - AREA 1	3.2	0.437	0.080	0.1235	
15 minute winter	SW02 - AREA 1	10	46.966	0.065	6.4	0.0927	0.0000	OK	15 minute winter	1.001	SW03 - AREA 1	6.4	0.608	0.159	0.0830	
15 minute summer	SW03 - AREA 1	10	46.928	0.074	9.6	0.1046	0.0000	OK	15 minute summer	1.002	SW04 - AREA 1	9.5	0.716	0.238	0.4005	
15 minute winter	SW04 - AREA 1	10	46.768	0.092	12.7	0.1234	0.0000	OK	15 minute winter	1.003	SW05 - AREA 1	12.4	0.768	0.310	0.2205	
15 minute winter	SW05 - AREA 1	11	46.695	0.100	15.6	0.1339	0.0000	OK	15 minute winter	1.004	SW06 - AREA 1	15.4	0.884	0.388	0.4353	
15 minute winter	SW06 - AREA 1	11	46.554	0.105	18.3	0.1379	0.0000	OK	15 minute winter	1.005	SW07 - AREA 1	18.0	0.875	0.452	1.7764	
15 minute winter	SW07 - AREA 1	11	46.081	0.130	20.8	0.1707	0.0000	OK	15 minute winter	1.006	SW08 - AREA 1	20.2	0.900	0.508	0.1348	
15 minute summer	SW08 - AREA 1	11	46.042	0.126	21.4	0.1643	0.0000	OK	15 minute summer	1.007	SW12 - AREA 1	21.9	0.844	0.545	0.8551	
15 minute summer	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0995	
15 minute winter	SW10 - AREA 1	10	46.091	0.042	3.2	0.0574	0.0000	OK	15 minute winter	2.001	SW11 - AREA 1	3.2	0.469	0.079	0.0581	
15 minute winter	SW11 - AREA 1	10	46.058	0.060	6.4	0.0794	0.0000	OK	15 minute winter	2.002	SW12 - AREA 1	6.2	0.410	0.156	1.0031	
15 minute winter	SW12 - AREA 1	10	46.016	0.264	31.7	0.3449	0.0000	OK	15 minute winter	1.008	SW20 - AREA 1	36.8	0.832	0.406	0.4638	
15 minute winter	SW13 - AREA 1	10	46.499	0.044	3.2	0.0708	0.0000	OK	15 minute winter	3.000	SW14 - AREA 1	3.2	0.424	0.087	0.2313	
15 minute winter	SW14 - AREA 1	10	46.367	0.065	6.4	0.0933	0.0000	OK	15 minute winter	3.001	SW15 - AREA 1	6.2	0.585	0.170	0.1233	
15 minute winter	SW15 - AREA 1	10	46.320	0.076	9.4	0.1061	0.0000	OK	15 minute winter	3.002	SW16 - AREA 1	9.2	0.646	0.250	0.4280	
15 minute winter	SW16 - AREA 1	11	46.193	0.099	12.4	0.1322	0.0000	OK	15 minute winter	3.003	SW17 - AREA 1	12.2	0.720	0.332	0.1331	
15 minute winter	SW17 - AREA 1	11	46.155	0.100	15.1	0.1313	0.0000	OK	15 minute winter	3.004	SW18 - AREA 1	15.1	0.758	0.412	0.8461	
15 minute summer	SW18 - AREA 1	11	46.034	0.168	17.5	0.2208	0.0000	OK	15 minute summer	3.005	SW19 - AREA 1	20.3	0.925	0.554	0.3187	
15 minute winter	SW19 - AREA 1	10	46.017	0.200	25.8	0.3211	0.0000	OK	15 minute winter	3.006	SW20 - AREA 1	33.0	0.590	0.229	1.6228	
15 minute winter	SW20 - AREA 1	10	45.997	0.291	69.7	0.4170	0.0000	OK	15 minute winter	1.009	SW21 - AREA 1	77.4	2.021	0.700	0.1355	
60 minute winter	SW21 - AREA 1	42	45.813	0.116	31.7	20.0144	0.0000	OK	60 minute winter	1.010	SW22 - AREA 1	20.1	0.784	0.284	0.4518	
60 minute winter	SW22 - AREA 1	43	45.745	0.119	20.1	0.1352	0.0000	OK	60 minute winter	1.011	SW23 HB - AREA 1	20.1	0.751	0.283	0.3309	
60 minute winter	SW23 HB - AREA 1	43	45.698	0.124	20.1	0.1398	0.0000	OK	60 minute winter	1.012	SW24 - AREA 1	20.1	0.750	0.280	0.1843	
60 minute winter	SW24 - AREA 1	43	45.665	0.120	20.1	0.1354	0.0000	OK	60 minute winter	1.013	SW25 - AREA 1	20.1	0.801	0.281	0.1976	
60 minute winter	SW25 - AREA 1	43	45.624	0.112	20.1	0.1266	0.0000	OK	60 minute winter	1.014	SW26 - AREA 1	20.1	0.809	0.283	0.7610	
60 minute winter	SW26 - AREA 1	44	45.504	0.118	20.1	0.1336	0.0000	OK	60 minute winter	1.015	SW27 - AREA 1	20.1	0.794	0.284	0.3159	
60 minute winter	SW27 - AREA 1	44	45.450	0.115	20.1	0.1301	0.0000	OK	60 minute winter	1.016	SW28 - AREA 1	20.1	0.804	0.283	0.4662	
60 minute winter	SW28 - AREA 1	44	45.374	0.116	20.1	0.1309	0.0000	OK	60 minute winter	1.017	EXSW MH	20.1	0.840	0.284	0.3217	44.3
60 minute winter	EXSW MH	45	45.311	0.108	20.1	0.0000	0.0000	OK								

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.13%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 1	10	47.058	0.058	5.9	0.0836	0.0000	OK	15 minute winter	1.000	SW02 - AREA 1	5.9	0.502	0.148	0.1986	
15 minute winter	SW02 - AREA 1	10	46.995	0.094	11.8	0.1333	0.0000	OK	15 minute winter	1.001	SW03 - AREA 1	11.8	0.699	0.295	0.1332	
15 minute summer	SW03 - AREA 1	10	46.958	0.104	17.7	0.1467	0.0000	OK	15 minute summer	1.002	SW04 - AREA 1	17.6	0.820	0.444	0.6500	
15 minute winter	SW04 - AREA 1	10	46.812	0.136	23.6	0.1835	0.0000	OK	15 minute winter	1.003	SW05 - AREA 1	23.0	0.867	0.577	0.3631	
15 minute winter	SW05 - AREA 1	10	46.744	0.149	28.9	0.1990	0.0000	OK	15 minute winter	1.004	SW06 - AREA 1	28.4	1.014	0.714	0.7047	
15 minute winter	SW06 - AREA 1	11	46.605	0.156	34.1	0.2048	0.0000	OK	15 minute winter	1.005	SW07 - AREA 1	33.5	0.910	0.842	2.9227	
15 minute winter	SW07 - AREA 1	11	46.271	0.320	38.6	0.4189	0.0000	SURCHARGED	15 minute winter	1.006	SW08 - AREA 1	38.2	0.961	0.960	0.2360	
15 minute winter	SW08 - AREA 1	11	46.215	0.299	43.0	0.3900	0.0000	SURCHARGED	15 minute winter	1.007	SW12 - AREA 1	42.8	1.076	1.066	1.0866	
15 minute summer	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.1642	
15 minute summer	SW10 - AREA 1	10	46.109	0.060	5.9	0.0815	0.0000	OK	15 minute summer	2.001	SW11 - AREA 1	5.8	0.540	0.145	0.0926	
15 minute winter	SW11 - AREA 1	10	46.082	0.084	11.7	0.1121	0.0000	OK	15 minute winter	2.002	SW12 - AREA 1	12.1	0.445	0.303	1.1101	
15 minute winter	SW12 - AREA 1	9	46.064	0.312	59.0	0.4076	0.0000	SURCHARGED	15 minute winter	1.008	SW20 - AREA 1	58.7	0.961	0.648	0.4818	
15 minute winter	SW13 - AREA 1	10	46.515	0.060	5.9	0.0963	0.0000	OK	15 minute winter	3.000	SW14 - AREA 1	5.9	0.489	0.160	0.3718	
15 minute winter	SW14 - AREA 1	10	46.396	0.094	11.8	0.1341	0.0000	OK	15 minute winter	3.001	SW15 - AREA 1	11.6	0.676	0.317	0.1983	
15 minute winter	SW15 - AREA 1	10	46.351	0.107	17.5	0.1495	0.0000	OK	15 minute winter	3.002	SW16 - AREA 1	17.1	0.730	0.468	0.7008	
15 minute winter	SW16 - AREA 1	10	46.245	0.151	23.0	0.2005	0.0000	OK	15 minute winter	3.003	SW17 - AREA 1	22.5	0.807	0.613	0.2206	
15 minute winter	SW17 - AREA 1	10	46.203	0.148	28.2	0.1960	0.0000	OK	15 minute winter	3.004	SW18 - AREA 1	28.1	0.894	0.768	1.2602	
15 minute winter	SW18 - AREA 1	9	46.136	0.270	34.0	0.3539	0.0000	SURCHARGED	15 minute winter	3.005	SW19 - AREA 1	35.9	1.120	0.980	0.3879	
15 minute winter	SW19 - AREA 1	9	46.080	0.263	41.8	0.4231	0.0000	OK	15 minute winter	3.006	SW20 - AREA 1	47.8	0.721	0.333	2.0077	
15 minute winter	SW20 - AREA 1	9	46.045	0.339	104.1	0.4851	0.0000	OK	15 minute winter	1.009	SW21 - AREA 1	111.2	2.382	1.005	0.1559	
30 minute winter	SW21 - AREA 1	24	45.883	0.186	85.3	32.1313	0.0000	OK	30 minute winter	1.010	SW22 - AREA 1	42.0	0.895	0.594	0.8300	
30 minute winter	SW22 - AREA 1	25	45.819	0.194	42.0	0.2199	0.0000	OK	30 minute winter	1.011	SW23 HB - AREA 1	42.0	0.859	0.591	0.6055	
30 minute winter	SW23 HB - AREA 1	25	45.773	0.199	42.0	0.2251	0.0000	OK	30 minute winter	1.012	SW24 - AREA 1	42.0	0.869	0.584	0.3326	
30 minute winter	SW24 - AREA 1	25	45.735	0.190	42.0	0.2149	0.0000	OK	30 minute winter	1.013	SW25 - AREA 1	42.0	0.935	0.586	0.3535	
30 minute winter	SW25 - AREA 1	25	45.687	0.175	42.0	0.1981	0.0000	OK	30 minute winter	1.014	SW26 - AREA 1	41.9	0.942	0.591	1.3631	
30 minute winter	SW26 - AREA 1	26	45.574	0.188	41.9	0.2125	0.0000	OK	30 minute winter	1.015	SW27 - AREA 1	41.9	0.922	0.592	0.5674	
30 minute winter	SW27 - AREA 1	26	45.516	0.181	41.9	0.2049	0.0000	OK	30 minute winter	1.016	SW28 - AREA 1	41.9	0.951	0.590	0.8226	
30 minute winter	SW28 - AREA 1	26	45.436	0.178	41.9	0.2016	0.0000	OK	30 minute winter	1.017	EXSW MH	41.8	1.030	0.592	0.5467	62.7
30 minute winter	EXSW MH	26	45.361	0.158	41.8	0.0000	0.0000	OK								

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.13%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 1	10	47.066	0.066	7.7	0.0957	0.0000	OK	15 minute winter	1.000	SW02 - AREA 1	7.7	0.530	0.193	0.2453	
15 minute summer	SW02 - AREA 1	10	47.013	0.112	15.4	0.1582	0.0000	OK	15 minute summer	1.001	SW03 - AREA 1	15.4	0.739	0.385	0.1645	
15 minute summer	SW03 - AREA 1	10	46.976	0.122	23.1	0.1716	0.0000	OK	15 minute summer	1.002	SW04 - AREA 1	23.1	0.857	0.581	0.8275	
15 minute winter	SW04 - AREA 1	12	46.929	0.253	30.8	0.3401	0.0000	SURCHARGED	15 minute winter	1.003	SW05 - AREA 1	29.9	0.895	0.750	0.5443	
15 minute winter	SW05 - AREA 1	12	46.888	0.293	37.6	0.3914	0.0000	SURCHARGED	15 minute winter	1.004	SW06 - AREA 1	36.6	1.046	0.920	0.9823	
15 minute winter	SW06 - AREA 1	12	46.787	0.338	44.3	0.4437	0.0000	SURCHARGED	15 minute winter	1.005	SW07 - AREA 1	36.2	0.939	0.909	3.3624	
15 minute winter	SW07 - AREA 1	10	46.371	0.420	41.1	0.5495	0.0000	SURCHARGED	15 minute winter	1.006	SW08 - AREA 1	41.3	1.039	1.038	0.2360	
15 minute winter	SW08 - AREA 1	10	46.312	0.396	47.5	0.5175	0.0000	SURCHARGED	15 minute winter	1.007	SW12 - AREA 1	47.8	1.201	1.189	1.0866	
15 minute summer	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.2110	
15 minute winter	SW10 - AREA 1	10	46.129	0.080	7.7	0.1080	0.0000	OK	15 minute winter	2.001	SW11 - AREA 1	9.1	0.578	0.227	0.1428	
15 minute winter	SW11 - AREA 1	9	46.125	0.127	16.8	0.1695	0.0000	OK	15 minute winter	2.002	SW12 - AREA 1	19.0	0.563	0.476	1.3100	
15 minute winter	SW12 - AREA 1	9	46.083	0.331	72.9	0.4319	0.0000	SURCHARGED	15 minute winter	1.008	SW20 - AREA 1	74.7	1.079	0.825	0.4818	
15 minute winter	SW13 - AREA 1	10	46.524	0.069	7.7	0.1104	0.0000	OK	15 minute winter	3.000	SW14 - AREA 1	7.7	0.518	0.209	0.4592	
15 minute winter	SW14 - AREA 1	10	46.413	0.111	15.4	0.1590	0.0000	OK	15 minute winter	3.001	SW15 - AREA 1	15.1	0.714	0.414	0.2556	
15 minute winter	SW15 - AREA 1	11	46.382	0.138	22.8	0.1921	0.0000	OK	15 minute winter	3.002	SW16 - AREA 1	22.3	0.741	0.609	0.9757	
15 minute winter	SW16 - AREA 1	11	46.333	0.239	30.0	0.3187	0.0000	SURCHARGED	15 minute winter	3.003	SW17 - AREA 1	28.6	0.798	0.782	0.3133	
15 minute winter	SW17 - AREA 1	11	46.295	0.240	35.3	0.3172	0.0000	SURCHARGED	15 minute winter	3.004	SW18 - AREA 1	36.1	0.918	0.986	1.5000	
15 minute summer	SW18 - AREA 1	9	46.154	0.288	41.8	0.3777	0.0000	SURCHARGED	15 minute summer	3.005	SW19 - AREA 1	42.2	1.134	1.153	0.3879	
15 minute summer	SW19 - AREA 1	9	46.092	0.275	48.6	0.4416	0.0000	OK	15 minute summer	3.006	SW20 - AREA 1	52.4	0.737	0.365	2.0836	
15 minute winter	SW20 - AREA 1	8	46.067	0.361	128.0	0.5159	0.0000	OK	15 minute winter	1.009	SW21 - AREA 1	131.7	2.568	1.191	0.1903	
30 minute winter	SW21 - AREA 1	24	45.930	0.233	101.9	40.0957	0.0000	OK	30 minute winter	1.010	SW22 - AREA 1	54.8	0.926	0.775	1.0532	
30 minute winter	SW22 - AREA 1	25	45.867	0.242	54.8	0.2740	0.0000	OK	30 minute winter	1.011	SW23 HB - AREA 1	54.6	0.897	0.769	0.7568	
30 minute winter	SW23 HB - AREA 1	25	45.818	0.244	54.6	0.2763	0.0000	OK	30 minute winter	1.012	SW24 - AREA 1	54.6	0.913	0.761	0.4124	
30 minute winter	SW24 - AREA 1	25	45.777	0.232	54.6	0.2621	0.0000	OK	30 minute winter	1.013	SW25 - AREA 1	54.6	0.977	0.763	0.4412	
30 minute winter	SW25 - AREA 1	25	45.725	0.213	54.6	0.2413	0.0000	OK	30 minute winter	1.014	SW26 - AREA 1	54.5	0.982	0.769	1.7038	
30 minute winter	SW26 - AREA 1	26	45.615	0.229	54.5	0.2592	0.0000	OK	30 minute winter	1.015	SW27 - AREA 1	54.5	0.966	0.770	0.7050	
30 minute winter	SW27 - AREA 1	26	45.554	0.219	54.5	0.2479	0.0000	OK	30 minute winter	1.016	SW28 - AREA 1	54.5	1.007	0.767	1.0102	
30 minute winter	SW28 - AREA 1	26	45.469	0.211	54.5	0.2389	0.0000	OK	30 minute winter	1.017	EXSW MH	54.4	1.115	0.770	0.6564	82.2
30 minute winter	EXSW MH	26	45.384	0.181	54.4	0.0000	0.0000	OK								

Results for 2 year +20% CC 15 minute summer. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
15 minute summer	SW01 - AREA 1	10	47.043	0.043	3.2	0.0616	0.0000	OK	15 minute summer	1.000	SW02 - AREA 1	3.2	0.437	0.080	0.1234	
15 minute summer	SW02 - AREA 1	10	46.966	0.065	6.4	0.0926	0.0000	OK	15 minute summer	1.001	SW03 - AREA 1	6.4	0.607	0.159	0.0830	
15 minute summer	SW03 - AREA 1	10	46.928	0.074	9.6	0.1046	0.0000	OK	15 minute summer	1.002	SW04 - AREA 1	9.5	0.716	0.238	0.4005	
15 minute summer	SW04 - AREA 1	10	46.767	0.091	12.7	0.1228	0.0000	OK	15 minute summer	1.003	SW05 - AREA 1	12.2	0.767	0.306	0.2184	
15 minute summer	SW05 - AREA 1	11	46.695	0.100	15.4	0.1331	0.0000	OK	15 minute summer	1.004	SW06 - AREA 1	15.3	0.887	0.384	0.4313	
15 minute summer	SW06 - AREA 1	11	46.553	0.104	18.0	0.1368	0.0000	OK	15 minute summer	1.005	SW07 - AREA 1	17.7	0.868	0.446	1.7283	
15 minute summer	SW07 - AREA 1	12	46.078	0.127	20.4	0.1655	0.0000	OK	15 minute summer	1.006	SW08 - AREA 1	19.7	0.901	0.496	0.1357	
15 minute summer	SW08 - AREA 1	11	46.042	0.126	21.4	0.1643	0.0000	OK	15 minute summer	1.007	SW12 - AREA 1	21.9	0.844	0.545	0.8551	
15 minute summer	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0995	
15 minute summer	SW10 - AREA 1	10	46.091	0.042	3.2	0.0573	0.0000	OK	15 minute summer	2.001	SW11 - AREA 1	3.2	0.470	0.079	0.0578	
15 minute summer	SW11 - AREA 1	10	46.057	0.059	6.4	0.0790	0.0000	OK	15 minute summer	2.002	SW12 - AREA 1	6.1	0.375	0.154	1.0018	
15 minute summer	SW12 - AREA 1	10	45.998	0.246	30.5	0.3212	0.0000	OK	15 minute summer	1.008	SW20 - AREA 1	37.3	0.775	0.411	0.4484	
15 minute summer	SW13 - AREA 1	10	46.499	0.044	3.2	0.0707	0.0000	OK	15 minute summer	3.000	SW14 - AREA 1	3.2	0.424	0.086	0.2304	
15 minute summer	SW14 - AREA 1	10	46.367	0.065	6.4	0.0930	0.0000	OK	15 minute summer	3.001	SW15 - AREA 1	6.2	0.585	0.169	0.1223	
15 minute summer	SW15 - AREA 1	10	46.319	0.075	9.4	0.1053	0.0000	OK	15 minute summer	3.002	SW16 - AREA 1	9.0	0.645	0.246	0.4233	
15 minute summer	SW16 - AREA 1	11	46.192	0.098	12.2	0.1310	0.0000	OK	15 minute summer	3.003	SW17 - AREA 1	12.0	0.719	0.328	0.1315	
15 minute summer	SW17 - AREA 1	11	46.154	0.099	14.8	0.1302	0.0000	OK	15 minute summer	3.004	SW18 - AREA 1	14.8	0.725	0.405	0.9161	
15 minute summer	SW18 - AREA 1	11	46.034	0.168	17.5	0.2208	0.0000	OK	15 minute summer	3.005	SW19 - AREA 1	20.3	0.925	0.554	0.3187	
15 minute summer	SW19 - AREA 1	11	45.994	0.177	23.0	0.2843	0.0000	OK	15 minute summer	3.006	SW20 - AREA 1	29.4	0.618	0.205	1.4741	
15 minute summer	SW20 - AREA 1	10	45.992	0.286	64.5	0.4087	0.0000	OK	15 minute summer	1.009	SW21 - AREA 1	72.8	2.209	0.659	0.1321	
15 minute summer	SW21 - AREA 1	18	45.787	0.090	72.8	15.5722	0.0000	OK	15 minute summer	1.010	SW22 - AREA 1	12.9	0.711	0.182	0.3190	
15 minute summer	SW22 - AREA 1	18	45.717	0.092	12.9	0.1044	0.0000	OK	15 minute summer	1.011	SW23 HB - AREA 1	12.9	0.685	0.181	0.2322	
15 minute summer	SW23 HB - AREA 1	18	45.669	0.095	12.9	0.1076	0.0000	OK	15 minute summer	1.012	SW24 - AREA 1	12.8	0.681	0.179	0.1298	
15 minute summer	SW24 - AREA 1	19	45.638	0.093	12.8	0.1051	0.0000	OK	15 minute summer	1.013	SW25 - AREA 1	12.8	0.719	0.179	0.1407	
15 minute summer	SW25 - AREA 1	19	45.600	0.088	12.8	0.0994	0.0000	OK	15 minute summer	1.014	SW26 - AREA 1	12.9	0.728	0.181	0.5414	
15 minute summer	SW26 - AREA 1	19	45.478	0.092	12.9	0.1036	0.0000	OK	15 minute summer	1.015	SW27 - AREA 1	12.8	0.716	0.181	0.2236	
15 minute summer	SW27 - AREA 1	20	45.425	0.090	12.8	0.1014	0.0000	OK	15 minute summer	1.016	SW28 - AREA 1	12.8	0.721	0.181	0.3322	
15 minute summer	SW28 - AREA 1	20	45.349	0.091	12.8	0.1025	0.0000	OK	15 minute summer	1.017	EXSW MH	12.8	0.745	0.181	0.2315	21.1
15 minute summer	EXSW MH	20	45.288	0.085	12.8	0.0000	0.0000	OK								

