MALONE O'REGAN
CONSULTING ENGINEERS

SOCIAL HOUSING BUNDLE 4
DEVELOPMENT AT CHURCH OF THE ANNUNCIATION, FINGLAS, DUBLIN.

ENGINEERING REPORT

DUBLIN CITY COUNCIL

June 2024

Job: 23006

Contents Amendment Record

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2	26/03/2024	Planning	P3	KA	PB	PB
3	02/07/2024	Planning	P3	KA	ND	ND

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1 INTRODUCTION

1.1 Introduction

This report is prepared on behalf of Dublin City Council to accompany a Part 8 proposal for the construction of 110 residential units for ‘Older Persons’ at a site c.0.77 ha at the site of the former Church of Annunciation on Cardiffsbridge Road, Finglas, Dublin 11, which will consist of the following:

- One apartment block ranging from 4 to 5-storeys, containing:
  - 110 residential units for ‘Older Persons’ comprising 106 no. 1-bed and 4 no. 2-bed; and
  - 434 sq.m. of community, arts and cultural facilities.
- 15 no. car parking spaces and 87 no. cycle spaces.
- 935 sq.m. of public open space and 609 sq.m. of communal open space.
- One vehicular and pedestrian access and one dedicated pedestrian access off Cardiffsbridge Road.
- Boundary treatments, public lighting, site drainage works, internal road surfacing and footpath, ESB meter rooms, plant rooms, stores, bin and bicycle storage, 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 a residential area of Finglas, approximately 5.7km from Dublin city centre. The site is the location of the former Church of the Annunciation now demolished. The lands to the north of the site are currently in development proposals for the new church site. There are existing two storey houses opposite the development on the west of the site. To the east of the site the new development faces on to an existing school. The southern end of the site is facing a future health centre facility by the HSE. 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 ‘City centres / industrial / commercial areas’)
Attenuation Stone Storage Design Return Period	100 years
Allowance for climate change	20% (Ref. OPW Flood Risk Management Climate Change Sectoral Adaptation Plan, High-End Future Scenario)
M5-60	16.4mm (Met Eireann data)
M5-2D	59.6mm (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 sewers 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 225mm concrete sewer running parallel to the western boundary of the site on Cardiffsbridge Road.

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-CAF-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 below.

Type of Areas	CV
Landscaping (Grass / Soft)	0.2
Intensive Blue/Green Roof	0.6
Permeable Paving	0.5
Impermeable Hardstanding	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 Cardiffsbridge Road was taken from the Flood Studies Report as 967mm.

An appropriate Soil Index value was determined following a review of published data and site-specific ground investigation works.

The 1975 Flood Studies Report included a Soil Index map, a digitised version of which is available at www.uksuds.com. This map indicates that the site lies within an area of Soil Type 2. Soil Type 2 corresponds with a very permeable soil such as sand and gravel with low runoff potential.

However, site investigation works completed by Ground Investigations Ireland in November 2023 indicate that the subsoils are actually impermeable in nature with high runoff potential. These investigations show that ground conditions include topsoil or surfacing up to depths of 0.5m over made ground which varies in depth from 0.5 to 1.7m below ground level. The made ground consists of slightly sandy slightly gravelly clay with cobbles and boulders containing fragments of concrete, brick, plastic and gravel or crushed rock fill. The granular deposits were encountered with the cohesive deposits and were described as dark grey medium to coarse angular clayey gravel. The cohesive deposits were encountered beneath the made ground and were described as yellowish brown slightly sandy slightly gravelly clay with occasional cobbles and boulders overlying a stiff dark grey or black slightly sandy slightly gravelly clay. The bedrock encountered between 9.58m to 10.5m below ground level was medium strong to strong dark grey fine grained massive limestone.

2 no. infiltration tests were conducted across the site. The results of these tests did not yield an infiltration rate as the water level dropped too slowly to allow calculation of the soil infiltration rate in both locations. The report prepared by Ground Investigations Ireland concludes that the site is not suitable for soakaway design due to the impermeable nature of the subsoils.

Given the impermeable nature of the subsoils it is considered appropriate to adopt a Soil Index value of 3 which generally equates to very fine sands, silts and clays with moderate runoff potential. Soil Type 3 has a corresponding Standard Percentage Runoff (SPR) of 0.37.

When this equation is applied to the proposed development, the following value for QBAR is obtained.

For 50ha area QBAR $= 0.00108\,[0.5]^{0.89} \times [967]^{1.17} \times [0.37]^{2.17}$

$= 0.210\ m^3/s$

$= 4.193$ l/s/ha > 2l/s/ha

$QBAR_{rural}$ for the subject site (overall catchment area) = 4.193 l/s/ha x 0.77ha

QBAR = 3.247l/s

According to GDSDS Chapter 6.3.1.4 if the separate long-term storage cannot be provided and temporary flood storage forms part of the single attenuation system, all the runoff from the site should be discharge at a rate of 2 l/s/ha or the average annual peak flow rate QBAR, whichever is greater. In this case QBAR is the higher value and has been adopted as the limiting discharge rate.

For the purposes of surface water attenuation design, the site is dealt with as one catchment 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 below.