Results for 2 year +20% CC 15 minute winter. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 1	10	47.043	0.043	3.2	0.0616	0.0000	OK	15 minute winter	1.000	SW02 - AREA 1	3.2	0.437	0.080	0.1235	
15 minute winter	SW02 - AREA 1	10	46.966	0.065	6.4	0.0927	0.0000	OK	15 minute winter	1.001	SW03 - AREA 1	6.4	0.608	0.159	0.0830	
15 minute winter	SW03 - AREA 1	10	46.928	0.074	9.6	0.1045	0.0000	OK	15 minute winter	1.002	SW04 - AREA 1	9.5	0.714	0.239	0.4020	
15 minute winter	SW04 - AREA 1	10	46.768	0.092	12.7	0.1234	0.0000	OK	15 minute winter	1.003	SW05 - AREA 1	12.4	0.768	0.310	0.2205	
15 minute winter	SW05 - AREA 1	11	46.695	0.100	15.6	0.1339	0.0000	OK	15 minute winter	1.004	SW06 - AREA 1	15.4	0.884	0.388	0.4353	
15 minute winter	SW06 - AREA 1	11	46.554	0.105	18.3	0.1379	0.0000	OK	15 minute winter	1.005	SW07 - AREA 1	18.0	0.875	0.452	1.7764	
15 minute winter	SW07 - AREA 1	11	46.081	0.130	20.8	0.1707	0.0000	OK	15 minute winter	1.006	SW08 - AREA 1	20.2	0.900	0.508	0.1348	
15 minute winter	SW08 - AREA 1	11	46.036	0.120	22.8	0.1570	0.0000	OK	15 minute winter	1.007	SW12 - AREA 1	22.8	0.864	0.569	0.8338	
15 minute winter	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	15 minute winter	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0996	
15 minute winter	SW10 - AREA 1	10	46.091	0.042	3.2	0.0574	0.0000	OK	15 minute winter	2.001	SW11 - AREA 1	3.2	0.469	0.079	0.0581	
15 minute winter	SW11 - AREA 1	10	46.058	0.060	6.4	0.0794	0.0000	OK	15 minute winter	2.002	SW12 - AREA 1	6.2	0.410	0.156	1.0031	
15 minute winter	SW12 - AREA 1	10	46.016	0.264	31.7	0.3449	0.0000	OK	15 minute winter	1.008	SW20 - AREA 1	36.8	0.832	0.406	0.4638	
15 minute winter	SW13 - AREA 1	10	46.499	0.044	3.2	0.0708	0.0000	OK	15 minute winter	3.000	SW14 - AREA 1	3.2	0.424	0.087	0.2313	
15 minute winter	SW14 - AREA 1	10	46.367	0.065	6.4	0.0933	0.0000	OK	15 minute winter	3.001	SW15 - AREA 1	6.2	0.585	0.170	0.1233	
15 minute winter	SW15 - AREA 1	10	46.320	0.076	9.4	0.1061	0.0000	OK	15 minute winter	3.002	SW16 - AREA 1	9.2	0.646	0.250	0.4280	
15 minute winter	SW16 - AREA 1	11	46.193	0.099	12.4	0.1322	0.0000	OK	15 minute winter	3.003	SW17 - AREA 1	12.2	0.720	0.332	0.1331	
15 minute winter	SW17 - AREA 1	11	46.155	0.100	15.1	0.1313	0.0000	OK	15 minute winter	3.004	SW18 - AREA 1	15.1	0.758	0.412	0.8461	
15 minute winter	SW18 - AREA 1	11	46.015	0.149	17.9	0.1958	0.0000	OK	15 minute winter	3.005	SW19 - AREA 1	23.0	0.984	0.627	0.3146	
15 minute winter	SW19 - AREA 1	10	46.017	0.200	25.8	0.3211	0.0000	OK	15 minute winter	3.006	SW20 - AREA 1	33.0	0.590	0.229	1.6228	
15 minute winter	SW20 - AREA 1	10	45.997	0.291	69.7	0.4170	0.0000	OK	15 minute winter	1.009	SW21 - AREA 1	77.4	2.021	0.700	0.1355	
15 minute winter	SW21 - AREA 1	18	45.796	0.099	77.4	17.1390	0.0000	OK	15 minute winter	1.010	SW22 - AREA 1	15.3	0.740	0.217	0.3651	
15 minute winter	SW22 - AREA 1	18	45.727	0.102	15.3	0.1152	0.0000	OK	15 minute winter	1.011	SW23 HB - AREA 1	15.3	0.711	0.216	0.2665	
15 minute winter	SW23 HB - AREA 1	18	45.679	0.105	15.3	0.1191	0.0000	OK	15 minute winter	1.012	SW24 - AREA 1	15.3	0.708	0.213	0.1488	
15 minute winter	SW24 - AREA 1	18	45.647	0.102	15.3	0.1158	0.0000	OK	15 minute winter	1.013	SW25 - AREA 1	15.3	0.785	0.213	0.1605	
15 minute winter	SW25 - AREA 1	19	45.608	0.096	15.3	0.1091	0.0000	OK	15 minute winter	1.014	SW26 - AREA 1	15.3	0.759	0.216	0.6183	
15 minute winter	SW26 - AREA 1	19	45.487	0.101	15.3	0.1142	0.0000	OK	15 minute winter	1.015	SW27 - AREA 1	15.3	0.746	0.216	0.2555	
15 minute winter	SW27 - AREA 1	20	45.434	0.099	15.3	0.1115	0.0000	OK	15 minute winter	1.016	SW28 - AREA 1	15.3	0.764	0.215	0.3788	
15 minute winter	SW28 - AREA 1	20	45.358	0.100	15.3	0.1127	0.0000	OK	15 minute winter	1.017	EXSW MH	15.3	0.780	0.216	0.2637	23.9
15 minute winter	EXSW MH	20	45.297	0.094	15.3	0.0000	0.0000	OK								

Results for 2 year +20% CC 30 minute summer. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
30 minute summer	SW01 - AREA 1	17	47.041	0.041	2.9	0.0584	0.0000	OK	30 minute summer	1.000	SW02 - AREA 1	2.9	0.426	0.072	0.1132	
30 minute summer	SW02 - AREA 1	18	46.962	0.061	5.8	0.0868	0.0000	OK	30 minute summer	1.001	SW03 - AREA 1	5.7	0.591	0.142	0.0763	
30 minute summer	SW03 - AREA 1	18	46.924	0.070	8.5	0.0988	0.0000	OK	30 minute summer	1.002	SW04 - AREA 1	8.5	0.695	0.214	0.3729	
30 minute summer	SW04 - AREA 1	18	46.763	0.087	11.3	0.1169	0.0000	OK	30 minute summer	1.003	SW05 - AREA 1	11.3	0.752	0.284	0.2061	
30 minute summer	SW05 - AREA 1	18	46.690	0.095	14.1	0.1274	0.0000	OK	30 minute summer	1.004	SW06 - AREA 1	14.0	0.864	0.353	0.4017	
30 minute summer	SW06 - AREA 1	19	46.548	0.099	16.8	0.1302	0.0000	OK	30 minute summer	1.005	SW07 - AREA 1	16.2	0.850	0.408	1.6465	
30 minute summer	SW07 - AREA 1	19	46.074	0.123	18.6	0.1604	0.0000	OK	30 minute summer	1.006	SW08 - AREA 1	18.2	0.858	0.457	0.1266	
30 minute summer	SW08 - AREA 1	19	46.032	0.116	20.5	0.1512	0.0000	OK	30 minute summer	1.007	SW12 - AREA 1	20.4	0.869	0.507	0.6404	
30 minute summer	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	30 minute summer	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0921	
30 minute summer	SW10 - AREA 1	18	46.089	0.040	2.9	0.0544	0.0000	OK	30 minute summer	2.001	SW11 - AREA 1	2.8	0.454	0.071	0.0540	
30 minute summer	SW11 - AREA 1	18	46.055	0.057	5.7	0.0756	0.0000	OK	30 minute summer	2.002	SW12 - AREA 1	5.6	0.384	0.141	0.7028	
30 minute summer	SW12 - AREA 1	19	45.894	0.142	27.9	0.1848	0.0000	OK	30 minute summer	1.008	SW20 - AREA 1	27.4	0.772	0.302	0.2437	
30 minute summer	SW13 - AREA 1	18	46.497	0.042	2.9	0.0670	0.0000	OK	30 minute summer	3.000	SW14 - AREA 1	2.8	0.413	0.077	0.2136	
30 minute summer	SW14 - AREA 1	18	46.364	0.062	5.7	0.0881	0.0000	OK	30 minute summer	3.001	SW15 - AREA 1	5.7	0.570	0.155	0.1150	
30 minute summer	SW15 - AREA 1	18	46.317	0.073	8.5	0.1015	0.0000	OK	30 minute summer	3.002	SW16 - AREA 1	8.4	0.628	0.230	0.4016	
30 minute summer	SW16 - AREA 1	18	46.188	0.094	11.2	0.1256	0.0000	OK	30 minute summer	3.003	SW17 - AREA 1	11.1	0.696	0.302	0.1252	
30 minute summer	SW17 - AREA 1	18	46.150	0.095	13.9	0.1260	0.0000	OK	30 minute summer	3.004	SW18 - AREA 1	13.6	0.782	0.372	0.6585	
30 minute summer	SW18 - AREA 1	19	45.974	0.108	16.4	0.1423	0.0000	OK	30 minute summer	3.005	SW19 - AREA 1	16.2	0.960	0.442	0.1646	
30 minute summer	SW19 - AREA 1	19	45.907	0.090	18.8	0.1448	0.0000	OK	30 minute summer	3.006	SW20 - AREA 1	18.7	0.600	0.130	0.7015	
30 minute summer	SW20 - AREA 1	19	45.867	0.161	46.1	0.2305	0.0000	OK	30 minute summer	1.009	SW21 - AREA 1	45.3	1.809	0.410	0.0891	
30 minute summer	SW21 - AREA 1	25	45.803	0.106	45.3	18.1920	0.0000	OK	30 minute summer	1.010	SW22 - AREA 1	17.0	0.757	0.241	0.3960	
30 minute summer	SW22 - AREA 1	26	45.733	0.108	17.0	0.1223	0.0000	OK	30 minute summer	1.011	SW23 HB - AREA 1	17.0	0.727	0.239	0.2894	
30 minute summer	SW23 HB - AREA 1	26	45.686	0.112	17.0	0.1266	0.0000	OK	30 minute summer	1.012	SW24 - AREA 1	17.0	0.724	0.237	0.1617	
30 minute summer	SW24 - AREA 1	26	45.654	0.109	17.0	0.1230	0.0000	OK	30 minute summer	1.013	SW25 - AREA 1	17.0	0.770	0.237	0.1740	
30 minute summer	SW25 - AREA 1	26	45.614	0.102	17.0	0.1155	0.0000	OK	30 minute summer	1.014	SW26 - AREA 1	17.0	0.778	0.239	0.6688	
30 minute summer	SW26 - AREA 1	27	45.493	0.107	17.0	0.1212	0.0000	OK	30 minute summer	1.015	SW27 - AREA 1	17.0	0.764	0.240	0.2774	
30 minute summer	SW27 - AREA 1	27	45.440	0.105	17.0	0.1183	0.0000	OK	30 minute summer	1.016	SW28 - AREA 1	17.0	0.773	0.239	0.4102	
30 minute summer	SW28 - AREA 1	27	45.363	0.105	17.0	0.1192	0.0000	OK	30 minute summer	1.017	EXSW MH	16.9	0.803	0.240	0.2840	29.7
30 minute summer	EXSW MH	28	45.302	0.099	16.9	0.0000	0.0000	OK								

Results for 2 year +20% CC 30 minute winter. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
30 minute winter	SW01 - AREA 1	18	47.038	0.038	2.5	0.0547	0.0000	OK	30 minute winter	1.000	SW02 - AREA 1	2.5	0.411	0.063	0.1026	
30 minute winter	SW02 - AREA 1	18	46.958	0.057	5.0	0.0808	0.0000	OK	30 minute winter	1.001	SW03 - AREA 1	5.0	0.573	0.125	0.0693	
30 minute winter	SW03 - AREA 1	18	46.920	0.066	7.5	0.0924	0.0000	OK	30 minute winter	1.002	SW04 - AREA 1	7.5	0.671	0.188	0.3380	
30 minute winter	SW04 - AREA 1	18	46.757	0.081	10.0	0.1084	0.0000	OK	30 minute winter	1.003	SW05 - AREA 1	9.9	0.729	0.249	0.1865	
30 minute winter	SW05 - AREA 1	18	46.684	0.089	12.4	0.1183	0.0000	OK	30 minute winter	1.004	SW06 - AREA 1	12.4	0.829	0.310	0.3682	
30 minute winter	SW06 - AREA 1	19	46.542	0.093	14.9	0.1224	0.0000	OK	30 minute winter	1.005	SW07 - AREA 1	14.5	0.814	0.366	1.5224	
30 minute winter	SW07 - AREA 1	19	46.066	0.115	16.8	0.1509	0.0000	OK	30 minute winter	1.006	SW08 - AREA 1	16.6	0.837	0.416	0.1177	
30 minute winter	SW08 - AREA 1	19	46.026	0.110	18.8	0.1431	0.0000	OK	30 minute winter	1.007	SW12 - AREA 1	18.7	0.852	0.465	0.5997	
30 minute winter	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	30 minute winter	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0843	
30 minute winter	SW10 - AREA 1	18	46.087	0.038	2.5	0.0511	0.0000	OK	30 minute winter	2.001	SW11 - AREA 1	2.5	0.436	0.062	0.0494	
30 minute winter	SW11 - AREA 1	18	46.051	0.053	5.0	0.0710	0.0000	OK	30 minute winter	2.002	SW12 - AREA 1	5.0	0.348	0.125	0.6601	
30 minute winter	SW12 - AREA 1	19	45.886	0.134	25.7	0.1754	0.0000	OK	30 minute winter	1.008	SW20 - AREA 1	25.4	0.761	0.280	0.2289	
30 minute winter	SW13 - AREA 1	18	46.495	0.040	2.5	0.0630	0.0000	OK	30 minute winter	3.000	SW14 - AREA 1	2.5	0.398	0.068	0.1940	
30 minute winter	SW14 - AREA 1	18	46.359	0.057	5.0	0.0820	0.0000	OK	30 minute winter	3.001	SW15 - AREA 1	5.0	0.551	0.136	0.1046	
30 minute winter	SW15 - AREA 1	18	46.312	0.068	7.5	0.0951	0.0000	OK	30 minute winter	3.002	SW16 - AREA 1	7.4	0.609	0.203	0.3658	
30 minute winter	SW16 - AREA 1	18	46.182	0.088	9.9	0.1169	0.0000	OK	30 minute winter	3.003	SW17 - AREA 1	9.8	0.678	0.268	0.1141	
30 minute winter	SW17 - AREA 1	18	46.144	0.089	12.3	0.1178	0.0000	OK	30 minute winter	3.004	SW18 - AREA 1	12.2	0.758	0.332	0.6062	
30 minute winter	SW18 - AREA 1	19	45.968	0.102	14.7	0.1342	0.0000	OK	30 minute winter	3.005	SW19 - AREA 1	14.5	0.928	0.397	0.1530	
30 minute winter	SW19 - AREA 1	19	45.903	0.086	16.9	0.1374	0.0000	OK	30 minute winter	3.006	SW20 - AREA 1	16.9	0.567	0.117	0.6574	
30 minute winter	SW20 - AREA 1	12	45.871	0.165	42.2	0.2368	0.0000	OK	30 minute winter	1.009	SW21 - AREA 1	42.8	1.730	0.387	0.0894	
30 minute winter	SW21 - AREA 1	26	45.809	0.112	42.8	19.3185	0.0000	OK	30 minute winter	1.010	SW22 - AREA 1	18.9	0.774	0.268	0.4307	
30 minute winter	SW22 - AREA 1	26	45.740	0.115	18.9	0.1303	0.0000	OK	30 minute winter	1.011	SW23 HB - AREA 1	18.9	0.743	0.266	0.3148	
30 minute winter	SW23 HB - AREA 1	26	45.693	0.119	18.9	0.1346	0.0000	OK	30 minute winter	1.012	SW24 - AREA 1	18.9	0.741	0.263	0.1753	
30 minute winter	SW24 - AREA 1	27	45.660	0.115	18.9	0.1306	0.0000	OK	30 minute winter	1.013	SW25 - AREA 1	18.9	0.789	0.264	0.1885	
30 minute winter	SW25 - AREA 1	27	45.620	0.108	18.9	0.1224	0.0000	OK	30 minute winter	1.014	SW26 - AREA 1	18.9	0.798	0.266	0.7260	
30 minute winter	SW26 - AREA 1	27	45.500	0.114	18.9	0.1288	0.0000	OK	30 minute winter	1.015	SW27 - AREA 1	18.8	0.783	0.267	0.3005	
30 minute winter	SW27 - AREA 1	28	45.446	0.111	18.8	0.1255	0.0000	OK	30 minute winter	1.016	SW28 - AREA 1	18.9	0.792	0.265	0.4447	
30 minute winter	SW28 - AREA 1	28	45.370	0.112	18.9	0.1266	0.0000	OK	30 minute winter	1.017	EXSW MH	18.9	0.825	0.267	0.3077	32.5
30 minute winter	EXSW MH	28	45.307	0.104	18.9	0.0000	0.0000	OK								