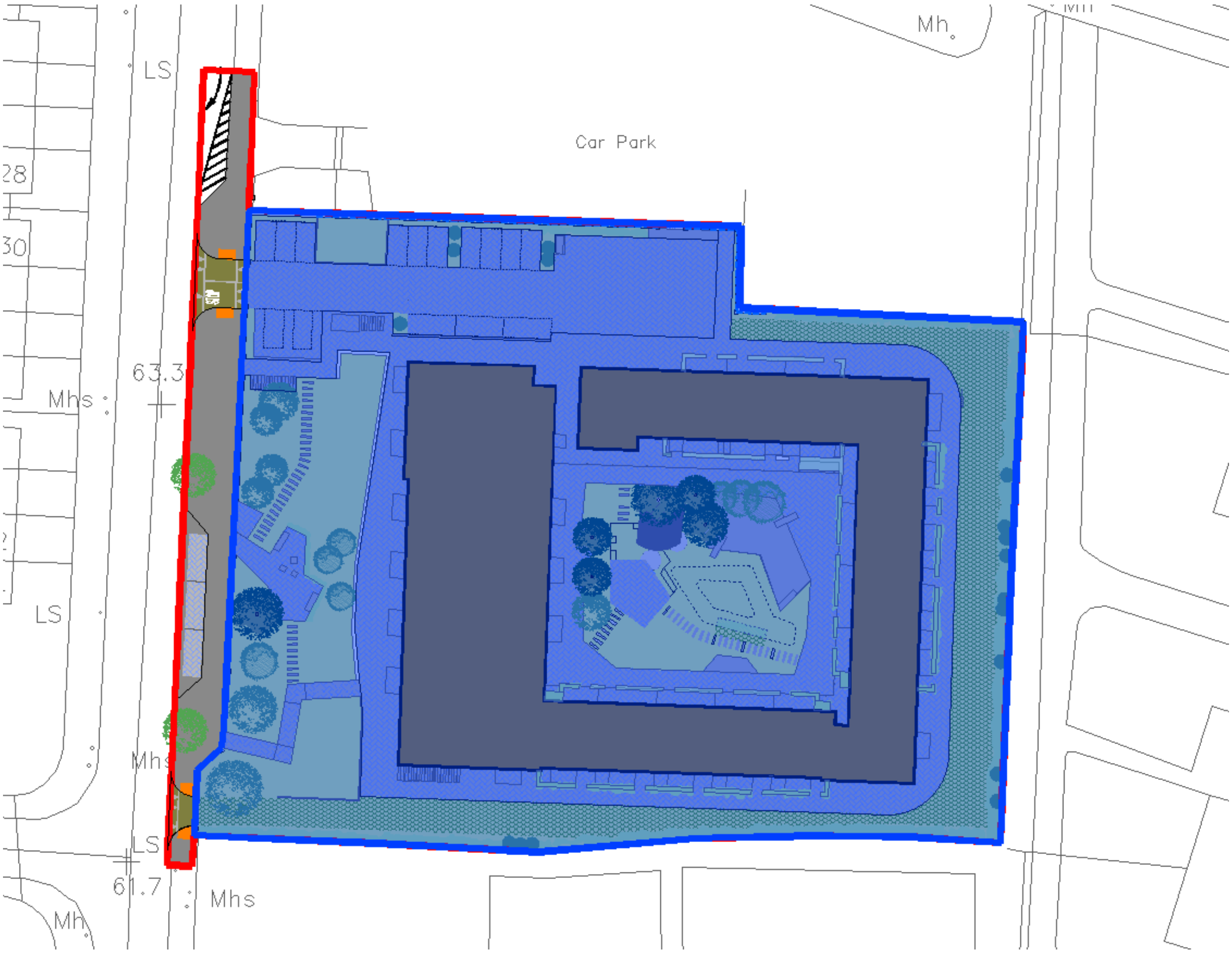


Figure 2.1 – Surface Water Drainage Catchment Area (shown in Blue hatch)

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
7744.76	Roof - Apartments	Standard - 15%		0.95	0.0	0.0	970.5
		Green/ Blue Roof - 85%	1470.50	0.60	882.3	970.5	
	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
0.77							0.1
	Hardstanding			0.90	0.0	0.0	

Table 2.3 Breakdown of Impermeable Areas for Green/ Blue Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance	Overall Impermeable
7744.76	Roof - Apartments	Standard - 15%	259.50	0.95	246.53	271.18	3365.20
		Blue/Green Roof - 85%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		4180.95	0.50	2090.48	2299.52	
ha	Landscaped Areas inc. areas from hardstanding		1325.93	0.20	265.19	291.70	ha
0.77							0.34
	Hardstanding		507.88	0.90	457.09	502.80	

Table 2.4 Breakdown of Impermeable Areas

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 urbanization 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)

The table below 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 Measures	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*	No	Bioretention swales are not proposed within the site due to the large number of trees in the green areas.
Tree pits *Attenuate surface water runoff by utilising voids within the root zone*	No	Tree pits are not proposed within the site due to the limited area of green space available.
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 apartments.
Blue Roofs *Provide attenuation storage, reducing requirement for storage elsewhere on site*	Yes	It is proposed to provide blue roofs in areas directly beneath the Green Roofs.
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 collect runoff from roofs and allow infiltration and absorption*	No	The proposed residential development does not aim to provide rain gardens within the site due to the large number of trees in the green areas.
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.
Grasscrete paving *Cast-on-site cellular reinforced concrete system with voids created by plastic formers*	Yes	Grasscrete is proposed within the development around the east and southern border.
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 not considered appropriate due to the limited space available.