Results for 2 year +20% CC 60 minute summer. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%																
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60 minute summer	SW01 - AREA 1	33	47.036	0.036	2.2	0.0514	0.0000	OK	60 minute summer	1.000	SW02 - AREA 1	2.2	0.399	0.055	0.0931	
60 minute summer	SW02 - AREA 1	33	46.954	0.053	4.4	0.0753	0.0000	OK	60 minute summer	1.001	SW03 - AREA 1	4.4	0.555	0.110	0.0629	
60 minute summer	SW03 - AREA 1	33	46.915	0.061	6.6	0.0865	0.0000	OK	60 minute summer	1.002	SW04 - AREA 1	6.6	0.649	0.165	0.3069	
60 minute summer	SW04 - AREA 1	33	46.751	0.075	8.8	0.1008	0.0000	OK	60 minute summer	1.003	SW05 - AREA 1	8.7	0.707	0.219	0.1688	
60 minute summer	SW05 - AREA 1	33	46.677	0.082	10.9	0.1099	0.0000	OK	60 minute summer	1.004	SW06 - AREA 1	10.8	0.803	0.272	0.3334	
60 minute summer	SW06 - AREA 1	34	46.536	0.087	13.0	0.1138	0.0000	OK	60 minute summer	1.005	SW07 - AREA 1	12.7	0.789	0.320	1.3728	
60 minute summer	SW07 - AREA 1	34	46.057	0.106	14.7	0.1387	0.0000	OK	60 minute summer	1.006	SW08 - AREA 1	14.5	0.812	0.363	0.1058	
60 minute summer	SW08 - AREA 1	34	46.017	0.101	16.4	0.1320	0.0000	OK	60 minute summer	1.007	SW12 - AREA 1	16.3	0.828	0.406	0.5395	
60 minute summer	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	60 minute summer	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0769	
60 minute summer	SW10 - AREA 1	33	46.085	0.036	2.2	0.0480	0.0000	OK	60 minute summer	2.001	SW11 - AREA 1	2.2	0.420	0.055	0.0451	
60 minute summer	SW11 - AREA 1	33	46.048	0.050	4.4	0.0665	0.0000	OK	60 minute summer	2.002	SW12 - AREA 1	4.4	0.337	0.109	0.5947	
60 minute summer	SW12 - AREA 1	34	45.875	0.123	22.4	0.1606	0.0000	OK	60 minute summer	1.008	SW20 - AREA 1	22.2	0.742	0.245	0.2068	
60 minute summer	SW13 - AREA 1	33	46.492	0.037	2.2	0.0591	0.0000	OK	60 minute summer	3.000	SW14 - AREA 1	2.2	0.386	0.060	0.1761	
60 minute summer	SW14 - AREA 1	33	46.356	0.054	4.4	0.0764	0.0000	OK	60 minute summer	3.001	SW15 - AREA 1	4.4	0.533	0.119	0.0950	
60 minute summer	SW15 - AREA 1	33	46.308	0.064	6.6	0.0889	0.0000	OK	60 minute summer	3.002	SW16 - AREA 1	6.5	0.591	0.178	0.3312	
60 minute summer	SW16 - AREA 1	33	46.175	0.081	8.7	0.1083	0.0000	OK	60 minute summer	3.003	SW17 - AREA 1	8.6	0.658	0.235	0.1031	
60 minute summer	SW17 - AREA 1	33	46.138	0.083	10.8	0.1094	0.0000	OK	60 minute summer	3.004	SW18 - AREA 1	10.7	0.733	0.291	0.5495	
60 minute summer	SW18 - AREA 1	34	45.961	0.095	12.9	0.1247	0.0000	OK	60 minute summer	3.005	SW19 - AREA 1	12.7	0.893	0.348	0.1393	
60 minute summer	SW19 - AREA 1	34	45.897	0.080	14.8	0.1286	0.0000	OK	60 minute summer	3.006	SW20 - AREA 1	14.7	0.546	0.103	0.5983	
60 minute summer	SW20 - AREA 1	34	45.849	0.143	36.9	0.2053	0.0000	OK	60 minute summer	1.009	SW21 - AREA 1	37.9	1.380	0.343	0.0874	
60 minute summer	SW21 - AREA 1	41	45.809	0.112	37.9	19.3757	0.0000	OK	60 minute summer	1.010	SW22 - AREA 1	19.0	0.775	0.269	0.4325	
60 minute summer	SW22 - AREA 1	41	45.741	0.116	19.0	0.1307	0.0000	OK	60 minute summer	1.011	SW23 HB - AREA 1	19.0	0.743	0.268	0.3163	
60 minute summer	SW23 HB - AREA 1	41	45.693	0.119	19.0	0.1351	0.0000	OK	60 minute summer	1.012	SW24 - AREA 1	19.0	0.741	0.264	0.1762	
60 minute summer	SW24 - AREA 1	42	45.661	0.116	19.0	0.1310	0.0000	OK	60 minute summer	1.013	SW25 - AREA 1	19.0	0.790	0.265	0.1893	
60 minute summer	SW25 - AREA 1	42	45.621	0.109	19.0	0.1228	0.0000	OK	60 minute summer	1.014	SW26 - AREA 1	19.0	0.798	0.268	0.7292	
60 minute summer	SW26 - AREA 1	42	45.500	0.114	19.0	0.1292	0.0000	OK	60 minute summer	1.015	SW27 - AREA 1	19.0	0.784	0.268	0.3020	
60 minute summer	SW27 - AREA 1	43	45.446	0.111	19.0	0.1259	0.0000	OK	60 minute summer	1.016	SW28 - AREA 1	19.0	0.793	0.267	0.4466	
60 minute summer	SW28 - AREA 1	43	45.370	0.112	19.0	0.1270	0.0000	OK	60 minute summer	1.017	EXSW MH	19.0	0.827	0.268	0.3090	39.1
60 minute summer	EXSW MH	43	45.308	0.105	19.0	0.0000	0.0000	OK								

Results for 2 year +20% CC 60 minute winter. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%																
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60 minute winter	SW01 - AREA 1	32	47.032	0.032	1.8	0.0462	0.0000	OK	60 minute winter	1.000	SW02 - AREA 1	1.8	0.379	0.044	0.0786	
60 minute winter	SW02 - AREA 1	32	46.948	0.047	3.6	0.0664	0.0000	OK	60 minute winter	1.001	SW03 - AREA 1	3.5	0.523	0.088	0.0531	
60 minute winter	SW03 - AREA 1	33	46.909	0.055	5.3	0.0772	0.0000	OK	60 minute winter	1.002	SW04 - AREA 1	5.2	0.612	0.132	0.2595	
60 minute winter	SW04 - AREA 1	33	46.742	0.066	7.0	0.0890	0.0000	OK	60 minute winter	1.003	SW05 - AREA 1	7.0	0.671	0.175	0.1424	
60 minute winter	SW05 - AREA 1	33	46.668	0.073	8.7	0.0972	0.0000	OK	60 minute winter	1.004	SW06 - AREA 1	8.7	0.752	0.218	0.2859	
60 minute winter	SW06 - AREA 1	34	46.527	0.078	10.4	0.1019	0.0000	OK	60 minute winter	1.005	SW07 - AREA 1	10.3	0.743	0.260	1.1803	
60 minute winter	SW07 - AREA 1	34	46.045	0.094	12.0	0.1236	0.0000	OK	60 minute winter	1.006	SW08 - AREA 1	11.9	0.775	0.300	0.0915	
60 minute winter	SW08 - AREA 1	34	46.007	0.091	13.6	0.1188	0.0000	OK	60 minute winter	1.007	SW12 - AREA 1	13.6	0.796	0.338	0.4672	
60 minute winter	SW09 - AREA 1	1	46.275	0.000	0.0	0.0000	0.0000	OK	60 minute winter	2.000	SW10 - AREA 1	0.0	0.000	0.000	0.0656	
60 minute winter	SW10 - AREA 1	32	46.081	0.032	1.8	0.0430	0.0000	OK	60 minute winter	2.001	SW11 - AREA 1	1.7	0.393	0.044	0.0384	
60 minute winter	SW11 - AREA 1	33	46.043	0.045	3.5	0.0595	0.0000	OK	60 minute winter	2.002	SW12 - AREA 1	3.5	0.301	0.087	0.5141	
60 minute winter	SW12 - AREA 1	34	45.862	0.110	18.7	0.1429	0.0000	OK	60 minute winter	1.008	SW20 - AREA 1	18.7	0.726	0.207	0.1781	
60 minute winter	SW13 - AREA 1	32	46.488	0.033	1.8	0.0530	0.0000	OK	60 minute winter	3.000	SW14 - AREA 1	1.7	0.365	0.048	0.1483	
60 minute winter	SW14 - AREA 1	33	46.349	0.047	3.5	0.0675	0.0000	OK	60 minute winter	3.001	SW15 - AREA 1	3.5	0.503	0.095	0.0804	
60 minute winter	SW15 - AREA 1	33	46.301	0.057	5.3	0.0795	0.0000	OK	60 minute winter	3.002	SW16 - AREA 1	5.2	0.558	0.143	0.2808	
60 minute winter	SW16 - AREA 1	33	46.166	0.072	6.9	0.0957	0.0000	OK	60 minute winter	3.003	SW17 - AREA 1	6.9	0.626	0.190	0.0874	
60 minute winter	SW17 - AREA 1	33	46.129	0.074	8.6	0.0973	0.0000	OK	60 minute winter	3.004	SW18 - AREA 1	8.6	0.692	0.236	0.4712	
60 minute winter	SW18 - AREA 1	34	45.951	0.085	10.3	0.1114	0.0000	OK	60 minute winter	3.005	SW19 - AREA 1	10.3	0.836	0.282	0.1205	
60 minute winter	SW19 - AREA 1	34	45.889	0.072	12.0	0.1163	0.0000	OK	60 minute winter	3.006	SW20 - AREA 1	12.0	0.508	0.084	0.5162	
60 minute winter	SW20 - AREA 1	39	45.836	0.130	30.6	0.1860	0.0000	OK	60 minute winter	1.009	SW21 - AREA 1	31.7	1.266	0.287	0.0907	
60 minute winter	SW21 - AREA 1	42	45.813	0.116	31.7	20.0144	0.0000	OK	60 minute winter	1.010	SW22 - AREA 1	20.1	0.784	0.284	0.4518	
60 minute winter	SW22 - AREA 1	43	45.745	0.119	20.1	0.1352	0.0000	OK	60 minute winter	1.011	SW23 HB - AREA 1	20.1	0.751	0.283	0.3309	
60 minute winter	SW23 HB - AREA 1	43	45.698	0.124	20.1	0.1398	0.0000	OK	60 minute winter	1.012	SW24 - AREA 1	20.1	0.750	0.280	0.1843	
60 minute winter	SW24 - AREA 1	43	45.665	0.120	20.1	0.1354	0.0000	OK	60 minute winter	1.013	SW25 - AREA 1	20.1	0.801	0.281	0.1976	
60 minute winter	SW25 - AREA 1	43	45.624	0.112	20.1	0.1266	0.0000	OK	60 minute winter	1.014	SW26 - AREA 1	20.1	0.809	0.283	0.7610	
60 minute winter	SW26 - AREA 1	44	45.504	0.118	20.1	0.1336	0.0000	OK	60 minute winter	1.015	SW27 - AREA 1	20.1	0.794	0.284	0.3159	
60 minute winter	SW27 - AREA 1	44	45.450	0.115	20.1	0.1301	0.0000	OK	60 minute winter	1.016	SW28 - AREA 1	20.1	0.804	0.283	0.4662	
60 minute winter	SW28 - AREA 1	44	45.374	0.116	20.1	0.1309	0.0000	OK	60 minute winter	1.017	EXSW MH	20.1	0.840	0.284	0.3217	44.3
60 minute winter	EXSW MH	45	45.311	0.108	20.1	0.0000	0.0000	OK								

Adoptable						
Max Width (mm)	**Diameter (mm)**	**Width (mm)**		**Max Depth (m)**	**Diameter (mm)**	**Width (mm)**
374	1200			1.500	1050	
499	1350			99.999	1200	
749	1500					
900	1800					
>900	Link+900 mm					

Circular			
Shape	Circular		**Dia (mm)**
Barrels	1		100
Height (mm)			150
Width (mm)			
Side Slope (1:X)			
Auto Increment (mm)	75		
Preferred Cover (m)			
Steep Slope (1:X)			
Follow Ground	No		
Velocity	Default		
ks (mm) / n			
uPVC			
Shape	Circular		**Dia (mm)**
Barrels	1		225
Height (mm)			
Width (mm)			
Side Slope (1:X)			
Auto Increment (mm)	75		
Preferred Cover (m)			
Steep Slope (1:X)			
Follow Ground	No		
Velocity	Colebrook-White		
ks (mm) / n	0.150		

Drainage Design Report

Flow+

v10.8

Network	Storm Network - Area 2
Filename	
Username	Kezia Adanza (kadanza@morce.ie)
Last analysed	23/07/2024 12:52:37
Report produced on	23/07/2024 13:02:55

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

http://support.causeway.com

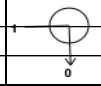
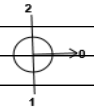
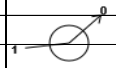
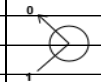
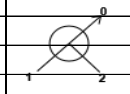
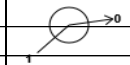
Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.000
Ratio-R	0.280
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	Yes
Enforce best practice design rules	Yes

	Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Sump (m)	Easting (m)	Northing (m)	Depth (m)	Notes
✓	SW01 - AREA 2	0.014	4.00		48.000	Manhole	Adoptable	1200			716131.116	738919.292	1.425	
✓	SW02 - AREA 2	0.014	4.00		48.000	Manhole	Adoptable	1200			716158.108	738920.277	1.584	
✓	SW03 - AREA 2	0.014	4.00		48.000	Manhole	Adoptable	1200			716158.450	738910.497	1.425	
✓	SW04 - AREA 2	0.014	4.00		48.000	Manhole	Adoptable	1200			716158.285	738915.222	1.614	
✓	SW05 - AREA 2	0.014	4.00		48.000	Manhole	Adoptable	1200			716162.789	738915.430	1.641	
✓	SW06 - AREA 2	0.014	4.00		48.000	Manhole	Adoptable	1200			716179.717	738931.747	1.780	
✓	SW07 - AREA 2		4.00		48.000	Manhole	Adoptable	1200			716163.638	738923.529	0.725	
✓	SW08 HB - AREA 2	0.014	4.00		47.860	Manhole	Adoptable	1200			716176.067	738935.527	1.671	
✓	SW09 - AREA 2				47.860	Manhole	Adoptable	1200			716179.828	738939.154	1.702	
✓	SW10 - AREA 2				47.180	Manhole	Adoptable	1200			716197.004	738941.791	1.425	
✓	EXSW MH				47.180	Manhole	Adoptable	1200			716203.106	738941.154	1.462	

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Con Offset (m)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
✓	1.000	SW01 - AREA 2	SW02 - AREA 2	27.010	0.600	Colebrook-White	46.575	46.416	0.159	169.9	225	Circular	4.45	50.0					
✓	1.001	SW02 - AREA 2	SW04 - AREA 2	5.058	0.600	Colebrook-White	46.416	46.386	0.030	168.6	225	Circular	4.53	50.0					
✓	2.000	SW03 - AREA 2	SW04 - AREA 2	4.728	0.600	Colebrook-White	46.575	46.386	0.189	25.0	225	Circular	4.03	50.0					
✓	1.002	SW04 - AREA 2	SW05 - AREA 2	4.510	0.600	Colebrook-White	46.386	46.359	0.027	167.1	225	Circular	4.61	50.0					
✓	1.003	SW05 - AREA 2	SW06 - AREA 2	23.512	0.600	Colebrook-White	46.359	46.220	0.139	169.1	225	Circular	5.00	48.5					
✓	1.004	SW06 - AREA 2	SW08 HB - AREA 2	5.255	0.600	Colebrook-White	46.220	46.189	0.031	169.5	225	Circular	5.09	48.2					
?	3.000	SW07 - AREA 2	SW08 HB - AREA 2	17.275	0.600	Colebrook-White	47.275	46.189	1.086	15.9	225	Circular	4.09	50.0					
✓	1.005	SW08 HB - AREA 2	SW09 - AREA 2	5.225	0.600	Colebrook-White	46.189	46.158	0.031	168.5	225	Circular	5.17	47.9					
✓	1.006	SW09 - AREA 2	SW10 - AREA 2	17.377	0.600	Colebrook-White	46.158	45.755	0.403	43.1	225	Circular	5.32	47.4					
✓	1.007	SW10 - AREA 2	EXSW MH	6.135	0.600	Colebrook-White	45.755	45.718	0.037	165.8	225	Circular	5.42	47.1					

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)	Notes
✓	1.000	SW01 - AREA 2	SW02 - AREA 2	1.000	39.8	1.9	1.200	1.359	1.200	1.359	0.014	0.0	33	0.513	
✓	1.001	SW02 - AREA 2	SW04 - AREA 2	1.004	39.9	3.8	1.359	1.389	1.359	1.389	0.028	0.0	47	0.639	
✓	2.000	SW03 - AREA 2	SW04 - AREA 2	2.626	104.4	1.9	1.200	1.389	1.200	1.389	0.014	0.0	21	1.008	Fall increased to remove backdrop
✓	1.002	SW04 - AREA 2	SW05 - AREA 2	1.009	40.1	7.6	1.389	1.416	1.389	1.416	0.056	0.0	66	0.780	
✓	1.003	SW05 - AREA 2	SW06 - AREA 2	1.002	39.8	9.2	1.416	1.555	1.416	1.555	0.070	0.0	73	0.818	
✓	1.004	SW06 - AREA 2	SW08 HB - AREA 2	1.001	39.8	11.0	1.555	1.446	1.446	1.555	0.084	0.0	80	0.857	
?	3.000	SW07 - AREA 2	SW08 HB - AREA 2	3.297	131.1	0.0	0.500	1.446	0.500	1.446	0.000	0.0	0	0.000	Fall increased to remove backdrop | Velocity is more than 3 m/s | Upstream Depth is less than the specified minimum
✓	1.005	SW08 HB - AREA 2	SW09 - AREA 2	1.004	39.9	12.7	1.446	1.477	1.446	1.477	0.098	0.0	87	0.896	
✓	1.006	SW09 - AREA 2	SW10 - AREA 2	1.997	79.4	12.6	1.477	1.200	1.200	1.477	0.098	0.0	60	1.468	
✓	1.007	SW10 - AREA 2	EXSW MH	1.012	40.3	12.5	1.200	1.237	1.200	1.237	0.098	0.0	86	0.894	

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type
1.000	27.010	169.9	225	Circular	48.000	46.575	1.200	48.000	46.416	1.359	SW01 - AREA 2	1200			Manhole	Adoptable	SW02 - AREA 2	1200			Manhole	Adoptable
1.001	5.058	168.6	225	Circular	48.000	46.416	1.359	48.000	46.386	1.389	SW02 - AREA 2	1200			Manhole	Adoptable	SW04 - AREA 2	1200			Manhole	Adoptable
2.000	4.728	25.0	225	Circular	48.000	46.575	1.200	48.000	46.386	1.389	SW03 - AREA 2	1200			Manhole	Adoptable	SW04 - AREA 2	1200			Manhole	Adoptable
1.002	4.510	167.1	225	Circular	48.000	46.386	1.389	48.000	46.359	1.416	SW04 - AREA 2	1200			Manhole	Adoptable	SW05 - AREA 2	1200			Manhole	Adoptable
1.003	23.512	169.1	225	Circular	48.000	46.359	1.416	48.000	46.220	1.555	SW05 - AREA 2	1200			Manhole	Adoptable	SW06 - AREA 2	1200			Manhole	Adoptable
1.004	5.255	169.5	225	Circular	48.000	46.220	1.555	47.860	46.189	1.446	SW06 - AREA 2	1200			Manhole	Adoptable	SW08 HB - AREA 2	1200			Manhole	Adoptable
3.000	17.275	15.9	225	Circular	48.000	47.275	0.500	47.860	46.189	1.446	SW07 - AREA 2	1200			Manhole	Adoptable	SW08 HB - AREA 2	1200			Manhole	Adoptable
1.005	5.225	168.5	225	Circular	47.860	46.189	1.446	47.860	46.158	1.477	SW08 HB - AREA 2	1200			Manhole	Adoptable	SW09 - AREA 2	1200			Manhole	Adoptable
1.006	17.377	43.1	225	Circular	47.860	46.158	1.477	47.180	45.755	1.200	SW09 - AREA 2	1200			Manhole	Adoptable	SW10 - AREA 2	1200			Manhole	Adoptable
1.007	6.135	165.8	225	Circular	47.180	45.755	1.200	47.180	45.718	1.237	SW10 - AREA 2	1200			Manhole	Adoptable	EXSW MH	1200			Manhole	Adoptable

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	Connections		Link	IL (m)	Dia (mm)	Link Type
SW01 - AREA 2	716131.116	738919.292	48.000	1.425	1200			Manhole	Adoptable						
															
											0	1.000	46.575	225	Circular
SW02 - AREA 2	716158.108	738920.277	48.000	1.584	1200			Manhole	Adoptable		1	1.000	46.416	225	Circular
															
											0	1.001	46.416	225	Circular
SW03 - AREA 2	716158.450	738910.497	48.000	1.425	1200			Manhole	Adoptable						
											0	2.000	46.575	225	Circular
SW04 - AREA 2	716158.285	738915.222	48.000	1.614	1200			Manhole	Adoptable		1	2.000	46.386	225	Circular
											2	1.001	46.386	225	Circular
											0	1.002	46.386	225	Circular
SW05 - AREA 2	716162.789	738915.430	48.000	1.641	1200			Manhole	Adoptable		1	1.002	46.359	225	Circular
															
											0	1.003	46.359	225	Circular
SW06 - AREA 2	716179.717	738931.747	48.000	1.780	1200			Manhole	Adoptable		1	1.003	46.220	225	Circular
															
											0	1.004	46.220	225	Circular
SW07 - AREA 2	716163.638	738923.529	48.000	0.725	1200			Manhole	Adoptable						
															
											0	3.000	47.275	225	Circular
SW08 HB - AREA 2	716176.067	738935.527	47.860	1.671	1200			Manhole	Adoptable		1	3.000	46.189	225	Circular
											2	1.004	46.189	225	Circular
											0	1.005	46.189	225	Circular
SW09 - AREA 2	716179.828	738939.154	47.860	1.702	1200			Manhole	Adoptable		1	1.005	46.158	225	Circular
															
											0	1.006	46.158	225	Circular
SW10 - AREA 2	716197.004	738941.791	47.180	1.425	1200			Manhole	Adoptable		1	1.006	45.755	225	Circular
															
											0	1.007	45.755	225	Circular
EXSW MH	716203.106	738941.154	47.180	1.462	1200			Manhole	Adoptable		1	1.007	45.718	225	Circular

										1					

Rainfall Methodology	FSR		Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
FSR Region	Scotland and Ireland		2	20	0	0
M5-60 (mm)	16.000		30	20	0	0
Ratio-R	0.280		100	20	0	0
Summer CV	0.750					
Winter CV	0.840					
Analysis Speed	Normal					
Skip Steady State	No					
Drain Down Time (mins)	240					
Additional Storage (m³/ha)	20.0					
Storm Durations (mins)	15					
	30					
	60					
	120					
	180					
	240					
	360					
	480					
	600					
	720					
	960					
	1440					
	2160					
	2880					
	4320					
	5760					
	7200					
	8640					
	10080					
Check Discharge Rate(s)	No					
Check Discharge Volume	No					
100 year 360 minute (m³)						

Depth/Area/Inf Area									
Node	**Base Inf Coefficient (m/hr)**	**Side Inf Coefficient (m/hr)**	**Safety Factor**	**Porosity**	**Invert Level (m)**	**Time to half empty (mins)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
SW07 - AREA 2	0.00000	0.00000	2.0	1.00	47.275	0	0.000	15.6	0.0
							0.325	62.7	0.0
							0.500	109.6	0.0

Default Values			**Overrides**					
Entry Loss (manhole)	0.250		**Link**	**Entry Loss**	**Exit Loss**		**Node**	**Flood Risk (m)**
Exit Loss (manhole)	0.250							
Entry Loss (junction)	0.000							
Exit Loss (junction)	0.000							
Apply Recommended Losses	No							
Flood Risk (m)	0.300							

Node Size	Yes
Node Losses	Yes
Link Size	Yes
Minimum Diameter (mm)	150
Link Length	Yes
Maximum Length (m)	100.000
Coordinates	Yes
Accuracy (m)	1.000
Crossings	Yes
Cover Depth	Yes
Minimum Cover Depth (m)	
Maximum Cover Depth (m)	3.000
Backdrops	Yes
Minimum Backdrop Height (m)	
Maximum Backdrop Height (m)	1.500
Full Bore Velocity	Yes
Minimum Full Bore Velocity (m/s)	
Maximum Full Bore Velocity (m/s)	3.000
Proportional Velocity	Yes
Return Period (years)	
Minimum Proportional Velocity (m/s)	0.750
Maximum Proportional Velocity (m/s)	3.000
Surcharged Depth	Yes
Return Period (years)	
Maximum Surcharged Depth (m)	0.100
Flooding	Yes
Return Period (years)	30
Time to Half Empty	No
Return Period (years)	
Discharge Rates	Yes
Discharge Volume	Yes
100 year 360 minute (m^3)	

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +20% CC 15 minute summer	125.076	35.392
2 year +20% CC 15 minute winter	87.773	35.392
2 year +20% CC 30 minute summer	85.296	24.136
2 year +20% CC 30 minute winter	59.857	24.136
2 year +20% CC 60 minute summer	60.447	15.974
2 year +20% CC 60 minute winter	40.160	15.974
2 year +20% CC 120 minute summer	39.259	10.375
2 year +20% CC 120 minute winter	26.083	10.375
2 year +20% CC 180 minute summer	30.986	7.974
2 year +20% CC 180 minute winter	20.142	7.974
2 year +20% CC 240 minute summer	25.068	6.625
2 year +20% CC 240 minute winter	16.654	6.625
2 year +20% CC 360 minute summer	19.895	5.120
2 year +20% CC 360 minute winter	12.932	5.120
2 year +20% CC 480 minute summer	16.078	4.249
2 year +20% CC 480 minute winter	10.682	4.249
2 year +20% CC 600 minute summer	13.442	3.677
2 year +20% CC 600 minute winter	9.184	3.677
2 year +20% CC 720 minute summer	12.188	3.267
2 year +20% CC 720 minute winter	8.191	3.267
2 year +20% CC 960 minute summer	10.295	2.711
2 year +20% CC 960 minute winter	6.820	2.711
2 year +20% CC 1440 minute summer	7.780	2.085
2 year +20% CC 1440 minute winter	5.229	2.085
2 year +20% CC 2160 minute summer	5.787	1.599
2 year +20% CC 2160 minute winter	3.987	1.599
2 year +20% CC 2880 minute summer	4.939	1.324
2 year +20% CC 2880 minute winter	3.320	1.324
2 year +20% CC 4320 minute summer	3.880	1.015
2 year +20% CC 4320 minute winter	2.555	1.015

2 year +20% CC 5760 minute summer	3.280	0.840
2 year +20% CC 5760 minute winter	2.123	0.840
2 year +20% CC 7200 minute summer	2.837	0.724
2 year +20% CC 7200 minute winter	1.831	0.724
2 year +20% CC 8640 minute summer	2.512	0.641
2 year +20% CC 8640 minute winter	1.621	0.641
2 year +20% CC 10080 minute summer	2.267	0.578
2 year +20% CC 10080 minute winter	1.463	0.578
30 year +20% CC 15 minute summer	229.581	64.964
30 year +20% CC 15 minute winter	161.110	64.964
30 year +20% CC 30 minute summer	157.518	44.572
30 year +20% CC 30 minute winter	110.539	44.572
30 year +20% CC 60 minute summer	109.995	29.068
30 year +20% CC 60 minute winter	73.078	29.068
30 year +20% CC 120 minute summer	69.900	18.472
30 year +20% CC 120 minute winter	46.440	18.472
30 year +20% CC 180 minute summer	54.666	14.067
30 year +20% CC 180 minute winter	35.534	14.067
30 year +20% CC 240 minute summer	43.793	11.573
30 year +20% CC 240 minute winter	29.095	11.573
30 year +20% CC 360 minute summer	34.080	8.770
30 year +20% CC 360 minute winter	22.153	8.770
30 year +20% CC 480 minute summer	27.227	7.195
30 year +20% CC 480 minute winter	18.089	7.195
30 year +20% CC 600 minute summer	22.551	6.168
30 year +20% CC 600 minute winter	15.408	6.168
30 year +20% CC 720 minute summer	20.288	5.437
30 year +20% CC 720 minute winter	13.635	5.437
30 year +20% CC 960 minute summer	16.917	4.455
30 year +20% CC 960 minute winter	11.206	4.455
30 year +20% CC 1440 minute summer	12.545	3.362
30 year +20% CC 1440 minute winter	8.431	3.362
30 year +20% CC 2160 minute summer	9.180	2.537

30 year +20% CC 2160 minute winter	6.325	2.537
30 year +20% CC 2880 minute summer	7.747	2.076
30 year +20% CC 2880 minute winter	5.207	2.076
30 year +20% CC 4320 minute summer	5.982	1.564
30 year +20% CC 4320 minute winter	3.940	1.564
30 year +20% CC 5760 minute summer	4.995	1.279
30 year +20% CC 5760 minute winter	3.233	1.279
30 year +20% CC 7200 minute summer	4.286	1.093
30 year +20% CC 7200 minute winter	2.766	1.093
30 year +20% CC 8640 minute summer	3.771	0.962
30 year +20% CC 8640 minute winter	2.434	0.962
30 year +20% CC 10080 minute summer	3.384	0.863
30 year +20% CC 10080 minute winter	2.184	0.863
100 year +20% CC 15 minute summer	297.434	84.163
100 year +20% CC 15 minute winter	208.725	84.163
100 year +20% CC 30 minute summer	205.553	58.164
100 year +20% CC 30 minute winter	144.248	58.164
100 year +20% CC 60 minute summer	143.033	37.800
100 year +20% CC 60 minute winter	95.028	37.800
100 year +20% CC 120 minute summer	90.194	23.836
100 year +20% CC 120 minute winter	59.923	23.836
100 year +20% CC 180 minute summer	70.128	18.046
100 year +20% CC 180 minute winter	45.585	18.046
100 year +20% CC 240 minute summer	55.935	14.782
100 year +20% CC 240 minute winter	37.162	14.782
100 year +20% CC 360 minute summer	43.239	11.127
100 year +20% CC 360 minute winter	28.106	11.127
100 year +20% CC 480 minute summer	34.371	9.083
100 year +20% CC 480 minute winter	22.836	9.083
100 year +20% CC 600 minute summer	28.355	7.756
100 year +20% CC 600 minute winter	19.374	7.756
100 year +20% CC 720 minute summer	25.426	6.814
100 year +20% CC 720 minute winter	17.088	6.814

100 year +20% CC 960 minute summer	21.089	5.553
100 year +20% CC 960 minute winter	13.970	5.553
100 year +20% CC 1440 minute summer	15.523	4.160
100 year +20% CC 1440 minute winter	10.432	4.160
100 year +20% CC 2160 minute summer	11.275	3.116
100 year +20% CC 2160 minute winter	7.769	3.116
100 year +20% CC 2880 minute summer	9.462	2.536
100 year +20% CC 2880 minute winter	6.359	2.536
100 year +20% CC 4320 minute summer	7.246	1.894
100 year +20% CC 4320 minute winter	4.772	1.894
100 year +20% CC 5760 minute summer	6.012	1.539
100 year +20% CC 5760 minute winter	3.891	1.539
100 year +20% CC 7200 minute summer	5.133	1.309
100 year +20% CC 7200 minute winter	3.313	1.309
100 year +20% CC 8640 minute summer	4.498	1.147
100 year +20% CC 8640 minute winter	2.903	1.147
100 year +20% CC 10080 minute summer	4.022	1.026
100 year +20% CC 10080 minute winter	2.596	1.026

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 2	10	46.612	0.037	2.4	0.0492	0.0000	OK	15 minute winter	1.000	SW02 - AREA 2	2.4	0.384	0.060	0.1737	
15 minute winter	SW02 - AREA 2	10	46.477	0.061	4.8	0.0793	0.0000	OK	15 minute winter	1.001	SW04 - AREA 2	4.6	0.427	0.115	0.0562	
15 minute summer	SW03 - AREA 2	10	46.599	0.024	2.4	0.0313	0.0000	OK	15 minute summer	2.000	SW04 - AREA 2	2.4	0.357	0.023	0.0373	
15 minute winter	SW04 - AREA 2	10	46.471	0.085	9.4	0.1103	0.0000	OK	15 minute winter	1.002	SW05 - AREA 2	9.3	0.688	0.231	0.0609	
15 minute winter	SW05 - AREA 2	10	46.442	0.083	11.7	0.1086	0.0000	OK	15 minute winter	1.003	SW06 - AREA 2	11.5	0.737	0.289	0.3681	
15 minute winter	SW06 - AREA 2	10	46.324	0.104	13.9	0.1340	0.0000	OK	15 minute winter	1.004	SW08 HB - AREA 2	13.6	0.776	0.342	0.0924	
15 minute summer	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.1485	
15 minute winter	SW08 HB - AREA 2	11	46.290	0.101	15.9	0.1310	0.0000	OK	15 minute winter	1.005	SW09 - AREA 2	15.9	1.168	0.398	0.0714	
15 minute winter	SW09 - AREA 2	11	46.226	0.068	15.9	0.0770	0.0000	OK	15 minute winter	1.006	SW10 - AREA 2	16.0	1.113	0.201	0.2514	
15 minute winter	SW10 - AREA 2	11	45.863	0.108	16.0	0.1222	0.0000	OK	15 minute winter	1.007	EXSW MH	16.0	0.905	0.397	0.1084	7.3
15 minute winter	EXSW MH	11	45.816	0.098	16.0	0.0000	0.0000	OK								

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 2	10	46.625	0.050	4.4	0.0665	0.0000	OK	15 minute winter	1.000	SW02 - AREA 2	4.4	0.405	0.110	0.3148	
15 minute winter	SW02 - AREA 2	10	46.515	0.099	8.8	0.1291	0.0000	OK	15 minute winter	1.001	SW04 - AREA 2	8.5	0.458	0.213	0.0990	
15 minute summer	SW03 - AREA 2	10	46.606	0.031	4.4	0.0417	0.0000	OK	15 minute summer	2.000	SW04 - AREA 2	4.4	0.404	0.042	0.0606	
15 minute winter	SW04 - AREA 2	10	46.510	0.124	17.3	0.1615	0.0000	OK	15 minute winter	1.002	SW05 - AREA 2	17.1	0.779	0.427	0.0991	
15 minute winter	SW05 - AREA 2	10	46.479	0.120	21.5	0.1564	0.0000	OK	15 minute winter	1.003	SW06 - AREA 2	21.3	0.839	0.533	0.5941	
15 minute winter	SW06 - AREA 2	10	46.374	0.154	25.7	0.1985	0.0000	OK	15 minute winter	1.004	SW08 HB - AREA 2	25.1	0.907	0.630	0.1456	
15 minute summer	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.2268	
15 minute winter	SW08 HB - AREA 2	10	46.331	0.142	29.5	0.1847	0.0000	OK	15 minute winter	1.005	SW09 - AREA 2	29.2	1.381	0.731	0.1103	
15 minute winter	SW09 - AREA 2	11	46.252	0.094	29.2	0.1067	0.0000	OK	15 minute winter	1.006	SW10 - AREA 2	29.4	1.271	0.370	0.4025	
15 minute winter	SW10 - AREA 2	11	45.917	0.162	29.4	0.1829	0.0000	OK	15 minute winter	1.007	EXSW MH	29.6	1.039	0.735	0.1744	13.3
15 minute winter	EXSW MH	11	45.860	0.142	29.6	0.0000	0.0000	OK								

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
15 minute winter	SW01 - AREA 2	10	46.632	0.057	5.7	0.0757	0.0000	OK	15 minute winter	1.000	SW02 - AREA 2	5.7	0.407	0.143	0.4101	
15 minute winter	SW02 - AREA 2	10	46.540	0.124	11.4	0.1625	0.0000	OK	15 minute winter	1.001	SW04 - AREA 2	11.0	0.468	0.275	0.1272	
15 minute winter	SW03 - AREA 2	10	46.611	0.036	5.7	0.0473	0.0000	OK	15 minute winter	2.000	SW04 - AREA 2	5.7	0.412	0.055	0.0753	
15 minute winter	SW04 - AREA 2	10	46.535	0.149	22.4	0.1939	0.0000	OK	15 minute winter	1.002	SW05 - AREA 2	22.1	0.809	0.551	0.1233	
15 minute winter	SW05 - AREA 2	10	46.503	0.144	27.8	0.1876	0.0000	OK	15 minute winter	1.003	SW06 - AREA 2	27.4	0.877	0.688	0.7297	
15 minute winter	SW06 - AREA 2	10	46.407	0.187	33.1	0.2404	0.0000	OK	15 minute winter	1.004	SW08 HB - AREA 2	32.4	0.969	0.814	0.1758	
15 minute summer	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.2719	
15 minute winter	SW08 HB - AREA 2	10	46.356	0.167	38.1	0.2176	0.0000	OK	15 minute winter	1.005	SW09 - AREA 2	37.7	1.456	0.944	0.1342	
15 minute winter	SW09 - AREA 2	11	46.270	0.112	37.7	0.1266	0.0000	OK	15 minute winter	1.006	SW10 - AREA 2	38.0	1.315	0.478	0.4918	
15 minute winter	SW10 - AREA 2	11	45.952	0.197	38.0	0.2229	0.0000	OK	15 minute winter	1.007	EXSW MH	38.2	1.119	0.949	0.2082	17.3
15 minute winter	EXSW MH	11	45.882	0.164	38.2	0.0000	0.0000	OK								

Results for 2 year +20% CC 15 minute summer. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute summer	SW01 - AREA 2	10	46.612	0.037	2.4	0.0492	0.0000	OK	15 minute summer	1.000	SW02 - AREA 2	2.4	0.388	0.060	0.1731	
15 minute summer	SW02 - AREA 2	10	46.476	0.060	4.8	0.0790	0.0000	OK	15 minute summer	1.001	SW04 - AREA 2	4.6	0.428	0.114	0.0560	
15 minute summer	SW03 - AREA 2	10	46.599	0.024	2.4	0.0313	0.0000	OK	15 minute summer	2.000	SW04 - AREA 2	2.4	0.357	0.023	0.0373	
15 minute summer	SW04 - AREA 2	10	46.470	0.084	9.4	0.1100	0.0000	OK	15 minute summer	1.002	SW05 - AREA 2	9.2	0.686	0.230	0.0607	
15 minute summer	SW05 - AREA 2	10	46.442	0.083	11.6	0.1084	0.0000	OK	15 minute summer	1.003	SW06 - AREA 2	11.5	0.736	0.287	0.3661	
15 minute summer	SW06 - AREA 2	11	46.324	0.104	13.9	0.1338	0.0000	OK	15 minute summer	1.004	SW08 HB - AREA 2	13.6	0.775	0.342	0.0922	
15 minute summer	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	15 minute summer	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.1485	
15 minute summer	SW08 HB - AREA 2	11	46.290	0.101	15.8	0.1308	0.0000	OK	15 minute summer	1.005	SW09 - AREA 2	15.8	1.167	0.397	0.0713	
15 minute summer	SW09 - AREA 2	11	46.226	0.068	15.8	0.0768	0.0000	OK	15 minute summer	1.006	SW10 - AREA 2	15.9	1.112	0.200	0.2507	
15 minute summer	SW10 - AREA 2	11	45.863	0.108	15.9	0.1218	0.0000	OK	15 minute summer	1.007	EXSW MH	15.9	0.904	0.395	0.1080	6.5
15 minute summer	EXSW MH	11	45.815	0.097	15.9	0.0000	0.0000	OK								

Results for 2 year +20% CC 15 minute winter. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 2	10	46.612	0.037	2.4	0.0492	0.0000	OK	15 minute winter	1.000	SW02 - AREA 2	2.4	0.384	0.060	0.1737	
15 minute winter	SW02 - AREA 2	10	46.477	0.061	4.8	0.0793	0.0000	OK	15 minute winter	1.001	SW04 - AREA 2	4.6	0.427	0.115	0.0562	
15 minute winter	SW03 - AREA 2	10	46.599	0.024	2.4	0.0313	0.0000	OK	15 minute winter	2.000	SW04 - AREA 2	2.4	0.344	0.023	0.0374	
15 minute winter	SW04 - AREA 2	10	46.471	0.085	9.4	0.1103	0.0000	OK	15 minute winter	1.002	SW05 - AREA 2	9.3	0.688	0.231	0.0609	
15 minute winter	SW05 - AREA 2	10	46.442	0.083	11.7	0.1086	0.0000	OK	15 minute winter	1.003	SW06 - AREA 2	11.5	0.737	0.289	0.3681	
15 minute winter	SW06 - AREA 2	10	46.324	0.104	13.9	0.1340	0.0000	OK	15 minute winter	1.004	SW08 HB - AREA 2	13.6	0.776	0.342	0.0924	
15 minute winter	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	15 minute winter	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.1488	
15 minute winter	SW08 HB - AREA 2	11	46.290	0.101	15.9	0.1310	0.0000	OK	15 minute winter	1.005	SW09 - AREA 2	15.9	1.168	0.398	0.0714	
15 minute winter	SW09 - AREA 2	11	46.226	0.068	15.9	0.0770	0.0000	OK	15 minute winter	1.006	SW10 - AREA 2	16.0	1.113	0.201	0.2514	
15 minute winter	SW10 - AREA 2	11	45.863	0.108	16.0	0.1222	0.0000	OK	15 minute winter	1.007	EXSW MH	16.0	0.905	0.397	0.1084	7.3
15 minute winter	EXSW MH	11	45.816	0.098	16.0	0.0000	0.0000	OK								

Results for 2 year +20% CC 30 minute summer. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
30 minute summer	SW01 - AREA 2	17	46.610	0.035	2.2	0.0463	0.0000	OK	30 minute summer	1.000	SW02 - AREA 2	2.1	0.376	0.053	0.1560	
30 minute summer	SW02 - AREA 2	18	46.472	0.056	4.3	0.0732	0.0000	OK	30 minute summer	1.001	SW04 - AREA 2	4.2	0.420	0.104	0.0508	
30 minute summer	SW03 - AREA 2	17	46.598	0.023	2.2	0.0299	0.0000	OK	30 minute summer	2.000	SW04 - AREA 2	2.2	0.331	0.021	0.0339	
30 minute summer	SW04 - AREA 2	18	46.465	0.079	8.3	0.1028	0.0000	OK	30 minute summer	1.002	SW05 - AREA 2	8.3	0.672	0.207	0.0556	
30 minute summer	SW05 - AREA 2	18	46.437	0.078	10.3	0.1020	0.0000	OK	30 minute summer	1.003	SW06 - AREA 2	10.4	0.720	0.262	0.3411	
30 minute summer	SW06 - AREA 2	18	46.319	0.099	12.4	0.1271	0.0000	OK	30 minute summer	1.004	SW08 HB - AREA 2	12.4	0.757	0.312	0.0863	
30 minute summer	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	30 minute summer	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.1392	
30 minute summer	SW08 HB - AREA 2	18	46.285	0.096	14.4	0.1245	0.0000	OK	30 minute summer	1.005	SW09 - AREA 2	14.4	1.136	0.360	0.0666	
30 minute summer	SW09 - AREA 2	18	46.222	0.064	14.4	0.0728	0.0000	OK	30 minute summer	1.006	SW10 - AREA 2	14.3	1.087	0.180	0.2306	
30 minute summer	SW10 - AREA 2	18	45.856	0.101	14.3	0.1138	0.0000	OK	30 minute summer	1.007	EXSW MH	14.2	0.880	0.352	0.0990	8.9
30 minute summer	EXSW MH	19	45.809	0.091	14.2	0.0000	0.0000	OK								

Results for 2 year +20% CC 30 minute winter. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
30 minute winter	SW01 - AREA 2	17	46.608	0.033	1.9	0.0436	0.0000	OK	30 minute winter	1.000	SW02 - AREA 2	1.8	0.366	0.046	0.1398	
30 minute winter	SW02 - AREA 2	18	46.467	0.051	3.7	0.0671	0.0000	OK	30 minute winter	1.001	SW04 - AREA 2	3.7	0.411	0.092	0.0457	
30 minute winter	SW03 - AREA 2	17	46.596	0.021	1.9	0.0279	0.0000	OK	30 minute winter	2.000	SW04 - AREA 2	1.9	0.317	0.018	0.0309	
30 minute winter	SW04 - AREA 2	18	46.460	0.074	7.4	0.0960	0.0000	OK	30 minute winter	1.002	SW05 - AREA 2	7.3	0.654	0.183	0.0507	
30 minute winter	SW05 - AREA 2	18	46.432	0.073	9.2	0.0954	0.0000	OK	30 minute winter	1.003	SW06 - AREA 2	9.2	0.698	0.231	0.3110	
30 minute winter	SW06 - AREA 2	18	46.312	0.092	11.0	0.1185	0.0000	OK	30 minute winter	1.004	SW08 HB - AREA 2	11.0	0.733	0.277	0.0791	
30 minute winter	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	30 minute winter	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.1281	
30 minute winter	SW08 HB - AREA 2	18	46.279	0.090	12.8	0.1170	0.0000	OK	30 minute winter	1.005	SW09 - AREA 2	12.8	1.099	0.321	0.0613	
30 minute winter	SW09 - AREA 2	18	46.219	0.061	12.8	0.0687	0.0000	OK	30 minute winter	1.006	SW10 - AREA 2	12.8	1.053	0.161	0.2124	
30 minute winter	SW10 - AREA 2	19	45.850	0.095	12.8	0.1070	0.0000	OK	30 minute winter	1.007	EXSW MH	12.7	0.855	0.316	0.0914	10.0
30 minute winter	EXSW MH	19	45.804	0.086	12.7	0.0000	0.0000	OK								