Table 2.4 Proposed SuDS Features

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

2.5.2 Intensive Green/ Blue Roofs

Green roofs provide ecological, aesthetic and amenity benefits and intercept and retain rainfall, at source, reducing the volume of runoff and attenuating peak flows. Details from the suppliers of green roof systems indicate that they will typically provide interception storage of 38 litres per square metre of roof covering.

Green roofs absorb most of the rainfall that they receive during normal rainfall events and treat surface water through removal of atmospherically deposited urban pollutants. They also reduce building heating requirements (by adding mass and thermal resistance value) and cooling requirements (by evaporative cooling). Intensive green roofs typically have a growing medium of 200mm allowing for a wider array of planting possibilities than extensive (sedum) green roof coverings.

The green roofs will be underlaid by a storage medium so that they also perform as blue roofs, capable of attenuating rainwater. The proposed green / blue roofs will provide initial storage of rainwater, while also reducing the rate at which rainwater from heavier rainfall events discharges to the attenuation systems.

Flow restrictor outlets will be provided to control the rate of runoff from the roof. Since the green / blue roofs provide their own attenuation with flow restrictor outlet on the roof, these areas will not drain towards the main attenuation system on site. Runoff from the green / blue roofs will connect to the surface water drainage pipework downstream of the main attenuation system and associated Hydrobrake.

It is proposed to provide green / blue roofs over at least 85% of the total roof area in accordance with the Dublin City Council Green & Blue Roof Guidelines 2021. Roof structures will be designed to cater for the additional loads associated with the blue roof storage layer and the overlying green roof build-up. Details of the proposed green / blue roof build-up are provided on Malone O'Regan drawing no. 150 and 151, an extract from which is provided below.

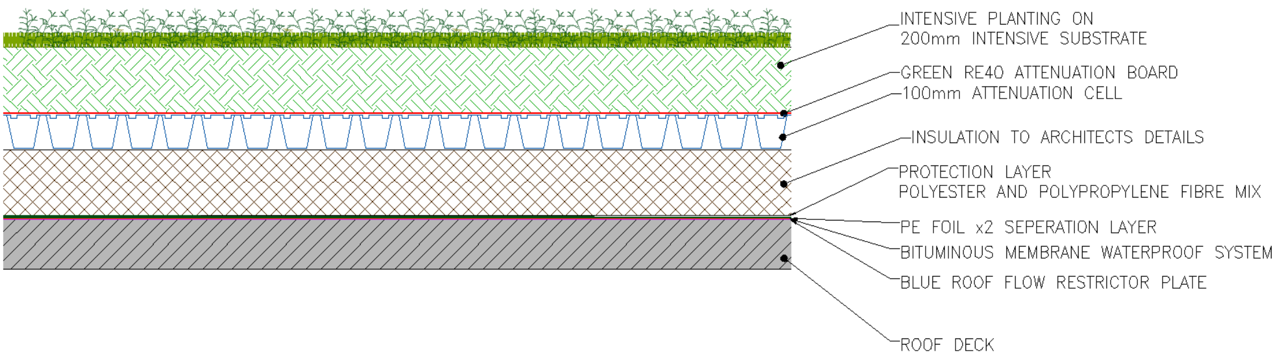


Figure 2.2 – Typical Intensive Green/ Blue Roof Landscaping

2.5.3 Blue Roofs

Blue roofs are proposed to the north/east roof where PV panels are proposed. Refer to architect's roof layout drawing. Similar to the intensive green/ blue roof described above. 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.

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.