Results for 2 year +20% CC 60 minute summer. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
60 minute summer	SW01 - AREA 2	33	46.606	0.031	1.6	0.0406	0.0000	OK	60 minute summer	1.000	SW02 - AREA 2	1.6	0.359	0.040	0.1231	
60 minute summer	SW02 - AREA 2	33	46.462	0.046	3.2	0.0607	0.0000	OK	60 minute summer	1.001	SW04 - AREA 2	3.2	0.404	0.080	0.0404	
60 minute summer	SW03 - AREA 2	33	46.595	0.019	1.6	0.0259	0.0000	OK	60 minute summer	2.000	SW04 - AREA 2	1.6	0.308	0.015	0.0277	
60 minute summer	SW04 - AREA 2	33	46.454	0.068	6.4	0.0885	0.0000	OK	60 minute summer	1.002	SW05 - AREA 2	6.4	0.632	0.159	0.0454	
60 minute summer	SW05 - AREA 2	33	46.427	0.068	8.0	0.0882	0.0000	OK	60 minute summer	1.003	SW06 - AREA 2	7.9	0.674	0.199	0.2778	
60 minute summer	SW06 - AREA 2	33	46.304	0.084	9.5	0.1086	0.0000	OK	60 minute summer	1.004	SW08 HB - AREA 2	9.5	0.705	0.238	0.0707	
60 minute summer	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	60 minute summer	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.1152	
60 minute summer	SW08 HB - AREA 2	33	46.272	0.083	11.1	0.1082	0.0000	OK	60 minute summer	1.005	SW09 - AREA 2	11.0	1.053	0.276	0.0551	
60 minute summer	SW09 - AREA 2	33	46.214	0.056	11.0	0.0637	0.0000	OK	60 minute summer	1.006	SW10 - AREA 2	11.0	1.014	0.138	0.1903	
60 minute summer	SW10 - AREA 2	34	45.842	0.087	11.0	0.0985	0.0000	OK	60 minute summer	1.007	EXSW MH	11.0	0.823	0.274	0.0821	11.8
60 minute summer	EXSW MH	34	45.798	0.080	11.0	0.0000	0.0000	OK								

Results for 2 year +20% CC 60 minute winter. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
60 minute winter	SW01 - AREA 2	33	46.603	0.028	1.3	0.0368	0.0000	OK	60 minute winter	1.000	SW02 - AREA 2	1.3	0.345	0.033	0.1031	
60 minute winter	SW02 - AREA 2	33	46.457	0.040	2.6	0.0530	0.0000	OK	60 minute winter	1.001	SW04 - AREA 2	2.6	0.391	0.065	0.0339	
60 minute winter	SW03 - AREA 2	32	46.593	0.018	1.3	0.0235	0.0000	OK	60 minute winter	2.000	SW04 - AREA 2	1.3	0.287	0.012	0.0237	
60 minute winter	SW04 - AREA 2	33	46.446	0.060	5.2	0.0789	0.0000	OK	60 minute winter	1.002	SW05 - AREA 2	5.2	0.602	0.129	0.0388	
60 minute winter	SW05 - AREA 2	33	46.420	0.061	6.5	0.0792	0.0000	OK	60 minute winter	1.003	SW06 - AREA 2	6.5	0.641	0.162	0.2379	
60 minute winter	SW06 - AREA 2	33	46.295	0.075	7.8	0.0968	0.0000	OK	60 minute winter	1.004	SW08 HB - AREA 2	7.7	0.668	0.194	0.0608	
60 minute winter	SW07 - AREA 2	1	47.275	0.000	0.0	0.0000	0.0000	OK	60 minute winter	3.000	SW08 HB - AREA 2	0.0	0.000	0.000	0.0999	
60 minute winter	SW08 HB - AREA 2	33	46.264	0.075	9.0	0.0974	0.0000	OK	60 minute winter	1.005	SW09 - AREA 2	9.0	0.993	0.226	0.0478	
60 minute winter	SW09 - AREA 2	33	46.209	0.051	9.0	0.0576	0.0000	OK	60 minute winter	1.006	SW10 - AREA 2	9.0	0.962	0.113	0.1642	
60 minute winter	SW10 - AREA 2	34	45.833	0.078	9.0	0.0881	0.0000	OK	60 minute winter	1.007	EXSW MH	9.0	0.781	0.224	0.0708	13.0
60 minute winter	EXSW MH	34	45.790	0.072	9.0	0.0000	0.0000	OK								

Adoptable						
Max Width (mm)	**Diameter (mm)**	**Width (mm)**		**Max Depth (m)**	**Diameter (mm)**	**Width (mm)**
374	1200			1.500	1050	
499	1350			99.999	1200	
749	1500					
900	1800					
>900	Link+900 mm					

Circular			
Shape	Circular		**Dia (mm)**
Barrels	1		100
Height (mm)			150
Width (mm)			
Side Slope (1:X)			
Auto Increment (mm)	75		
Preferred Cover (m)			
Steep Slope (1:X)			
Follow Ground	No		
Velocity	Default		
ks (mm) / n			
uPVC			
Shape	Circular		**Dia (mm)**
Barrels	1		225
Height (mm)			
Width (mm)			
Side Slope (1:X)			
Auto Increment (mm)	75		
Preferred Cover (m)			
Steep Slope (1:X)			
Follow Ground	No		
Velocity	Colebrook-White		
ks (mm) / n	0.150		

Drainage Design Report

Flow+

v10.8

Network	Storm Network - Area 3
Filename	
Username	Kezia Adanza (kadanza@morce.ie)
Last analysed	23/07/2024 12:52:37
Report produced on	23/07/2024 13:03:19

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

http://support.causeway.com

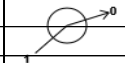
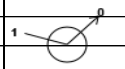
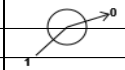
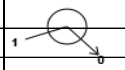
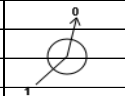
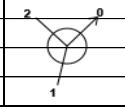
Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.000
Ratio-R	0.280
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	Yes
Enforce best practice design rules	Yes

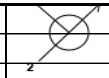
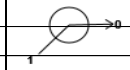
	Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Sump (m)	Easting (m)	Northing (m)	Depth (m)	Notes
✓	SW01 - AREA 3	0.010	4.00		47.200	Manhole	Adoptable	1200			716225.192	738941.700	1.425	
✓	SW02 - AREA 3	0.010	4.00		47.090	Manhole	Adoptable	1200			716233.376	738949.602	1.425	
✓	SW03 - AREA 3	0.010	4.00		46.890	Manhole	Adoptable	1200			716252.255	738956.108	1.425	
✓	SW04 - AREA 3	0.010	4.00		46.890	Manhole	Adoptable	1350			716258.214	738954.352	1.575	
✓	SW05 - AREA 3	0.010	4.00		46.740	Manhole	Adoptable	1350			716267.328	738963.499	1.575	
✓	SW06 - AREA 3	0.010	4.00		46.520	Manhole	Adoptable	1350			716288.541	738970.679	1.575	
✓	SW07 - AREA 3	0.010	4.00		46.850	Manhole	Adoptable	1200			716283.048	738934.331	1.425	
✓	SW08 - AREA 3	0.010	4.00		46.850	Manhole	Adoptable	1350			716300.978	738952.273	1.575	
✓	SW09 - AREA 3	0.010	4.00		46.850	Manhole	Adoptable	1350			716302.066	738957.178	2.001	
✓	SW10 - AREA 3		4.00		46.530	Manhole	Adoptable	1200			716304.780	738967.414	0.900	
✓	SW11 HB - AREA 3	0.010	4.00		46.530	Manhole	Adoptable	1350			716308.447	738963.879	1.727	
✓	SW12 - AREA 3				46.450	Manhole	Adoptable	1200			716324.067	738980.281	1.781	
✓	EXSW MH				46.410	Manhole	Adoptable	1200			716334.636	738980.528	1.804	

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Con Offset (m)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
✓	1.000	SW01 - AREA 3	SW02 - AREA 3	11.376	0.600	Colebrook-White	45.775	45.665	0.110	103.4	225	Circular	4.15	50.0					
✓	1.001	SW02 - AREA 3	SW03 - AREA 3	19.969	0.600	Colebrook-White	45.665	45.465	0.200	99.8	225	Circular	4.40	50.0					
?	1.002	SW03 - AREA 3	SW04 - AREA 3	6.212	0.600	Colebrook-White	45.465	45.315	0.150	41.4	375	Circular	4.44	50.0					
✓	1.003	SW04 - AREA 3	SW05 - AREA 3	12.912	0.600	Colebrook-White	45.315	45.165	0.150	86.1	375	Circular	4.55	50.0					
✓	1.004	SW05 - AREA 3	SW06 - AREA 3	22.395	0.600	Colebrook-White	45.165	44.945	0.220	101.8	375	Circular	4.76	49.4					
✓	1.005	SW06 - AREA 3	SW09 - AREA 3	19.110	0.600	Colebrook-White	44.945	44.849	0.096	200.0	375	Circular	5.01	48.5					
✓	2.000	SW07 - AREA 3	SW08 - AREA 3	25.365	0.600	Colebrook-White	45.425	45.275	0.150	169.1	225	Circular	4.42	50.0					
✓	2.001	SW08 - AREA 3	SW09 - AREA 3	5.024	0.600	Colebrook-White	45.275	45.225	0.050	100.0	375	Circular	4.47	50.0					
✓	1.006	SW09 - AREA 3	SW11 HB - AREA 3	9.253	0.600	Colebrook-White	44.849	44.803	0.046	200.0	375	Circular	5.13	48.1					
?	3.000	SW10 - AREA 3	SW11 HB - AREA 3	5.093	0.600	Colebrook-White	45.630	45.545	0.085	60.0	225	Circular	4.05	50.0					
✓	1.007	SW11 HB - AREA 3	SW12 - AREA 3	22.650	0.600	Colebrook-White	44.803	44.669	0.134	169.0	225	Circular	5.50	46.8					
✓	1.008	SW12 - AREA 3	EXSW MH	10.572	0.600	Colebrook-White	44.669	44.606	0.063	167.8	225	Circular	5.68	46.3					

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)	Notes
✓	1.000	SW01 - AREA 3	SW02 - AREA 3	1.285	51.1	1.4	1.200	1.200	1.200	1.200	0.010	0.0	25	0.555	
✓	1.001	SW02 - AREA 3	SW03 - AREA 3	1.308	52.0	2.7	1.200	1.200	1.200	1.200	0.020	0.0	35	0.694	
?	1.002	SW03 - AREA 3	SW04 - AREA 3	2.822	311.7	4.1	1.050	1.200	1.050	1.200	0.030	0.0	30	1.002	Upstream Depth is less than the specified minimum
✓	1.003	SW04 - AREA 3	SW05 - AREA 3	1.954	215.8	5.4	1.200	1.200	1.200	1.200	0.040	0.0	41	0.845	
✓	1.004	SW05 - AREA 3	SW06 - AREA 3	1.795	198.3	6.7	1.200	1.200	1.200	1.200	0.050	0.0	47	0.844	
✓	1.005	SW06 - AREA 3	SW09 - AREA 3	1.277	141.1	7.9	1.200	1.626	1.200	1.626	0.060	0.0	60	0.698	
✓	2.000	SW07 - AREA 3	SW08 - AREA 3	1.002	39.9	1.4	1.200	1.350	1.200	1.350	0.010	0.0	29	0.470	
✓	2.001	SW08 - AREA 3	SW09 - AREA 3	1.812	200.1	2.7	1.200	1.250	1.200	1.250	0.020	0.0	30	0.651	
✓	1.006	SW09 - AREA 3	SW11 HB - AREA 3	1.277	141.1	11.7	1.626	1.352	1.352	1.626	0.090	0.0	72	0.781	
?	3.000	SW10 - AREA 3	SW11 HB - AREA 3	1.691	67.2	0.0	0.675	0.760	0.675	0.760	0.000	0.0	0	0.000	Upstream Depth is less than the specified minimum | Downstream Depth is less than the specified minimum
✓	1.007	SW11 HB - AREA 3	SW12 - AREA 3	1.003	39.9	12.7	1.502	1.556	1.502	1.556	0.100	0.0	87	0.895	
✓	1.008	SW12 - AREA 3	EXSW MH	1.006	40.0	12.5	1.556	1.579	1.556	1.579	0.100	0.0	87	0.893	

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type
1.000	11.376	103.4	225	Circular	47.200	45.775	1.200	47.090	45.665	1.200	SW01 - AREA 3	1200			Manhole	Adoptable	SW02 - AREA 3	1200			Manhole	Adoptable
1.001	19.969	99.8	225	Circular	47.090	45.665	1.200	46.890	45.465	1.200	SW02 - AREA 3	1200			Manhole	Adoptable	SW03 - AREA 3	1200			Manhole	Adoptable
1.002	6.212	41.4	375	Circular	46.890	45.465	1.050	46.890	45.315	1.200	SW03 - AREA 3	1200			Manhole	Adoptable	SW04 - AREA 3	1350			Manhole	Adoptable
1.003	12.912	86.1	375	Circular	46.890	45.315	1.200	46.740	45.165	1.200	SW04 - AREA 3	1350			Manhole	Adoptable	SW05 - AREA 3	1350			Manhole	Adoptable
1.004	22.395	101.8	375	Circular	46.740	45.165	1.200	46.520	44.945	1.200	SW05 - AREA 3	1350			Manhole	Adoptable	SW06 - AREA 3	1350			Manhole	Adoptable
1.005	19.110	200.0	375	Circular	46.520	44.945	1.200	46.850	44.849	1.626	SW06 - AREA 3	1350			Manhole	Adoptable	SW09 - AREA 3	1350			Manhole	Adoptable
2.000	25.365	169.1	225	Circular	46.850	45.425	1.200	46.850	45.275	1.350	SW07 - AREA 3	1200			Manhole	Adoptable	SW08 - AREA 3	1350			Manhole	Adoptable
2.001	5.024	100.0	375	Circular	46.850	45.275	1.200	46.850	45.225	1.250	SW08 - AREA 3	1350			Manhole	Adoptable	SW09 - AREA 3	1350			Manhole	Adoptable
1.006	9.253	200.0	375	Circular	46.850	44.849	1.626	46.530	44.803	1.352	SW09 - AREA 3	1350			Manhole	Adoptable	SW11 HB - AREA 3	1350			Manhole	Adoptable
3.000	5.093	60.0	225	Circular	46.530	45.630	0.675	46.530	45.545	0.760	SW10 - AREA 3	1200			Manhole	Adoptable	SW11 HB - AREA 3	1350			Manhole	Adoptable
1.007	22.650	169.0	225	Circular	46.530	44.803	1.502	46.450	44.669	1.556	SW11 HB - AREA 3	1350			Manhole	Adoptable	SW12 - AREA 3	1200			Manhole	Adoptable
1.008	10.572	167.8	225	Circular	46.450	44.669	1.556	46.410	44.606	1.579	SW12 - AREA 3	1200			Manhole	Adoptable	EXSW MH	1200			Manhole	Adoptable

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	Connections		Link	IL (m)	Dia (mm)	Link Type
SW01 - AREA 3	716225.192	738941.700	47.200	1.425	1200			Manhole	Adoptable						
															
											0	1.000	45.775	225	Circular
SW02 - AREA 3	716233.376	738949.602	47.090	1.425	1200			Manhole	Adoptable		1	1.000	45.665	225	Circular
															
											0	1.001	45.665	225	Circular
SW03 - AREA 3	716252.255	738956.108	46.890	1.425	1200			Manhole	Adoptable		1	1.001	45.465	225	Circular
															
											0	1.002	45.465	375	Circular
SW04 - AREA 3	716258.214	738954.352	46.890	1.575	1350			Manhole	Adoptable		1	1.002	45.315	375	Circular
															
											0	1.003	45.315	375	Circular
SW05 - AREA 3	716267.328	738963.499	46.740	1.575	1350			Manhole	Adoptable		1	1.003	45.165	375	Circular
															
											0	1.004	45.165	375	Circular
SW06 - AREA 3	716288.541	738970.679	46.520	1.575	1350			Manhole	Adoptable		1	1.004	44.945	375	Circular
															
											0	1.005	44.945	375	Circular
SW07 - AREA 3	716283.048	738934.331	46.850	1.425	1200			Manhole	Adoptable						
															
											0	2.000	45.425	225	Circular
SW08 - AREA 3	716300.978	738952.273	46.850	1.575	1350			Manhole	Adoptable		1	2.000	45.275	225	Circular
															
											0	2.001	45.275	375	Circular
SW09 - AREA 3	716302.066	738957.178	46.850	2.001	1350			Manhole	Adoptable		1	2.001	45.225	375	Circular
											2	1.005	44.849	375	Circular
											0	1.006	44.849	375	Circular
SW10 - AREA 3	716304.780	738967.414	46.530	0.900	1200			Manhole	Adoptable						
															
											0	3.000	45.630	225	Circular
SW11 HB - AREA 3	716308.447	738963.879	46.530	1.727	1350			Manhole	Adoptable		1	3.000	45.545	225	Circular

											2	1.006	44.803	375	Circular
											0	1.007	44.803	225	Circular
SW12 - AREA 3	716324.067	738980.281	46.450	1.781	1200			Manhole	Adoptable		1	1.007	44.669	225	Circular
															
											0	1.008	44.669	225	Circular
EXSW MH	716334.636	738980.528	46.410	1.804	1200			Manhole	Adoptable		1	1.008	44.606	225	Circular
															

Rainfall Methodology	FSR		Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
FSR Region	Scotland and Ireland		2	20	0	0
M5-60 (mm)	16.000		30	20	0	0
Ratio-R	0.280		100	20	0	0
Summer CV	0.750					
Winter CV	0.840					
Analysis Speed	Normal					
Skip Steady State	No					
Drain Down Time (mins)	240					
Additional Storage (m³/ha)	20.0					
Storm Durations (mins)	15					
	30					
	60					
	120					
	180					
	240					
	360					
	480					
	600					
	720					
	960					
	1440					
	2160					
	2880					
	4320					
	5760					
	7200					
	8640					
	10080					
Check Discharge Rate(s)	No					
Check Discharge Volume	No					
100 year 360 minute (m³)						

Hydro-Brake®

Node	Flap Valve	Online / Offline	Downstream Link	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Objective	Sump Available	Product Number	Min Outlet Diameter (m)	Min Node Diameter (mm)
SW11 HB - AREA 3	No	Online		Yes		44.803	1.200	2.7	(HE) Minimise upstream storage	Yes	CTL-SHE-0075-2700-1200-2700	0.100	1200

Depth/Area/Inf Area									
Node	**Base Inf Coefficient (m/hr)**	**Side Inf Coefficient (m/hr)**	**Safety Factor**	**Porosity**	**Invert Level (m)**	**Time to half empty (mins)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
SW10 - AREA 3	0.00000	0.00000	2.0	1.00	45.630	0	0.000	20.5	0.0
							0.310	88.2	0.0
							0.910	139.2	0.0

Default Values			**Overrides**					
Entry Loss (manhole)	0.250		**Link**	**Entry Loss**	**Exit Loss**		**Node**	**Flood Risk (m)**
Exit Loss (manhole)	0.250							
Entry Loss (junction)	0.000							
Exit Loss (junction)	0.000							
Apply Recommended Losses	No							
Flood Risk (m)	0.300							

Node Size	Yes
Node Losses	Yes
Link Size	Yes
Minimum Diameter (mm)	150
Link Length	Yes
Maximum Length (m)	100.000
Coordinates	Yes
Accuracy (m)	1.000
Crossings	Yes
Cover Depth	Yes
Minimum Cover Depth (m)	
Maximum Cover Depth (m)	3.000
Backdrops	Yes
Minimum Backdrop Height (m)	
Maximum Backdrop Height (m)	1.500
Full Bore Velocity	Yes
Minimum Full Bore Velocity (m/s)	
Maximum Full Bore Velocity (m/s)	3.000
Proportional Velocity	Yes
Return Period (years)	
Minimum Proportional Velocity (m/s)	0.750
Maximum Proportional Velocity (m/s)	3.000
Surcharged Depth	Yes
Return Period (years)	
Maximum Surcharged Depth (m)	0.100
Flooding	Yes
Return Period (years)	30
Time to Half Empty	No
Return Period (years)	
Discharge Rates	Yes
Discharge Volume	Yes
100 year 360 minute (m^3)	

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +20% CC 15 minute summer	125.076	35.392
2 year +20% CC 15 minute winter	87.773	35.392
2 year +20% CC 30 minute summer	85.296	24.136
2 year +20% CC 30 minute winter	59.857	24.136
2 year +20% CC 60 minute summer	60.447	15.974
2 year +20% CC 60 minute winter	40.160	15.974
2 year +20% CC 120 minute summer	39.259	10.375
2 year +20% CC 120 minute winter	26.083	10.375
2 year +20% CC 180 minute summer	30.986	7.974
2 year +20% CC 180 minute winter	20.142	7.974
2 year +20% CC 240 minute summer	25.068	6.625
2 year +20% CC 240 minute winter	16.654	6.625
2 year +20% CC 360 minute summer	19.895	5.120
2 year +20% CC 360 minute winter	12.932	5.120
2 year +20% CC 480 minute summer	16.078	4.249
2 year +20% CC 480 minute winter	10.682	4.249
2 year +20% CC 600 minute summer	13.442	3.677
2 year +20% CC 600 minute winter	9.184	3.677
2 year +20% CC 720 minute summer	12.188	3.267
2 year +20% CC 720 minute winter	8.191	3.267
2 year +20% CC 960 minute summer	10.295	2.711
2 year +20% CC 960 minute winter	6.820	2.711
2 year +20% CC 1440 minute summer	7.780	2.085
2 year +20% CC 1440 minute winter	5.229	2.085
2 year +20% CC 2160 minute summer	5.787	1.599
2 year +20% CC 2160 minute winter	3.987	1.599
2 year +20% CC 2880 minute summer	4.939	1.324
2 year +20% CC 2880 minute winter	3.320	1.324
2 year +20% CC 4320 minute summer	3.880	1.015
2 year +20% CC 4320 minute winter	2.555	1.015

2 year +20% CC 5760 minute summer	3.280	0.840
2 year +20% CC 5760 minute winter	2.123	0.840
2 year +20% CC 7200 minute summer	2.837	0.724
2 year +20% CC 7200 minute winter	1.831	0.724
2 year +20% CC 8640 minute summer	2.512	0.641
2 year +20% CC 8640 minute winter	1.621	0.641
2 year +20% CC 10080 minute summer	2.267	0.578
2 year +20% CC 10080 minute winter	1.463	0.578
30 year +20% CC 15 minute summer	229.581	64.964
30 year +20% CC 15 minute winter	161.110	64.964
30 year +20% CC 30 minute summer	157.518	44.572
30 year +20% CC 30 minute winter	110.539	44.572
30 year +20% CC 60 minute summer	109.995	29.068
30 year +20% CC 60 minute winter	73.078	29.068
30 year +20% CC 120 minute summer	69.900	18.472
30 year +20% CC 120 minute winter	46.440	18.472
30 year +20% CC 180 minute summer	54.666	14.067
30 year +20% CC 180 minute winter	35.534	14.067
30 year +20% CC 240 minute summer	43.793	11.573
30 year +20% CC 240 minute winter	29.095	11.573
30 year +20% CC 360 minute summer	34.080	8.770
30 year +20% CC 360 minute winter	22.153	8.770
30 year +20% CC 480 minute summer	27.227	7.195
30 year +20% CC 480 minute winter	18.089	7.195
30 year +20% CC 600 minute summer	22.551	6.168
30 year +20% CC 600 minute winter	15.408	6.168
30 year +20% CC 720 minute summer	20.288	5.437
30 year +20% CC 720 minute winter	13.635	5.437
30 year +20% CC 960 minute summer	16.917	4.455
30 year +20% CC 960 minute winter	11.206	4.455
30 year +20% CC 1440 minute summer	12.545	3.362
30 year +20% CC 1440 minute winter	8.431	3.362
30 year +20% CC 2160 minute summer	9.180	2.537

30 year +20% CC 2160 minute winter	6.325	2.537
30 year +20% CC 2880 minute summer	7.747	2.076
30 year +20% CC 2880 minute winter	5.207	2.076
30 year +20% CC 4320 minute summer	5.982	1.564
30 year +20% CC 4320 minute winter	3.940	1.564
30 year +20% CC 5760 minute summer	4.995	1.279
30 year +20% CC 5760 minute winter	3.233	1.279
30 year +20% CC 7200 minute summer	4.286	1.093
30 year +20% CC 7200 minute winter	2.766	1.093
30 year +20% CC 8640 minute summer	3.771	0.962
30 year +20% CC 8640 minute winter	2.434	0.962
30 year +20% CC 10080 minute summer	3.384	0.863
30 year +20% CC 10080 minute winter	2.184	0.863
100 year +20% CC 15 minute summer	297.434	84.163
100 year +20% CC 15 minute winter	208.725	84.163
100 year +20% CC 30 minute summer	205.553	58.164
100 year +20% CC 30 minute winter	144.248	58.164
100 year +20% CC 60 minute summer	143.033	37.800
100 year +20% CC 60 minute winter	95.028	37.800
100 year +20% CC 120 minute summer	90.194	23.836
100 year +20% CC 120 minute winter	59.923	23.836
100 year +20% CC 180 minute summer	70.128	18.046
100 year +20% CC 180 minute winter	45.585	18.046
100 year +20% CC 240 minute summer	55.935	14.782
100 year +20% CC 240 minute winter	37.162	14.782
100 year +20% CC 360 minute summer	43.239	11.127
100 year +20% CC 360 minute winter	28.106	11.127
100 year +20% CC 480 minute summer	34.371	9.083
100 year +20% CC 480 minute winter	22.836	9.083
100 year +20% CC 600 minute summer	28.355	7.756
100 year +20% CC 600 minute winter	19.374	7.756
100 year +20% CC 720 minute summer	25.426	6.814
100 year +20% CC 720 minute winter	17.088	6.814

100 year +20% CC 960 minute summer	21.089	5.553
100 year +20% CC 960 minute winter	13.970	5.553
100 year +20% CC 1440 minute summer	15.523	4.160
100 year +20% CC 1440 minute winter	10.432	4.160
100 year +20% CC 2160 minute summer	11.275	3.116
100 year +20% CC 2160 minute winter	7.769	3.116
100 year +20% CC 2880 minute summer	9.462	2.536
100 year +20% CC 2880 minute winter	6.359	2.536
100 year +20% CC 4320 minute summer	7.246	1.894
100 year +20% CC 4320 minute winter	4.772	1.894
100 year +20% CC 5760 minute summer	6.012	1.539
100 year +20% CC 5760 minute winter	3.891	1.539
100 year +20% CC 7200 minute summer	5.133	1.309
100 year +20% CC 7200 minute winter	3.313	1.309
100 year +20% CC 8640 minute summer	4.498	1.147
100 year +20% CC 8640 minute winter	2.903	1.147
100 year +20% CC 10080 minute summer	4.022	1.026
100 year +20% CC 10080 minute winter	2.596	1.026

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 99.59%																		
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link Event (Upstream Depth)	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)		
15 minute winter	SW01 - AREA 3	10	45.803	0.028	1.7	0.0356	0.0000	OK	15 minute winter	1.000	SW02 - AREA 3	1.7	0.448	0.033	0.0436			
15 minute winter	SW02 - AREA 3	10	45.705	0.040	3.4	0.0514	0.0000	OK	15 minute winter	1.001	SW03 - AREA 3	3.4	0.802	0.065	0.0846			
15 minute winter	SW03 - AREA 3	10	45.498	0.033	5.1	0.0423	0.0000	OK	15 minute winter	1.002	SW04 - AREA 3	5.1	0.821	0.016	0.0387			
15 minute winter	SW04 - AREA 3	10	45.361	0.046	6.8	0.0717	0.0000	OK	15 minute winter	1.003	SW05 - AREA 3	6.7	0.800	0.031	0.1091			
60 minute winter	SW05 - AREA 3	46	45.268	0.103	4.5	0.1606	0.0000	OK	60 minute winter	1.004	SW06 - AREA 3	4.5	0.560	0.023	1.4010			
60 minute winter	SW06 - AREA 3	48	45.269	0.324	5.6	0.5051	0.0000	OK	60 minute winter	1.005	SW09 - AREA 3	5.1	0.340	0.036	2.0220			
15 minute winter	SW07 - AREA 3	10	45.456	0.031	1.7	0.0399	0.0000	OK	15 minute winter	2.000	SW08 - AREA 3	1.7	0.459	0.042	0.0934			
15 minute winter	SW08 - AREA 3	10	45.311	0.036	3.4	0.0554	0.0000	OK	15 minute winter	2.001	SW09 - AREA 3	3.4	0.664	0.017	0.0254			
60 minute winter	SW09 - AREA 3	47	45.268	0.419	7.7	0.6419	0.0000	OK	60 minute winter	1.006	SW11 HB - AREA 3	3.7	0.222	0.027	1.0206			
15 minute summer	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	15 minute summer	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000			
60 minute winter	SW11 HB - AREA 3	47	45.269	0.466	4.5	0.7212	0.0000	SURCHARGED	60 minute winter	Hydro-Brake®	SW12 - AREA 3	2.6					Surcharge due to flow behind hydrobrake - Acceptable	
15 minute summer	SW12 - AREA 3	13	44.709	0.040	2.6	0.0449	0.0000	OK	15 minute summer	1.008	EXSW MH	2.6	0.560	0.064	0.0486	6.6		
30 minute winter	EXSW MH	47	44.644	0.038	2.6	0.0000	0.0000	OK										

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.59%																
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link Event (Upstream Depth)	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01 - AREA 3	10	45.812	0.037	3.1	0.0476	0.0000	OK	15 minute winter	1.000	SW02 - AREA 3	3.1	0.533	0.061	0.0667	
15 minute winter	SW02 - AREA 3	10	45.720	0.055	6.2	0.0694	0.0000	OK	15 minute winter	1.001	SW03 - AREA 3	6.2	0.945	0.119	0.1313	
120 minute winter	SW03 - AREA 3	102	45.671	0.206	3.3	0.2615	0.0000	OK	120 minute winter	1.002	SW04 - AREA 3	3.5	0.728	0.011	0.5277	
120 minute winter	SW04 - AREA 3	102	45.670	0.355	4.4	0.5526	0.0000	OK	120 minute winter	1.003	SW05 - AREA 3	5.3	0.677	0.024	1.4085	
120 minute winter	SW05 - AREA 3	92	45.669	0.504	6.3	0.7848	0.0000	SURCHARGED	120 minute winter	1.004	SW06 - AREA 3	4.5	0.525	0.023	2.4701	
120 minute winter	SW06 - AREA 3	94	45.669	0.724	5.4	1.1279	0.0000	SURCHARGED	120 minute winter	1.005	SW09 - AREA 3	3.5	0.338	0.025	2.1078	
120 minute winter	SW07 - AREA 3	108	45.670	0.245	2.3	0.3114	0.0000	SURCHARGED	120 minute winter	2.000	SW08 - AREA 3	-1.4	0.415	-0.036	1.0088	
120 minute winter	SW08 - AREA 3	94	45.669	0.394	3.2	0.6141	0.0000	SURCHARGED	120 minute winter	2.001	SW09 - AREA 3	3.1	0.565	0.015	0.5541	
120 minute winter	SW09 - AREA 3	94	45.669	0.820	6.2	1.2557	0.0000	SURCHARGED	120 minute winter	1.006	SW11 HB - AREA 3	4.1	0.204	0.029	1.0206	
120 minute winter	SW10 - AREA 3	94	45.669	0.039	2.5	1.0058	0.0000	OK	120 minute winter	3.000	SW11 HB - AREA 3	-2.5	0.313	-0.037	0.0688	
120 minute winter	SW11 HB - AREA 3	94	45.669	0.866	4.6	1.3396	0.0000	SURCHARGED	120 minute winter	Hydro-Brake®	SW12 - AREA 3	2.6				
180 minute winter	SW12 - AREA 3	80	44.709	0.040	2.6	0.0449	0.0000	OK	180 minute winter	1.008	EXSW MH	2.6	0.560	0.064	0.0486	35.0
180 minute winter	EXSW MH	80	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.59%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event (Upstream Depth)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
15 minute winter	SW01 - AREA 3	10	45.818	0.043	4.1	0.0545	0.0000	OK	15 minute winter	1.000	SW02 - AREA 3	4.1	0.578	0.080	0.0815	
120 minute winter	SW02 - AREA 3	102	45.793	0.128	2.8	0.1625	0.0000	OK	120 minute winter	1.001	SW03 - AREA 3	2.9	0.754	0.055	0.6296	
120 minute winter	SW03 - AREA 3	106	45.794	0.329	4.3	0.4188	0.0000	OK	120 minute winter	1.002	SW04 - AREA 3	4.1	0.768	0.013	0.6604	
120 minute winter	SW04 - AREA 3	106	45.792	0.477	5.5	0.7432	0.0000	SURCHARGED	120 minute winter	1.003	SW05 - AREA 3	7.6	0.680	0.035	1.4242	
120 minute winter	SW05 - AREA 3	106	45.791	0.626	9.0	0.9760	0.0000	SURCHARGED	120 minute winter	1.004	SW06 - AREA 3	6.4	0.486	0.032	2.4701	
120 minute winter	SW06 - AREA 3	106	45.790	0.845	7.5	1.3162	0.0000	SURCHARGED	120 minute winter	1.005	SW09 - AREA 3	7.5	0.338	0.053	2.1078	
120 minute winter	SW07 - AREA 3	108	45.790	0.365	1.4	0.4637	0.0000	SURCHARGED	120 minute winter	2.000	SW08 - AREA 3	1.4	0.425	0.034	1.0088	
120 minute winter	SW08 - AREA 3	108	45.793	0.518	3.5	0.8074	0.0000	SURCHARGED	120 minute winter	2.001	SW09 - AREA 3	3.1	0.581	0.015	0.5541	
120 minute winter	SW09 - AREA 3	106	45.792	0.943	10.2	1.4435	0.0000	SURCHARGED	120 minute winter	1.006	SW11 HB - AREA 3	10.1	0.218	0.071	1.0206	
120 minute winter	SW10 - AREA 3	104	45.787	0.157	8.6	6.1011	0.0000	OK	120 minute winter	3.000	SW11 HB - AREA 3	-8.6	-0.465	-0.128	0.1767	
120 minute winter	SW11 HB - AREA 3	104	45.787	0.984	11.2	1.5220	0.0000	SURCHARGED	120 minute winter	Hydro-Brake®	SW12 - AREA 3	2.6				
120 minute summer	SW12 - AREA 3	54	44.709	0.040	2.6	0.0449	0.0000	OK	120 minute summer	1.008	EXSW MH	2.6	0.560	0.064	0.0486	36.5
30 minute summer	EXSW MH	132	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 2 year +20% CC 15 minute summer. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
15 minute summer	SW01 - AREA 3	10	45.803	0.028	1.7	0.0356	0.0000	OK	15 minute summer	1.000	SW02 - AREA 3	1.7	0.448	0.033	0.0435	
15 minute summer	SW02 - AREA 3	10	45.705	0.040	3.4	0.0513	0.0000	OK	15 minute summer	1.001	SW03 - AREA 3	3.4	0.801	0.065	0.0845	
15 minute summer	SW03 - AREA 3	10	45.498	0.033	5.1	0.0423	0.0000	OK	15 minute summer	1.002	SW04 - AREA 3	5.1	0.820	0.016	0.0386	
15 minute summer	SW04 - AREA 3	10	45.361	0.046	6.8	0.0716	0.0000	OK	15 minute summer	1.003	SW05 - AREA 3	6.7	0.800	0.031	0.1086	
15 minute summer	SW05 - AREA 3	10	45.217	0.052	8.4	0.0806	0.0000	OK	15 minute summer	1.004	SW06 - AREA 3	8.3	0.732	0.042	0.7441	
15 minute summer	SW06 - AREA 3	16	45.154	0.209	10.5	0.3252	0.0000	OK	15 minute summer	1.005	SW09 - AREA 3	10.3	0.422	0.073	1.5553	
15 minute summer	SW07 - AREA 3	10	45.456	0.031	1.7	0.0399	0.0000	OK	15 minute summer	2.000	SW08 - AREA 3	1.7	0.459	0.042	0.0931	
15 minute summer	SW08 - AREA 3	10	45.310	0.035	3.4	0.0553	0.0000	OK	15 minute summer	2.001	SW09 - AREA 3	3.3	0.663	0.017	0.0252	
15 minute summer	SW09 - AREA 3	17	45.168	0.319	14.8	0.4881	0.0000	OK	15 minute summer	1.006	SW11 HB - AREA 3	4.7	0.266	0.033	0.9694	
15 minute summer	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	15 minute summer	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000	
15 minute summer	SW11 HB - AREA 3	17	45.170	0.367	6.1	0.5675	0.0000	SURCHARGED	15 minute summer	Hydro-Brake®	SW12 - AREA 3	2.6				
15 minute summer	SW12 - AREA 3	13	44.709	0.040	2.6	0.0449	0.0000	OK	15 minute summer	1.008	EXSW MH	2.6	0.560	0.064	0.0486	6.6
15 minute summer	EXSW MH	13	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 2 year +20% CC 15 minute winter. 255 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
15 minute winter	SW01 - AREA 3	10	45.803	0.028	1.7	0.0356	0.0000	OK	15 minute winter	1.000	SW02 - AREA 3	1.7	0.448	0.033	0.0436	
15 minute winter	SW02 - AREA 3	10	45.705	0.040	3.4	0.0514	0.0000	OK	15 minute winter	1.001	SW03 - AREA 3	3.4	0.802	0.065	0.0846	
15 minute winter	SW03 - AREA 3	10	45.498	0.033	5.1	0.0423	0.0000	OK	15 minute winter	1.002	SW04 - AREA 3	5.1	0.821	0.016	0.0387	
15 minute winter	SW04 - AREA 3	10	45.361	0.046	6.8	0.0717	0.0000	OK	15 minute winter	1.003	SW05 - AREA 3	6.7	0.800	0.031	0.1091	
15 minute winter	SW05 - AREA 3	10	45.217	0.052	8.4	0.0809	0.0000	OK	15 minute winter	1.004	SW06 - AREA 3	8.3	0.735	0.042	1.0215	
15 minute winter	SW06 - AREA 3	17	45.214	0.269	12.3	0.4197	0.0000	OK	15 minute winter	1.005	SW09 - AREA 3	6.9	0.404	0.049	1.8368	
15 minute winter	SW07 - AREA 3	10	45.456	0.031	1.7	0.0399	0.0000	OK	15 minute winter	2.000	SW08 - AREA 3	1.7	0.459	0.042	0.0934	
15 minute winter	SW08 - AREA 3	10	45.311	0.036	3.4	0.0554	0.0000	OK	15 minute winter	2.001	SW09 - AREA 3	3.4	0.664	0.017	0.0254	
15 minute winter	SW09 - AREA 3	15	45.214	0.365	11.7	0.5581	0.0000	OK	15 minute winter	1.006	SW11 HB - AREA 3	7.1	0.283	0.050	1.0163	
15 minute winter	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	15 minute winter	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000	
15 minute winter	SW11 HB - AREA 3	15	45.216	0.413	8.8	0.6387	0.0000	SURCHARGED	15 minute winter	Hydro-Brake®	SW12 - AREA 3	2.6				
15 minute winter	SW12 - AREA 3	27	44.709	0.040	2.6	0.0449	0.0000	OK	15 minute winter	1.008	EXSW MH	2.6	0.560	0.064	0.0486	7.4
15 minute winter	EXSW MH	27	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 2 year +20% CC 30 minute summer. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
30 minute summer	SW01 - AREA 3	18	45.801	0.026	1.5	0.0336	0.0000	OK	30 minute summer	1.000	SW02 - AREA 3	1.5	0.432	0.029	0.0400	
30 minute summer	SW02 - AREA 3	18	45.703	0.038	3.0	0.0484	0.0000	OK	30 minute summer	1.001	SW03 - AREA 3	3.0	0.776	0.058	0.0775	
30 minute summer	SW03 - AREA 3	18	45.496	0.031	4.5	0.0398	0.0000	OK	30 minute summer	1.002	SW04 - AREA 3	4.5	0.794	0.014	0.0354	
30 minute summer	SW04 - AREA 3	18	45.358	0.043	6.0	0.0675	0.0000	OK	30 minute summer	1.003	SW05 - AREA 3	6.0	0.771	0.028	0.1004	
30 minute summer	SW05 - AREA 3	26	45.220	0.055	7.5	0.0859	0.0000	OK	30 minute summer	1.004	SW06 - AREA 3	7.5	0.652	0.038	1.0747	
30 minute summer	SW06 - AREA 3	25	45.220	0.275	10.9	0.4290	0.0000	OK	30 minute summer	1.005	SW09 - AREA 3	5.5	0.354	0.039	1.8715	
30 minute summer	SW07 - AREA 3	18	45.455	0.030	1.5	0.0377	0.0000	OK	30 minute summer	2.000	SW08 - AREA 3	1.5	0.442	0.038	0.0859	
30 minute summer	SW08 - AREA 3	18	45.309	0.034	3.0	0.0524	0.0000	OK	30 minute summer	2.001	SW09 - AREA 3	3.0	0.645	0.015	0.0233	
30 minute summer	SW09 - AREA 3	27	45.225	0.376	9.8	0.5754	0.0000	SURCHARGED	30 minute summer	1.006	SW11 HB - AREA 3	4.5	0.230	0.032	1.0202	
30 minute summer	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	30 minute summer	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000	
30 minute summer	SW11 HB - AREA 3	27	45.227	0.424	6.0	0.6556	0.0000	SURCHARGED	30 minute summer	Hydro-Brake®	SW12 - AREA 3	2.6				
30 minute summer	SW12 - AREA 3	42	44.709	0.040	2.6	0.0449	0.0000	OK	30 minute summer	1.008	EXSW MH	2.6	0.560	0.064	0.0486	9.2
30 minute summer	EXSW MH	42	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 2 year +20% CC 30 minute winter. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
30 minute winter	SW01 - AREA 3	18	45.800	0.025	1.3	0.0314	0.0000	OK	30 minute winter	1.000	SW02 - AREA 3	1.3	0.414	0.025	0.0361	
30 minute winter	SW02 - AREA 3	18	45.700	0.035	2.6	0.0450	0.0000	OK	30 minute winter	1.001	SW03 - AREA 3	2.6	0.742	0.050	0.0700	
30 minute winter	SW03 - AREA 3	18	45.494	0.029	3.9	0.0373	0.0000	OK	30 minute winter	1.002	SW04 - AREA 3	3.9	0.764	0.013	0.0320	
30 minute winter	SW04 - AREA 3	18	45.355	0.040	5.2	0.0629	0.0000	OK	30 minute winter	1.003	SW05 - AREA 3	5.2	0.741	0.024	0.1492	
30 minute winter	SW05 - AREA 3	28	45.257	0.092	6.5	0.1436	0.0000	OK	30 minute winter	1.004	SW06 - AREA 3	6.5	0.632	0.033	1.3189	
30 minute winter	SW06 - AREA 3	29	45.258	0.313	8.9	0.4874	0.0000	OK	30 minute winter	1.005	SW09 - AREA 3	7.9	0.371	0.056	1.9931	
30 minute winter	SW07 - AREA 3	18	45.453	0.028	1.3	0.0352	0.0000	OK	30 minute winter	2.000	SW08 - AREA 3	1.3	0.425	0.033	0.0777	
30 minute winter	SW08 - AREA 3	18	45.306	0.031	2.6	0.0488	0.0000	OK	30 minute winter	2.001	SW09 - AREA 3	2.6	0.617	0.013	0.0211	
30 minute winter	SW09 - AREA 3	28	45.257	0.408	11.2	0.6241	0.0000	SURCHARGED	30 minute winter	1.006	SW11 HB - AREA 3	4.8	0.233	0.034	1.0206	
30 minute winter	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	30 minute winter	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000	
30 minute winter	SW11 HB - AREA 3	28	45.258	0.455	5.9	0.7041	0.0000	SURCHARGED	30 minute winter	Hydro-Brake®	SW12 - AREA 3	2.6				
30 minute winter	SW12 - AREA 3	47	44.709	0.040	2.6	0.0449	0.0000	OK	30 minute winter	1.008	EXSW MH	2.6	0.560	0.064	0.0486	10.0
30 minute winter	EXSW MH	47	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 2 year +20% CC 60 minute summer. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
60 minute summer	SW01 - AREA 3	32	45.799	0.024	1.2	0.0299	0.0000	OK	60 minute summer	1.000	SW02 - AREA 3	1.2	0.404	0.023	0.0332	
60 minute summer	SW02 - AREA 3	32	45.698	0.033	2.4	0.0423	0.0000	OK	60 minute summer	1.001	SW03 - AREA 3	2.3	0.717	0.044	0.0642	
60 minute summer	SW03 - AREA 3	32	45.493	0.028	3.5	0.0351	0.0000	OK	60 minute summer	1.002	SW04 - AREA 3	3.4	0.739	0.011	0.0292	
60 minute summer	SW04 - AREA 3	33	45.353	0.038	4.6	0.0591	0.0000	OK	60 minute summer	1.003	SW05 - AREA 3	4.6	0.717	0.021	0.0878	
60 minute summer	SW05 - AREA 3	44	45.226	0.061	5.7	0.0956	0.0000	OK	60 minute summer	1.004	SW06 - AREA 3	5.7	0.607	0.029	1.1075	
60 minute summer	SW06 - AREA 3	42	45.225	0.280	7.1	0.4370	0.0000	OK	60 minute summer	1.005	SW09 - AREA 3	6.0	0.337	0.042	1.8959	
60 minute summer	SW07 - AREA 3	32	45.451	0.026	1.2	0.0333	0.0000	OK	60 minute summer	2.000	SW08 - AREA 3	1.1	0.410	0.029	0.0708	
60 minute summer	SW08 - AREA 3	33	45.304	0.029	2.3	0.0458	0.0000	OK	60 minute summer	2.001	SW09 - AREA 3	2.3	0.595	0.011	0.0193	
60 minute summer	SW09 - AREA 3	43	45.229	0.380	8.8	0.5814	0.0000	SURCHARGED	60 minute summer	1.006	SW11 HB - AREA 3	4.1	0.196	0.029	1.0206	
60 minute summer	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	60 minute summer	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000	
60 minute summer	SW11 HB - AREA 3	43	45.230	0.427	5.0	0.6600	0.0000	SURCHARGED	60 minute summer	Hydro-Brake®	SW12 - AREA 3	2.6				
60 minute summer	SW12 - AREA 3	66	44.709	0.040	2.6	0.0449	0.0000	OK	60 minute summer	1.008	EXSW MH	2.6	0.560	0.064	0.0486	11.8
60 minute summer	EXSW MH	66	44.644	0.038	2.6	0.0000	0.0000	OK								