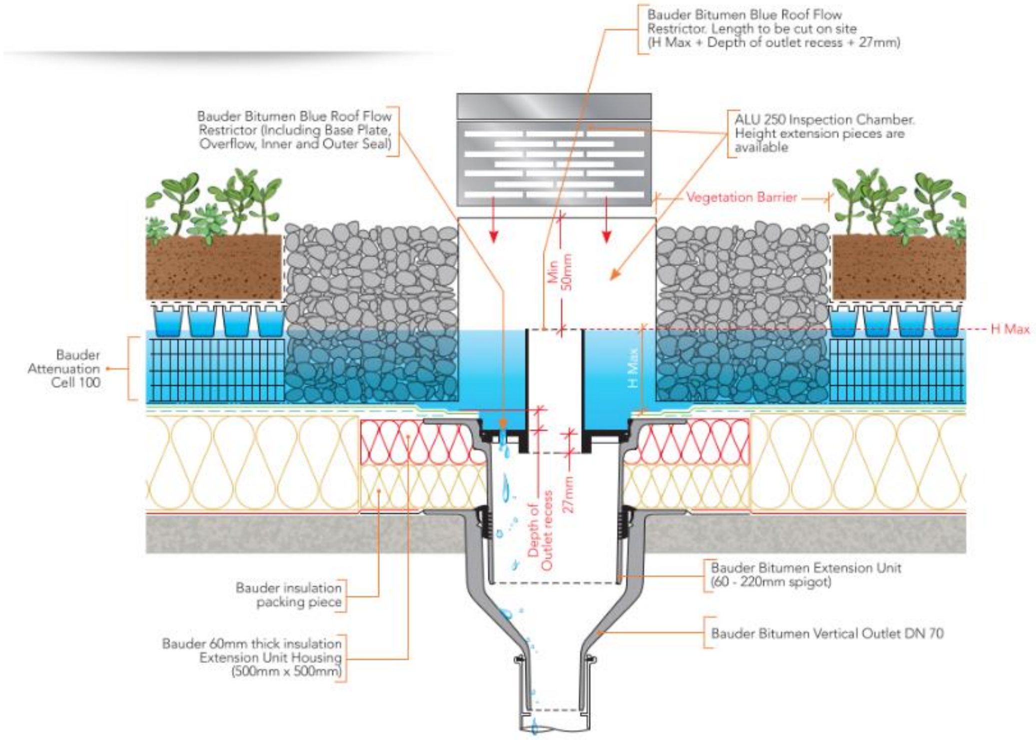


Figure 2.3 – Typical Blue Roof Section

2.5.4 Permeable Paving

It is proposed to use permeable paving to surface the parking spaces and footpaths 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-CAF-DR-MOR-CS-P3-151 for typical permeable paving details.

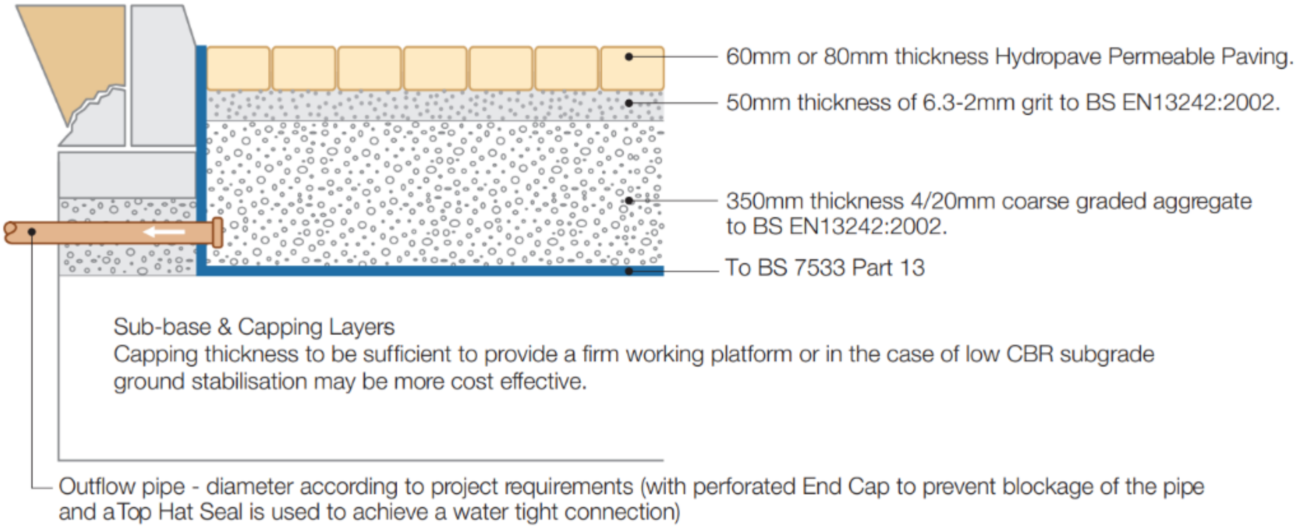


Figure 2.4 – Typical Section Through Permeable Paving in Parking Spaces

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

2.7.1 Permeable Paving Attenuation Storage

Attenuation storage is provided on the site using an attenuation storage system. For the purposes of surface water attenuation design, the site is one single catchment as shown in Figure 2.5 draining to the storage system. 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.