Results for 2 year +20% CC 60 minute winter. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m^3)**	**Flood (m^3)**	**Status**	**Link Event**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m^3)**	**Discharge Vol (m^3)**
60 minute winter	SW01 - AREA 3	33	45.796	0.021	0.9	0.0264	0.0000	OK	60 minute winter	1.000	SW02 - AREA 3	0.9	0.373	0.018	0.0278	
60 minute winter	SW02 - AREA 3	34	45.695	0.030	1.8	0.0376	0.0000	OK	60 minute winter	1.001	SW03 - AREA 3	1.8	0.662	0.035	0.0543	
60 minute winter	SW03 - AREA 3	34	45.490	0.025	2.7	0.0316	0.0000	OK	60 minute winter	1.002	SW04 - AREA 3	2.7	0.684	0.009	0.0246	
60 minute winter	SW04 - AREA 3	33	45.349	0.034	3.6	0.0524	0.0000	OK	60 minute winter	1.003	SW05 - AREA 3	3.6	0.666	0.017	0.1735	
60 minute winter	SW05 - AREA 3	46	45.268	0.103	4.5	0.1606	0.0000	OK	60 minute winter	1.004	SW06 - AREA 3	4.5	0.560	0.023	1.4010	
60 minute winter	SW06 - AREA 3	48	45.269	0.324	5.6	0.5051	0.0000	OK	60 minute winter	1.005	SW09 - AREA 3	5.1	0.340	0.036	2.0220	
60 minute winter	SW07 - AREA 3	34	45.448	0.023	0.9	0.0296	0.0000	OK	60 minute winter	2.000	SW08 - AREA 3	0.9	0.382	0.023	0.0601	
60 minute winter	SW08 - AREA 3	34	45.301	0.026	1.8	0.0409	0.0000	OK	60 minute winter	2.001	SW09 - AREA 3	1.8	0.554	0.009	0.0211	
60 minute winter	SW09 - AREA 3	47	45.268	0.419	7.7	0.6419	0.0000	SURCHARGED	60 minute winter	1.006	SW11 HB - AREA 3	3.7	0.222	0.027	1.0206	
60 minute winter	SW10 - AREA 3	1	45.630	0.000	0.0	0.0000	0.0000	OK	60 minute winter	3.000	SW11 HB - AREA 3	0.0	0.000	0.000	0.0000	
60 minute winter	SW11 HB - AREA 3	47	45.269	0.466	4.5	0.7212	0.0000	SURCHARGED	60 minute winter	Hydro-Brake®	SW12 - AREA 3	2.6				
60 minute winter	SW12 - AREA 3	75	44.709	0.040	2.6	0.0449	0.0000	OK	60 minute winter	1.008	EXSW MH	2.6	0.560	0.064	0.0486	13.5
60 minute winter	EXSW MH	75	44.644	0.038	2.6	0.0000	0.0000	OK								

Adoptable						
Max Width (mm)	**Diameter (mm)**	**Width (mm)**		**Max Depth (m)**	**Diameter (mm)**	**Width (mm)**
374	1200			1.500	1050	
499	1350			99.999	1200	
749	1500					
900	1800					
>900	Link+900 mm					

Circular			
Shape	Circular		**Dia (mm)**
Barrels	1		100
Height (mm)			150
Width (mm)			
Side Slope (1:X)			
Auto Increment (mm)	75		
Preferred Cover (m)			
Steep Slope (1:X)			
Follow Ground	No		
Velocity	Default		
ks (mm) / n			
uPVC			
Shape	Circular		**Dia (mm)**
Barrels	1		225
Height (mm)			
Width (mm)			
Side Slope (1:X)			
Auto Increment (mm)	75		
Preferred Cover (m)			
Steep Slope (1:X)			
Follow Ground	No		
Velocity	Colebrook-White		
ks (mm) / n	0.150		

APPENDIX D – FOUL WATER PIPE NETWORK CALCULATIONS

Drainage Design Report

Flow+

v10.8

Network	Foul Network - Area 1
Filename	
Username	Kezia Adanza (kadanza@morce.ie)
Report produced on	23/07/2024 13:01:48

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

http://support.causeway.com

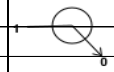
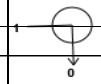
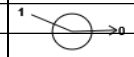
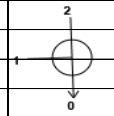
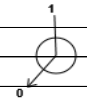
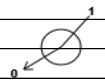
Frequency of use (kDU)	0.50
Flow per dwelling per day (l/day)	446
Domestic Flow (l/s/ha)	0.0
Industrial Flow (l/s/ha)	0.0
Additional Flow (%)	10
Minimum Velocity (m/s)	0.75
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	Yes

	Name	Area (ha)	Dwellings	Units	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
✓	FW01 - AREA 1			5.0		48.490	Manhole	Adoptable	1200		716037.770	738903.767	1.125	
✓	FW02 - AREA 1			5.0		48.110	Manhole	Adoptable	1200		716111.532	738906.322	1.799	
✓	FW03 - AREA 1			5.0		48.090	Manhole	Adoptable	1200		716115.220	738902.109	1.816	
✓	FW04 - AREA 1			5.0		48.450	Manhole	Adoptable	1200		716037.061	738879.505	0.750	
✓	FW05 - AREA 1			5.0		48.225	Manhole	Adoptable	1200		716083.882	738881.140	1.306	
✓	FW06 - AREA 1			5.0		48.225	Manhole	Adoptable	1200		716084.889	738852.323	1.787	
✓	FW07 - AREA 1			5.0		48.225	Manhole	Adoptable	1200		716100.154	738845.273	2.067	
✓	FW08 - AREA 1			5.0		47.970	Manhole	Adoptable	1200		716117.181	738845.867	2.096	
✓	FW09 - AREA 1			5.0		47.875	Manhole	Adoptable	1200		716117.568	738834.762	2.057	
✓	FW10 - AREA 1			5.0		47.300	Manhole	Adoptable	1200		716089.462	738800.219	1.705	
✓	FW11 - AREA 1					47.300	Manhole	Adoptable	1200		716083.834	738796.450	1.739	

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	Con Offset (m)	Min DS IL (m)
?	1.000	FW01 - AREA 1	FW02 - AREA 1	73.806	1.500	Colebrook-White	47.365	46.311	1.054	70.0	225	Circular		
?	1.001	FW02 - AREA 1	FW03 - AREA 1	5.599	1.500	Colebrook-White	46.311	46.274	0.037	150.0	225	Circular		
?	1.002	FW03 - AREA 1	FW08 - AREA 1	56.276	1.500	Colebrook-White	46.274	45.899	0.375	150.0	225	Circular		
?	2.000	FW04 - AREA 1	FW05 - AREA 1	46.850	1.500	Colebrook-White	47.700	46.919	0.781	60.0	150	Circular		
?	2.001	FW05 - AREA 1	FW06 - AREA 1	28.835	1.500	Colebrook-White	46.919	46.438	0.481	59.9	150	Circular		
✓	2.002	FW06 - AREA 1	FW07 - AREA 1	16.814	1.500	Colebrook-White	46.438	46.158	0.280	60.0	150	Circular		
✓	2.003	FW07 - AREA 1	FW08 - AREA 1	17.037	1.500	Colebrook-White	46.158	45.874	0.284	60.0	150	Circular		
?	1.003	FW08 - AREA 1	FW09 - AREA 1	11.112	1.500	Colebrook-White	45.874	45.818	0.056	200.0	225	Circular		
?	1.004	FW09 - AREA 1	FW10 - AREA 1	44.533	1.500	Colebrook-White	45.818	45.595	0.223	200.0	225	Circular		
?	1.005	FW10 - AREA 1	FW11 - AREA 1	6.773	1.500	Colebrook-White	45.595	45.561	0.034	200.0	225	Circular		

	Name	US Node	DS Node	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)	Notes
?	1.000	FW01 - AREA 1	FW02 - AREA 1	0.398	1.373	54.6	1.2	0.900	1.574	0.900	1.574	0.000	0	5.0	0.0	23	0.551	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is less than the specified minimum
?	1.001	FW02 - AREA 1	FW03 - AREA 1	0.336	0.936	37.2	1.7	1.574	1.591	1.574	1.591	0.000	0	10.0	0.0	33	0.471	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.002	FW03 - AREA 1	FW08 - AREA 1	0.356	0.936	37.2	2.1	1.591	1.846	1.591	1.846	0.000	0	15.0	0.0	36	0.503	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	2.000	FW04 - AREA 1	FW05 - AREA 1	0.434	1.132	20.0	1.2	0.600	1.156	0.600	1.156	0.000	0	5.0	0.0	25	0.620	Upstream Depth is less than the specified minimum | Downstream Depth is less than the specified minimum
?	2.001	FW05 - AREA 1	FW06 - AREA 1	0.491	1.133	20.0	1.7	1.156	1.637	1.156	1.637	0.000	0	10.0	0.0	30	0.690	Upstream Depth is less than the specified minimum
✓	2.002	FW06 - AREA 1	FW07 - AREA 1	0.523	1.132	20.0	2.1	1.637	1.917	1.637	1.917	0.000	0	15.0	0.0	33	0.730	
✓	2.003	FW07 - AREA 1	FW08 - AREA 1	0.543	1.132	20.0	2.5	1.917	1.946	1.917	1.946	0.000	0	20.0	0.0	35	0.761	
?	1.003	FW08 - AREA 1	FW09 - AREA 1	0.379	0.810	32.2	3.5	1.871	1.832	1.832	1.871	0.000	0	40.0	0.0	50	0.526	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.004	FW09 - AREA 1	FW10 - AREA 1	0.386	0.810	32.2	3.7	1.832	1.480	1.480	1.832	0.000	0	45.0	0.0	51	0.537	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.005	FW10 - AREA 1	FW11 - AREA 1	0.393	0.810	32.2	3.9	1.480	1.514	1.480	1.514	0.000	0	50.0	0.0	53	0.548	Proportional Velocity @ 1/3 Flow is less than the specified minimum

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type
1.000	73.806	70.0	225	Circular	48.490	47.365	0.900	48.110	46.311	1.574	FW01 - AREA 1	1200			Manhole	Adoptable	FW02 - AREA 1	1200			Manhole	Adoptable
1.001	5.599	150.0	225	Circular	48.110	46.311	1.574	48.090	46.274	1.591	FW02 - AREA 1	1200			Manhole	Adoptable	FW03 - AREA 1	1200			Manhole	Adoptable
1.002	56.276	150.0	225	Circular	48.090	46.274	1.591	47.970	45.899	1.846	FW03 - AREA 1	1200			Manhole	Adoptable	FW08 - AREA 1	1200			Manhole	Adoptable
2.000	46.850	60.0	150	Circular	48.450	47.700	0.600	48.225	46.919	1.156	FW04 - AREA 1	1200			Manhole	Adoptable	FW05 - AREA 1	1200			Manhole	Adoptable
2.001	28.835	59.9	150	Circular	48.225	46.919	1.156	48.225	46.438	1.637	FW05 - AREA 1	1200			Manhole	Adoptable	FW06 - AREA 1	1200			Manhole	Adoptable
2.002	16.814	60.0	150	Circular	48.225	46.438	1.637	48.225	46.158	1.917	FW06 - AREA 1	1200			Manhole	Adoptable	FW07 - AREA 1	1200			Manhole	Adoptable
2.003	17.037	60.0	150	Circular	48.225	46.158	1.917	47.970	45.874	1.946	FW07 - AREA 1	1200			Manhole	Adoptable	FW08 - AREA 1	1200			Manhole	Adoptable
1.003	11.112	200.0	225	Circular	47.970	45.874	1.871	47.875	45.818	1.832	FW08 - AREA 1	1200			Manhole	Adoptable	FW09 - AREA 1	1200			Manhole	Adoptable
1.004	44.533	200.0	225	Circular	47.875	45.818	1.832	47.300	45.595	1.480	FW09 - AREA 1	1200			Manhole	Adoptable	FW10 - AREA 1	1200			Manhole	Adoptable
1.005	6.773	200.0	225	Circular	47.300	45.595	1.480	47.300	45.561	1.514	FW10 - AREA 1	1200			Manhole	Adoptable	FW11 - AREA 1	1200			Manhole	Adoptable

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	Connections		Link	IL (m)	Dia (mm)	Link Type
FW01 - AREA 1	716037.770	738903.767	48.490	1.125	1200			Manhole	Adoptable						
															
											0	1.000	47.365	225	Circular
FW02 - AREA 1	716111.532	738906.322	48.110	1.799	1200			Manhole	Adoptable		1	1.000	46.311	225	Circular
															
											0	1.001	46.311	225	Circular
FW03 - AREA 1	716115.220	738902.109	48.090	1.816	1200			Manhole	Adoptable		1	1.001	46.274	225	Circular
															
											0	1.002	46.274	225	Circular
FW04 - AREA 1	716037.061	738879.505	48.450	0.750	1200			Manhole	Adoptable						
															
											0	2.000	47.700	150	Circular
FW05 - AREA 1	716083.882	738881.140	48.225	1.306	1200			Manhole	Adoptable		1	2.000	46.919	150	Circular
															
											0	2.001	46.919	150	Circular
FW06 - AREA 1	716084.889	738852.323	48.225	1.787	1200			Manhole	Adoptable		1	2.001	46.438	150	Circular
															
											0	2.002	46.438	150	Circular
FW07 - AREA 1	716100.154	738845.273	48.225	2.067	1200			Manhole	Adoptable		1	2.002	46.158	150	Circular
															
											0	2.003	46.158	150	Circular
FW08 - AREA 1	716117.181	738845.867	47.970	2.096	1200			Manhole	Adoptable		1	2.003	45.874	150	Circular
											2	1.002	45.899	225	Circular
											0	1.003	45.874	225	Circular
FW09 - AREA 1	716117.568	738834.762	47.875	2.057	1200			Manhole	Adoptable		1	1.003	45.818	225	Circular
															
											0	1.004	45.818	225	Circular
FW10 - AREA 1	716089.462	738800.219	47.300	1.705	1200			Manhole	Adoptable		1	1.004	45.595	225	Circular
															
											0	1.005	45.595	225	Circular
FW11 - AREA 1	716083.834	738796.450	47.300	1.739	1200			Manhole	Adoptable		1	1.005	45.561	225	Circular

Drainage Design Report

Flow+

v10.8

Network	Foul Network - Area 2 and 3
Filename	
Username	Kezia Adanza (kadanza@morce.ie)
Report produced on	23/07/2024 13:02:03

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

http://support.causeway.com

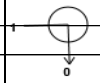
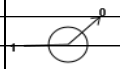
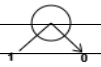
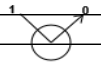
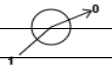
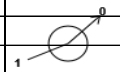
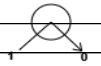
Frequency of use (kDU)	0.50
Flow per dwelling per day (l/day)	446
Domestic Flow (l/s/ha)	0.0
Industrial Flow (l/s/ha)	0.0
Additional Flow (%)	10
Minimum Velocity (m/s)	0.75
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	Yes

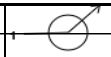
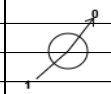
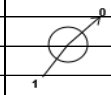
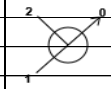
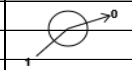
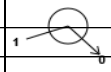
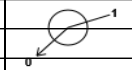
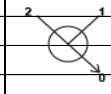
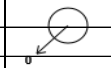
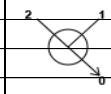
	Name	Area (ha)	Dwellings	Units	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
✓	FW01 - AREA 2&3			3.8		48.000	Manhole	Adoptable	1200		716129.361	738915.897	1.425	
✓	FW02 - AREA 2&3			3.8		48.000	Manhole	Adoptable	1200		716153.823	738916.699	1.833	
✓	FW03 - AREA 2&3			3.8		48.000	Manhole	Adoptable	1200		716154.085	738908.723	1.966	
✓	FW04 - AREA 2&3			3.8		48.000	Manhole	Adoptable	1200		716160.199	738908.936	2.068	
✓	FW05 - AREA 2&3			3.8		48.000	Manhole	Adoptable	1200		716185.768	738933.628	2.660	
✓	FW06 - AREA 2&3			3.8		47.700	Manhole	Adoptable	1200		716192.120	738927.051	2.512	
✓	FW07 - AREA 2&3					47.600	Manhole	Adoptable	1200		716197.669	738932.410	2.669	
✓	FW08 - AREA 2&3					47.500	Manhole	Adoptable	1200		716200.911	738933.851	2.687	
✓	FW09 - AREA 2&3					47.400	Manhole	Adoptable	1200		716215.722	738948.154	2.930	
✓	FW10 - AREA 2&3			3.8		48.420	Manhole	Adoptable	1200		716130.199	738890.721	2.125	
✓	FW 11 - AREA 2&3			3.8		47.930	Manhole	Adoptable	1200		716172.955	738892.274	2.348	
✓	FW12 - AREA 2&3			3.8		47.680	Manhole	Adoptable	1200		716190.086	738908.817	2.495	
✓	FW13 - AREA 2&3			3.8		47.580	Manhole	Adoptable	1200		716196.757	738918.260	2.588	
✓	FW14 - AREA 2&3					47.235	Manhole	Adoptable	1200		716221.508	738942.161	2.904	
✓	FW15 - AREA 2&3					47.090	Manhole	Adoptable	1200		716234.401	738954.611	2.849	
✓	FW16 - AREA 2&3					46.800	Manhole	Adoptable	1200		716247.534	738959.106	2.628	
✓	FW17 - AREA 2&3			3.6		46.520	Manhole	Adoptable	1200		716287.864	738968.567	1.425	
✓	FW18 - AREA 2&3			3.6		46.740	Manhole	Adoptable	1200		716267.461	738961.662	2.004	
✓	FW19 - AREA 2&3			3.6		46.860	Manhole	Adoptable	1200		716256.256	738950.416	2.750	
✓	FW20 - AREA 2&3			3.6		46.850	Manhole	Adoptable	1200		716298.353	738954.016	1.425	
✓	FW21 - AREA 2&3			3.6		46.850	Manhole	Adoptable	1200		716275.546	738931.194	2.876	
✓	EXFW MH					47.280	Manhole	Adoptable	1200		716288.515	738918.272	3.398	