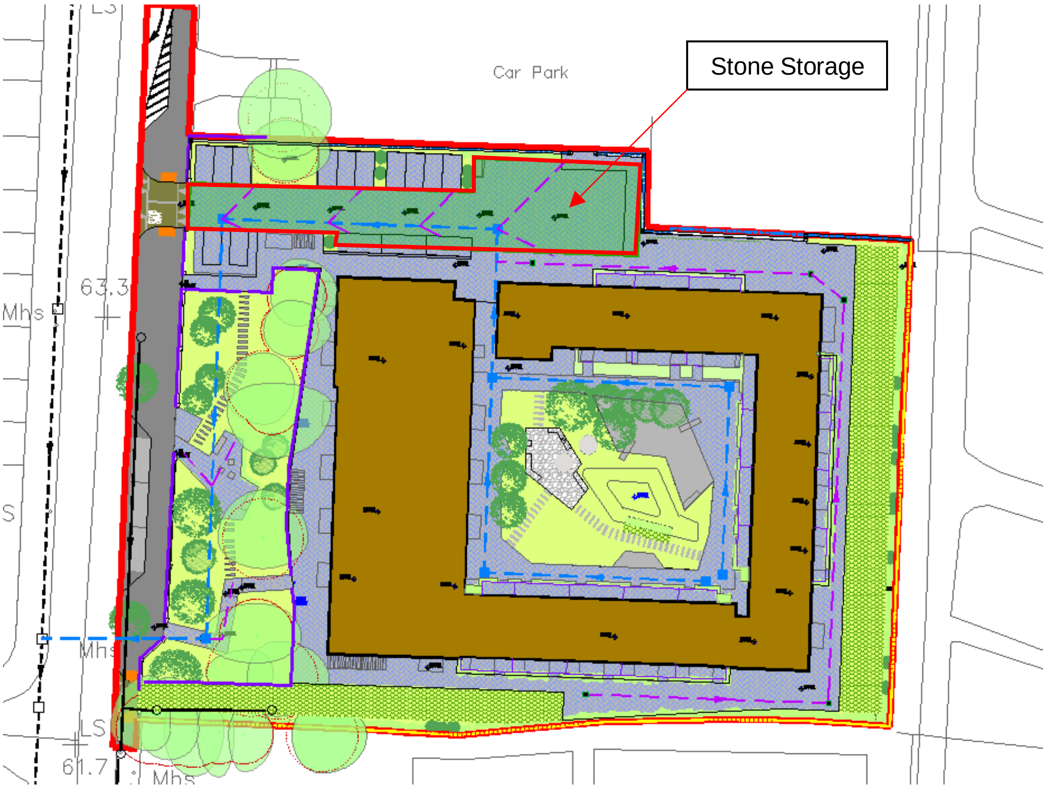


Figure 2.5 – Attenuation Storage Location on Proposed Site Layout

Surface water runoff from the site areas will drain by gravity to an attenuation stone storage area below the permeable paving located in the northwestern end of the site. The calculated storage capacity of the attenuation system is **119.792m^3**. This volume has been calculated accomodating a 20% increase in future rainfall intensities as a result of climate change and 10% urban creep. The outflow from the attenuation stone storage is limited by a Hydrobrake flow control device which restricts the flow to 3.247 litres/s.

The proposed attenuation system is stone storage below the permeable paving. The 1/100-year water level is set at the lowest site level less 300mm freeboard zone. The depth of stone required assuming 30% porosity is approx. 760mm. Storage is also achieved using blue roofs over 85% of the roof space. Refer to drawing SHB4-CAF-DR-MOR-CS-P3-153 for further information.

2.7.2 Groundwater Monitoring

The Site Investigation report shows water strike was encountered at 0.70m and 2.60m BGL at TP01. In March 2024 groundwater monitoring was completed at one location within the site BH02. Groundwater was encountered at 1.01m bgl.

The proposed permeable paving attenuation zone extends approximately 3m bgl. The attenuation zone will be lined due to the high-water table. The stone filled area of the proposed permeable paving attenuation zone will operate as an attenuation facility. The storage capacity has been sized with zero infiltration. The SuDS measures proposed i.e. permeable paving has allowed for opportunities for percolation before reaching the attenuation zone.

Figure 2.4 – Site Investigation Exploratory Hole Locations

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 2 River Regime Protection

Attenuation storage is provided to limit the discharge rate from the site into the public network. As per the GDSDS, the required attenuation volume has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each – refer to the calculations included in Appendix B.

The Soil Type was based on the "uksuds" website. The Soil Type for that site was Type 2 (SPR Index 0.3) which suggests very permeable soil. However, the site investigations carried out on site reveal "stiff dark grey or black slightly sandy slightly gravelly CLAY with occasional cobbles and boulders". The soakaways conducted also reveal zero infiltration rate. Stiff sandy clay allows for moderate runoff potential, and as such the attenuation calculations use a Soil Type 3 (SPR Index 0.37). The calculations use a Standard Average Annual Rainfall (SAAR) value of 967mm, taken from HR Wallingfords SuDS map.

Based on these calculations, the required attenuation storage volume for the site is approximately 119.78m3. This volume is sufficient for the 1–100-year storm, accounting for 20%.

The proposed attenuation system is stone storage below permeable paving, to the north of the site. Surface water runoff will be restricted via a Hydro-brake or similar approved flow control device with discharge from the site limited to the greenfield equivalent rate of 3.247l/s, before discharging to the public combined network.

2.8.3 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.

2.8.4 Criterion 4 River Flood Protection

The long-term storage volume is a comparison of pre- and post- development runoff volumes. The objective is to limit the runoff discharged after development to the same as that which occurred prior to the development.

Of the three methods described in the GDSDS for establishing River Flood Protection by comparison of the pre- and post- development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 is selected for use as the most practical criteria at this stage in the design.

The Criteria 4.3 approach is for all runoff to be limited to either QBAR or to 2l/s/ha, whichever is greater. As noted in Section 2.4, in this instance QBAR is the higher value and has been adopted as the limiting discharge rate.

The proposed drainage system includes a flow control device to ensure that the discharge rate is limited to the greenfield equivalent and ample attenuation is provided for the 1-in-100 year storm, accounting for 20% increase due to climate change.

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.

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.

2.10.4 Biodiversity

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, biodiversity on site is promoted.

2.10.5 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 one side. These underground sewers 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 225mm concrete sewer running parallel to the western boundary of the site on Cardiffsbridge Road.

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-CAF-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 Foul Water Demand Calculations

3.4.1 Residential Water Demand

In accordance with the Irish Water Code of Practice for Wastewater Infrastructure works which carry domestic wastewater shall be designed to carry a wastewater volume of between 6 times the dry weather flow.

Dry weather flow (DWF) should be taken as 446 litres per dwelling.

DWF = 110 units x 446 l/dwelling = 49,060 l/day = 0.568 l/sec

Peak discharge = 6 x DWF = 3.407 l/sec

3.4.2 Community Centre Water Demand

There is provision of 434m^2 of community, cultural and arts space within the development.

The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rater of 40 l/person/day for a Local Community Sports Club.

Total persons = 217 people (Assumed 1person per 2m^2 of floor area)

Average water demand = 40litres/person/day

Total daily discharge = 217 people x 40litres/person/day = 8680 litres/day

Average Hour Demand = 8680 litres/day / (24hr x 60min x 60sec)
= 0.100 l/s

In accordance with Table 2.7 Commercial Peaking Factors, the peaking factor applied to commercial wastewater flow for an area of 0 – 5.5ha is 4.5 x DWF.

Peak discharge = 4.5 x DWF = 0.45 l/s

Average and peak discharge rates for all existing and proposed developments are summarised in the Table below.

Development Description	Average Demand (l/s)	Peak Demand (l/s)
Proposed development of residential units	0.568	3.407
Community Centre	0.100	0.450
Total	**0.668**	**3.857**

Table 4.1 Average and Peak Foul Discharge Rates for All Developments

3.5 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.

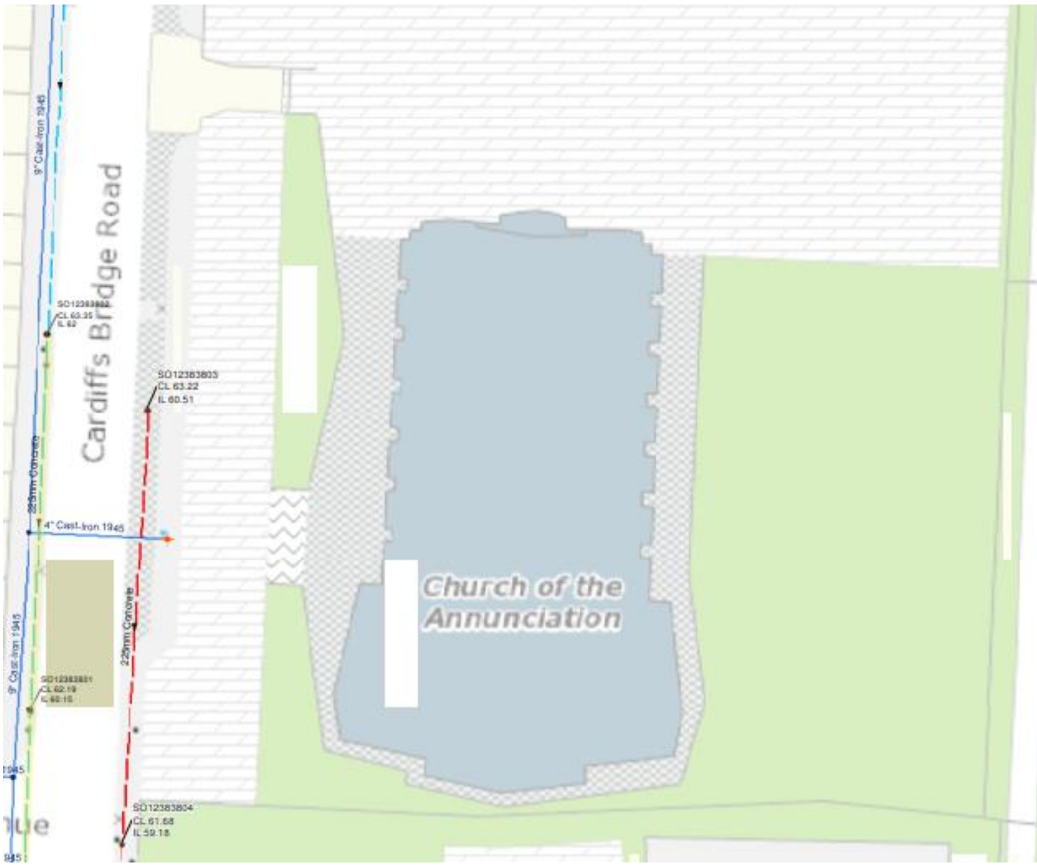


Figure 4.1 – Extract from Irish Water maps

4.2 Existing & Proposed Services

A 100mm diameter watermain is located under the road in Cardiffsbridge Road to the west of the proposed development. This connection is taken from the main 225mm diameter watermain located under the footpath in Cardiffsbridge Road.

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

4.3 Water Demand Calculations

4.3.1 Residential Water Demand

The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rate of 150 litres per person per day and an occupancy rate of 2.7 persons per dwelling.

The average day/ peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand is taken to be 5 times the average day/ peak week demand.

Total Daily Water Demand = 110 dwellings x 2.7 persons x 150 litres per day per person
= 44,550 litres/day

Average Hour Demand = 44,550 litres/day / (24hr x 60min x 60sec)
= 0.516 litres/sec

Average Day / Peak Week Demand = 0.516 litres/sec x 1.25
= 0.645 litres/sec

Peak Demand = 5 x 0.645 litres/sec = 3.223 litres/sec

4.3.2 Community Centre Water Demand

There is provision of 434m^2 of community, cultural and arts space.