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	Con Offset (m)	Min DS IL (m)
?	1.000	FW01 - AREA 2&3	FW02 - AREA 2&3	24.475	1.500	Colebrook-White	46.575	46.167	0.408	60.0	225	Circular		
?	1.001	FW02 - AREA 2&3	FW03 - AREA 2&3	7.980	1.500	Colebrook-White	46.167	46.034	0.133	60.0	225	Circular		
?	1.002	FW03 - AREA 2&3	FW04 - AREA 2&3	6.118	1.500	Colebrook-White	46.034	45.932	0.102	60.0	225	Circular		
?	1.003	FW04 - AREA 2&3	FW05 - AREA 2&3	35.545	1.500	Colebrook-White	45.932	45.340	0.592	60.0	225	Circular		
?	1.004	FW05 - AREA 2&3	FW06 - AREA 2&3	9.144	1.500	Colebrook-White	45.340	45.188	0.152	60.0	225	Circular		
?	1.005	FW06 - AREA 2&3	FW07 - AREA 2&3	7.714	1.500	Colebrook-White	45.188	44.931	0.257	30.0	225	Circular		
?	1.006	FW07 - AREA 2&3	FW08 - AREA 2&3	3.548	1.500	Colebrook-White	44.931	44.813	0.118	30.0	225	Circular		
?	1.007	FW08 - AREA 2&3	FW09 - AREA 2&3	20.590	1.500	Colebrook-White	44.813	44.470	0.343	60.0	225	Circular		
?	1.008	FW09 - AREA 2&3	FW14 - AREA 2&3	8.330	1.500	Colebrook-White	44.470	44.331	0.139	60.0	225	Circular		
?	2.000	FW10 - AREA 2&3	FW 11 - AREA 2&3	42.784	1.500	Colebrook-White	46.295	45.582	0.713	60.0	225	Circular		
?	2.001	FW 11 - AREA 2&3	FW12 - AREA 2&3	23.815	1.500	Colebrook-White	45.582	45.185	0.397	60.0	225	Circular		
?	2.002	FW12 - AREA 2&3	FW13 - AREA 2&3	11.562	1.500	Colebrook-White	45.185	44.992	0.193	60.0	225	Circular		
?	2.003	FW13 - AREA 2&3	FW14 - AREA 2&3	34.407	1.500	Colebrook-White	44.992	44.331	0.661	52.1	225	Circular		
?	1.009	FW14 - AREA 2&3	FW15 - AREA 2&3	17.923	1.500	Colebrook-White	44.331	44.241	0.090	200.0	225	Circular		
?	1.010	FW15 - AREA 2&3	FW16 - AREA 2&3	13.881	1.500	Colebrook-White	44.241	44.172	0.069	200.0	225	Circular		
?	1.011	FW16 - AREA 2&3	FW19 - AREA 2&3	12.312	1.500	Colebrook-White	44.172	44.110	0.062	200.0	225	Circular		
?	3.000	FW17 - AREA 2&3	FW18 - AREA 2&3	21.540	1.500	Colebrook-White	45.095	44.736	0.359	60.0	225	Circular		
?	3.001	FW18 - AREA 2&3	FW19 - AREA 2&3	15.875	1.500	Colebrook-White	44.736	44.471	0.265	60.0	225	Circular		
?	1.012	FW19 - AREA 2&3	FW21 - AREA 2&3	27.232	1.500	Colebrook-White	44.110	43.974	0.136	200.0	225	Circular		
?	4.000	FW20 - AREA 2&3	FW21 - AREA 2&3	32.265	1.500	Colebrook-White	45.425	44.887	0.538	60.0	225	Circular		
?	1.013	FW21 - AREA 2&3	EXFW MH	18.308	1.500	Colebrook-White	43.974	43.882	0.092	200.0	225	Circular		

	Name	US Node	DS Node	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)	Notes
?	1.000	FW01 - AREA 2&3	FW02 - AREA 2&3	0.392	1.483	59.0	1.1	1.200	1.608	1.200	1.608	0.000	0	3.8	0.0	22	0.565	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.001	FW02 - AREA 2&3	FW03 - AREA 2&3	0.448	1.483	59.0	1.5	1.608	1.741	1.608	1.741	0.000	0	7.6	0.0	25	0.626	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.002	FW03 - AREA 2&3	FW04 - AREA 2&3	0.468	1.483	59.0	1.9	1.741	1.843	1.741	1.843	0.000	0	11.4	0.0	28	0.668	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.003	FW04 - AREA 2&3	FW05 - AREA 2&3	0.501	1.483	59.0	2.1	1.843	2.435	1.843	2.435	0.000	0	15.2	0.0	29	0.696	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.004	FW05 - AREA 2&3	FW06 - AREA 2&3	0.517	1.483	59.0	2.4	2.435	2.287	2.287	2.435	0.000	0	19.0	0.0	31	0.722	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum
?	1.005	FW06 - AREA 2&3	FW07 - AREA 2&3	0.661	2.100	83.5	2.6	2.287	2.444	2.287	2.444	0.000	0	22.8	0.0	28	0.947	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.006	FW07 - AREA 2&3	FW08 - AREA 2&3	0.661	2.100	83.5	2.6	2.444	2.462	2.444	2.462	0.000	0	22.8	0.0	28	0.947	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.007	FW08 - AREA 2&3	FW09 - AREA 2&3	0.534	1.483	59.0	2.6	2.462	2.705	2.462	2.705	0.000	0	22.8	0.0	32	0.735	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.008	FW09 - AREA 2&3	FW14 - AREA 2&3	0.534	1.483	59.0	2.6	2.705	2.679	2.679	2.705	0.000	0	22.8	0.0	32	0.735	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	2.000	FW10 - AREA 2&3	FW 11 - AREA 2&3	0.392	1.483	59.0	1.1	1.900	2.123	1.900	2.123	0.000	0	3.8	0.0	22	0.565	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	2.001	FW 11 - AREA 2&3	FW12 - AREA 2&3	0.448	1.483	59.0	1.5	2.123	2.270	2.123	2.270	0.000	0	7.6	0.0	25	0.626	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	2.002	FW12 - AREA 2&3	FW13 - AREA 2&3	0.468	1.483	59.0	1.9	2.270	2.363	2.270	2.363	0.000	0	11.4	0.0	28	0.668	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	2.003	FW13 - AREA 2&3	FW14 - AREA 2&3	0.518	1.593	63.3	2.1	2.363	2.679	2.363	2.679	0.000	0	15.2	0.0	29	0.733	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.009	FW14 - AREA 2&3	FW15 - AREA 2&3	0.379	0.810	32.2	3.4	2.679	2.624	2.624	2.679	0.000	0	38.0	0.0	50	0.526	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.010	FW15 - AREA 2&3	FW16 - AREA 2&3	0.379	0.810	32.2	3.4	2.624	2.403	2.403	2.624	0.000	0	38.0	0.0	50	0.526	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	1.011	FW16 - AREA 2&3	FW19 - AREA 2&3	0.379	0.810	32.2	3.4	2.403	2.525	2.403	2.525	0.000	0	38.0	0.0	50	0.526	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	3.000	FW17 - AREA 2&3	FW18 - AREA 2&3	0.392	1.483	59.0	1.0	1.200	1.779	1.200	1.779	0.000	0	3.6	0.0	21	0.550	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	3.001	FW18 - AREA 2&3	FW19 - AREA 2&3	0.436	1.483	59.0	1.5	1.779	2.164	1.779	2.164	0.000	0	7.2	0.0	25	0.626	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.012	FW19 - AREA 2&3	FW21 - AREA 2&3	0.383	0.810	32.2	3.8	2.525	2.651	2.525	2.651	0.000	0	48.8	0.0	52	0.543	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
?	4.000	FW20 - AREA 2&3	FW21 - AREA 2&3	0.392	1.483	59.0	1.0	1.200	1.738	1.200	1.738	0.000	0	3.6	0.0	21	0.550	Proportional Velocity @ 1/3 Flow is less than the specified minimum
?	1.013	FW21 - AREA 2&3	EXFW MH	0.401	0.810	32.2	4.1	2.651	3.173	2.651	3.173	0.000	0	56.0	0.0	54	0.553	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type
1.000	24.475	60.0	225	Circular	48.000	46.575	1.200	48.000	46.167	1.608	FW01 - AREA 2&3	1200			Manhole	Adoptable	FW02 - AREA 2&3	1200			Manhole	Adoptable
1.001	7.980	60.0	225	Circular	48.000	46.167	1.608	48.000	46.034	1.741	FW02 - AREA 2&3	1200			Manhole	Adoptable	FW03 - AREA 2&3	1200			Manhole	Adoptable
1.002	6.118	60.0	225	Circular	48.000	46.034	1.741	48.000	45.932	1.843	FW03 - AREA 2&3	1200			Manhole	Adoptable	FW04 - AREA 2&3	1200			Manhole	Adoptable
1.003	35.545	60.0	225	Circular	48.000	45.932	1.843	48.000	45.340	2.435	FW04 - AREA 2&3	1200			Manhole	Adoptable	FW05 - AREA 2&3	1200			Manhole	Adoptable
1.004	9.144	60.0	225	Circular	48.000	45.340	2.435	47.700	45.188	2.287	FW05 - AREA 2&3	1200			Manhole	Adoptable	FW06 - AREA 2&3	1200			Manhole	Adoptable
1.005	7.714	30.0	225	Circular	47.700	45.188	2.287	47.600	44.931	2.444	FW06 - AREA 2&3	1200			Manhole	Adoptable	FW07 - AREA 2&3	1200			Manhole	Adoptable
1.006	3.548	30.0	225	Circular	47.600	44.931	2.444	47.500	44.813	2.462	FW07 - AREA 2&3	1200			Manhole	Adoptable	FW08 - AREA 2&3	1200			Manhole	Adoptable
1.007	20.590	60.0	225	Circular	47.500	44.813	2.462	47.400	44.470	2.705	FW08 - AREA 2&3	1200			Manhole	Adoptable	FW09 - AREA 2&3	1200			Manhole	Adoptable
1.008	8.330	60.0	225	Circular	47.400	44.470	2.705	47.235	44.331	2.679	FW09 - AREA 2&3	1200			Manhole	Adoptable	FW14 - AREA 2&3	1200			Manhole	Adoptable
2.000	42.784	60.0	225	Circular	48.420	46.295	1.900	47.930	45.582	2.123	FW10 - AREA 2&3	1200			Manhole	Adoptable	FW 11 - AREA 2&3	1200			Manhole	Adoptable
2.001	23.815	60.0	225	Circular	47.930	45.582	2.123	47.680	45.185	2.270	FW 11 - AREA 2&3	1200			Manhole	Adoptable	FW12 - AREA 2&3	1200			Manhole	Adoptable
2.002	11.562	60.0	225	Circular	47.680	45.185	2.270	47.580	44.992	2.363	FW12 - AREA 2&3	1200			Manhole	Adoptable	FW13 - AREA 2&3	1200			Manhole	Adoptable
2.003	34.407	52.1	225	Circular	47.580	44.992	2.363	47.235	44.331	2.679	FW13 - AREA 2&3	1200			Manhole	Adoptable	FW14 - AREA 2&3	1200			Manhole	Adoptable
1.009	17.923	200.0	225	Circular	47.235	44.331	2.679	47.090	44.241	2.624	FW14 - AREA 2&3	1200			Manhole	Adoptable	FW15 - AREA 2&3	1200			Manhole	Adoptable
1.010	13.881	200.0	225	Circular	47.090	44.241	2.624	46.800	44.172	2.403	FW15 - AREA 2&3	1200			Manhole	Adoptable	FW16 - AREA 2&3	1200			Manhole	Adoptable
1.011	12.312	200.0	225	Circular	46.800	44.172	2.403	46.860	44.110	2.525	FW16 - AREA 2&3	1200			Manhole	Adoptable	FW19 - AREA 2&3	1200			Manhole	Adoptable
3.000	21.540	60.0	225	Circular	46.520	45.095	1.200	46.740	44.736	1.779	FW17 - AREA 2&3	1200			Manhole	Adoptable	FW18 - AREA 2&3	1200			Manhole	Adoptable
3.001	15.875	60.0	225	Circular	46.740	44.736	1.779	46.860	44.471	2.164	FW18 - AREA 2&3	1200			Manhole	Adoptable	FW19 - AREA 2&3	1200			Manhole	Adoptable
1.012	27.232	200.0	225	Circular	46.860	44.110	2.525	46.850	43.974	2.651	FW19 - AREA 2&3	1200			Manhole	Adoptable	FW21 - AREA 2&3	1200			Manhole	Adoptable
4.000	32.265	60.0	225	Circular	46.850	45.425	1.200	46.850	44.887	1.738	FW20 - AREA 2&3	1200			Manhole	Adoptable	FW21 - AREA 2&3	1200			Manhole	Adoptable
1.013	18.308	200.0	225	Circular	46.850	43.974	2.651	47.280	43.882	3.173	FW21 - AREA 2&3	1200			Manhole	Adoptable	EXFW MH	1200			Manhole	Adoptable

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Sump (m)	Node Type	MH Type	Connections		Link	IL (m)	Dia (mm)	Link Type
FW01 - AREA 2&3	716129.361	738915.897	48.000	1.425	1200			Manhole	Adoptable						
															
											0	1.000	46.575	225	Circular
FW02 - AREA 2&3	716153.823	738916.699	48.000	1.833	1200			Manhole	Adoptable		1	1.000	46.167	225	Circular
															
											0	1.001	46.167	225	Circular
FW03 - AREA 2&3	716154.085	738908.723	48.000	1.966	1200			Manhole	Adoptable		1	1.001	46.034	225	Circular
											0	1.002	46.034	225	Circular
FW04 - AREA 2&3	716160.199	738908.936	48.000	2.068	1200			Manhole	Adoptable		1	1.002	45.932	225	Circular
															
											0	1.003	45.932	225	Circular
FW05 - AREA 2&3	716185.768	738933.628	48.000	2.660	1200			Manhole	Adoptable		1	1.003	45.340	225	Circular
															
											0	1.004	45.340	225	Circular
FW06 - AREA 2&3	716192.120	738927.051	47.700	2.512	1200			Manhole	Adoptable		1	1.004	45.188	225	Circular
											0	1.005	45.188	225	Circular
FW07 - AREA 2&3	716197.669	738932.410	47.600	2.669	1200			Manhole	Adoptable		1	1.005	44.931	225	Circular
															
											0	1.006	44.931	225	Circular
FW08 - AREA 2&3	716200.911	738933.851	47.500	2.687	1200			Manhole	Adoptable		1	1.006	44.813	225	Circular
															
											0	1.007	44.813	225	Circular
FW09 - AREA 2&3	716215.722	738948.154	47.400	2.930	1200			Manhole	Adoptable		1	1.007	44.470	225	Circular
															
											0	1.008	44.470	225	Circular
FW10 - AREA 2&3	716130.199	738890.721	48.420	2.125	1200			Manhole	Adoptable						
															
											0	2.000	46.295	225	Circular
FW 11 - AREA 2&3	716172.955	738892.274	47.930	2.348	1200			Manhole	Adoptable		1	2.000	45.582	225	Circular

															
											0	2.001	45.582	225	Circular
FW12 - AREA 2&3	716190.086	738908.817	47.680	2.495	1200			Manhole	Adoptable		1	2.001	45.185	225	Circular
											0	2.002	45.185	225	Circular
FW13 - AREA 2&3	716196.757	738918.260	47.580	2.588	1200			Manhole	Adoptable		1	2.002	44.992	225	Circular
											0	2.003	44.992	225	Circular
FW14 - AREA 2&3	716221.508	738942.161	47.235	2.904	1200			Manhole	Adoptable		1	2.003	44.331	225	Circular
											2	1.008	44.331	225	Circular
											0	1.009	44.331	225	Circular
FW15 - AREA 2&3	716234.401	738954.611	47.090	2.849	1200			Manhole	Adoptable		1	1.009	44.241	225	Circular
															
											0	1.010	44.241	225	Circular
FW16 - AREA 2&3	716247.534	738959.106	46.800	2.628	1200			Manhole	Adoptable		1	1.010	44.172	225	Circular
															
											0	1.011	44.172	225	Circular
FW17 - AREA 2&3	716287.864	738968.567	46.520	1.425	1200			Manhole	Adoptable						
															
											0	3.000	45.095	225	Circular
FW18 - AREA 2&3	716267.461	738961.662	46.740	2.004	1200			Manhole	Adoptable		1	3.000	44.736	225	Circular
															
											0	3.001	44.736	225	Circular
FW19 - AREA 2&3	716256.256	738950.416	46.860	2.750	1200			Manhole	Adoptable		1	3.001	44.471	225	Circular
											2	1.011	44.110	225	Circular
											0	1.012	44.110	225	Circular
FW20 - AREA 2&3	716298.353	738954.016	46.850	1.425	1200			Manhole	Adoptable						
															
											0	4.000	45.425	225	Circular
FW21 - AREA 2&3	716275.546	738931.194	46.850	2.876	1200			Manhole	Adoptable		1	4.000	44.887	225	Circular
											2	1.012	43.974	225	Circular
											0	1.013	43.974	225	Circular
EXFW MH	716288.515	738918.272	47.280	3.398	1200			Manhole	Adoptable		1	1.013	43.882	225	Circular

APPENDIX E – MAINTENANCE AND MANAGEMENT PLAN

Maintenance and Management Plan			
Project	NDFA Social Housing Bundles 4 & 5	Analysed by	Kezia Adanza
Job no.	23006	Date	

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required Action	Typical Frequency
Permeable Paving	PPP management company for 25 years then Dublin City Council	Regular Maintenance	Brushing (Standard cosmetic sweep over whole surface) Visual check on inspection chambers and removal of debris.	Once a year or reduced frequency as required
		Occasional Maintenance	Removal of weeds or management using glyphosate or other suitable weed killer.	As required – once a year on less frequently used pavements
		Remedial Action	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing materials.	As required
			Remediate any landscaping which has been raised within the level of the paving.	As required
			High pressure jetting of permeable pavement underdrains in the event of blockages. Inspections chambers provided to facilitate this work.	As required
			Rehabilitation of surface and upper sub-structure by remedial sweeping.	Every 10 to 15 years or as required (if performance is reduced due to significant flooding)
		Monitoring	Initial Inspection	Monthly for three months after installation
			Inspect for evidence of poor operation and/ or weed growth – if required, take remedial action,	Every 3 months, 48 hours after large storms in first six months

			Inspect slit accumulation rates and establish appropriate brushing frequencies.	Annually
			Monitor inspection chambers	Annually

Maintenance and Management Plan			
Project	NDFA Social Housing Bundles 4 & 5	Analysed by	Kezia Adanza
Job no.	23006	Date	

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required Action	Typical Frequency
Bioretention Areas - Swales / tree pits / Rain Gardens	PPP management company for 25 years then Dublin City Council	Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary.	Quarterly
			Check operation of underdrains by inspection of flows after rain.	Annually
			Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary.	Quarterly
			Inspect inlets and outlets for blockage.	Quarterly
		Regular Maintenance	Remove litter, surface debris and weeds.	Quarterly (or more frequently for tidiness or aesthetic reasons)
			Replace any plants to maintain plant density.	Quarterly to bi-annually
			Remove sediment, litter and debris build-up from around inlets.	As required
		Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required.	As required
			Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch.	As required
		Remedial Actions	Remove and replace filter medium and vegetation.	As required but likely to be > 20 years

Maintenance and Management Plan			
Project	NDFA Social Housing Bundles 4 & 5	Analysed by	Kezia Adanza
Job no.	23006	Date	

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required Action	Typical Frequency
Attenuation Storage	PPP management company for 25 years then Dublin City Council	Regular Inspections	Inspect infiltration surfaces for silting, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary.	Quarterly
			Check operation of underdrains by inspection of flows after rain.	Annually
			Inspect inlets and outlets for blockage.	Quarterly
		Regular Maintenance	Remove sediment, litter and debris build-up from around inlets.	As required