Total persons = 217 people (Assumed 1person per 2m^2 of floor area)

Average water demand = 90litres/person/day

Total daily discharge = 217 people x 90litres/person/day = 19,530 litres/day = 0.226 litres/sec

Average Day Peak Week Demand = 0.226 x 1.25 = 0.283 litres/ sec

Peak Demand = 5 x 0.283 litres/sec = 1.413 litres/sec

Average and peak discharge rates for all existing and proposed developments are summarised in the Table below.

Development Description	Average Demand (l/s)	Peak Demand (l/s)
Proposed development of residential units	0.645	3.223
Community Centre	0.283	1.413
Total	**0.928**	**4.636**

Table 4.1 Average and Peak Foul Discharge Rates for All Developments

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

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

Ray O'Connor

Malone O'Regan
2B Richview Office Park
Clonskeagh
Dublin 14
D14 XT57

9 February 2024

Our Ref: CDS24000428 Pre-Connection Enquiry
Apartments at Cappagh Road, Cardiffbridge Road, Dublin 11, 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 113 unit(s) at Apartments at Cappagh Road, Cardiffbridge Road, Dublin 11, 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
- **Wastewater Connection** - Feasible without infrastructure upgrade by Irish Water

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?

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)

APPENDIX B – ATTENUATION VOLUME CALCULATIONS

Job Title	B4 08 Church of Annunciation	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	16.4	
M5-2D (2 days - 5 years) mm	59.6	
Ratio "r" (M5-60/ M5-2D)	0.28	
SAAR mm	967	Soil Type 3 - Based on Site Investigation findings - "Stiff drark grey or black slightly sandy gravelly clay.
Soil/ SPR mm	0.37	

For 50 Ha Area ~ QBARrural =	0.210	m^3/s	
For 0.77 Ha Area ~ QBARrural =	4.193	l/s/ha	Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.
For 0.77 Ha Area ~ QBARrural =	3.247	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
7744.76	Roof - Apartments	Standard - 15%		0.95	0.0	0.0	970.5
		Green/ Blue Roof - 85%	1470.50	0.60	882.3	970.5	
	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
0.77							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	2.0	1.15	1	2.262	2.195	0.194824238	2.000
2min	5.7	3.4	1.16	1	3.941	3.825	0.389648475	3.435
5 min	10.3	6.1	1.18	1	7.244	7.030	0.974121188	6.056
10 min	14.8	8.8	1.18	1	10.409	10.102	1.948242376	8.154
15 min	17.7	10.5	1.18	1	12.448	12.081	2.922363564	9.159
30 min	23.3	13.9	1.18	1	16.386	15.904	5.844727128	10.059
60 min	30	17.9	1.17	1	20.920	20.303	11.68945426	8.614
2 hour	38	22.6	1.16	1	26.272	25.497	23.37890851	2.119
4 hour	48	28.6	1.15	1	32.899	31.930	46.75781702	-14.828
6 hour	55	32.8	1.14	1	37.369	36.268	70.13672553	-33.869
12 hour	68	40.5	1.14	1	46.202	44.840	140.2734511	-95.433
24 hour	85	50.7	1.13	1	57.246	55.559	280.5469021	-224.988
48 hour	106	63.2	1.12	1	70.757	68.672	561.0938043	-492.422
Size of Attenuation for 1 in 10 year flood event m³								**10.059**

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	2.0	1.39	1	2.734	2.653	0.194824238	2.458
2min	5.7	3.4	1.41	1	4.790	4.649	0.389648475	4.259
5 min	10.3	6.1	1.44	1	8.840	8.579	0.974121188	7.605
10 min	14.8	8.8	1.46	1	12.878	12.499	1.948242376	10.551
15 min	17.7	10.5	1.48	1	15.613	15.153	2.922363564	12.230
30 min	23.3	13.9	1.49	1	20.691	20.082	5.844727128	14.237
60 min	30	17.9	1.48	1	26.462	25.683	11.68945426	13.993
2 hour	38	22.6	1.47	1	33.293	32.311	23.37890851	8.933
4 hour	48	28.6	1.45	1	41.482	40.259	46.75781702	-6.499
6 hour	55	32.8	1.44	1	47.203	45.812	70.13672553	-24.325
12 hour	68	40.5	1.42	1	57.550	55.854	140.2734511	-84.420
24 hour	85	50.7	1.38	1	69.911	67.851	280.5469021	-212.696
48 hour	106	63.2	1.34	1	84.656	82.161	561.0938043	-478.933
Size of Attenuation for 1 in 30 year flood event m³								**14.237**

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	2.0	1.87	1	3.678	3.570	0.194824238	3.375
2min	5.7	3.4	1.88	1	6.387	6.199	0.389648475	5.809
5 min	10.3	6.1	1.97	1	12.093	11.737	0.974121188	10.763
10 min	14.8	8.8	1.98	1	17.465	16.950	1.948242376	15.002
15 min	17.7	10.5	1.95	1	20.571	19.965	2.922363564	17.042
30 min	23.3	13.9	1.91	1	26.524	25.742	5.844727128	19.897
60 min	30	17.9	1.85	1	33.078	32.103	11.68945426	20.414
2 hour	38	22.6	1.78	1	40.313	39.125	23.37890851	15.746
4 hour	48	28.6	1.73	1	49.492	48.033	46.75781702	1.275
6 hour	55	32.8	1.71	1	56.054	54.402	70.13672553	-15.735
12 hour	68	40.5	1.62	1	65.655	63.720	140.2734511	-76.553
24 hour	85	50.7	1.58	1	80.043	77.684	280.5469021	-202.863
48 hour	106	63.2	1.53	1	96.659	93.811	561.0938043	-467.283
Size of Attenuation for 1 in 100 year flood event m³								**20.414**

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 970.5 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' 4.66 m³

Interception Storage Provided *Only fill in SuDS on your site

Blue/Green Roof to retain 30 l/m² of rainwater will be used on roof level	Area	1470.5	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	44.115	m³

Total interception volume provided for the overall site 44.12 m³
which exceeds the required volume calculated of 4.66 m³

Job Title	B4 08 Church of Annunciation	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	16.4
M5-2D (2 days - 5 years) mm	59.6
Ratio "r" (M5-60/ M5-2D)	0.28
SAAR mm	967
Soil/ SPR mm	0.37

Soil Type 3 - Based on Site Investigation findings - "Stiff drark grey or black slightly sandy gravelly clay.

For 50 Ha Area ~ QBARrural =	0.210	m^3/s
For 0.77 Ha Area ~ QBARrural =	4.193	l/s/ha
For 0.77 Ha Area ~ QBARrural =	3.247	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

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
7744.76	Roof - Apartments	Standard - 15%	259.50	0.95	246.53	271.18	3365.20
		Blue/Green Roof - 85%		0.60	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		4180.95	0.50	2090.48	2299.52	
ha	Landscaped Areas inc. areas from hardstanding		1325.93	0.20	265.19	291.70	ha
0.77							0.34
	Hardstanding		507.88	0.90	457.09	502.80	

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Time	%	M5	Growth	Area	MT	Inflow	Outflow	Capacity Required
			Factor (10 Years)	Factor	Factor	"I"	"O"	"I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	2.0	1.15	1	2.262	7.611	0.194824238	7.417
2min	5.7	3.4	1.16	1	3.941	13.261	0.389648475	12.872
5 min	10.3	6.1	1.18	1	7.244	24.377	0.974121188	23.403
10 min	14.8	8.8	1.18	1	10.409	35.027	1.948242376	33.079
15 min	17.7	10.5	1.18	1	12.448	41.890	2.922363564	38.968
30 min	23.3	13.9	1.18	1	16.386	55.144	5.844727128	49.299
60 min	30	17.9	1.17	1	20.920	70.399	11.68945426	58.709
2 hour	38	22.6	1.16	1	26.272	88.410	23.37890851	65.031
4 hour	48	28.6	1.15	1	32.899	110.713	46.75781702	63.955
6 hour	55	32.8	1.14	1	37.369	125.755	70.13672553	55.618
12 hour	68	40.5	1.14	1	46.202	155.479	140.2734511	15.205
24 hour	85	50.7	1.13	1	57.246	192.644	280.5469021	-87.903
48 hour	106	63.2	1.12	1	70.757	238.112	561.0938043	-322.982
Size of Attenuation for 1 in 10 year flood event m³								**65.031**

1 in 30 Years								
Time	%	M5	Growth	Area	MT	Inflow	Outflow	Capacity Required
			Factor (30 Years)	Factor	Factor	"I"	"O"	"I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	2.0	1.39	1	2.734	9.200	0.194824238	9.005
2min	5.7	3.4	1.41	1	4.790	16.120	0.389648475	15.730
5 min	10.3	6.1	1.44	1	8.840	29.748	0.974121188	28.774
10 min	14.8	8.8	1.46	1	12.878	43.338	1.948242376	41.390
15 min	17.7	10.5	1.48	1	15.613	52.540	2.922363564	49.618
30 min	23.3	13.9	1.49	1	20.691	69.631	5.844727128	63.786
60 min	30	17.9	1.48	1	26.462	89.051	11.68945426	77.362
2 hour	38	22.6	1.47	1	33.293	112.036	23.37890851	88.657
4 hour	48	28.6	1.45	1	41.482	139.594	46.75781702	92.836
6 hour	55	32.8	1.44	1	47.203	158.848	70.13672553	88.712
12 hour	68	40.5	1.42	1	57.550	193.667	140.2734511	53.393
24 hour	85	50.7	1.38	1	69.911	235.264	280.5469021	-45.283
48 hour	106	63.2	1.34	1	84.656	284.884	561.0938043	-276.210
Size of Attenuation for 1 in 30 year flood event m³								**92.836**

1 in 100 Years								
Time	%	M5	Growth	Area	MT	Inflow	Outflow	Capacity Required
			Factor (30 Years)	Factor	Factor	"I"	"O"	"I"-"O" ="S"
note	1	2	3	4	5	6	7	8
1 min	3.3	2.0	1.87	1	3.678	12.377	0.194824238	12.182
2min	5.7	3.4	1.88	1	6.387	21.493	0.389648475	21.103
5 min	10.3	6.1	1.97	1	12.093	40.697	0.974121188	39.723
10 min	14.8	8.8	1.98	1	17.465	58.774	1.948242376	56.826
15 min	17.7	10.5	1.95	1	20.571	69.225	2.922363564	66.303
30 min	23.3	13.9	1.91	1	26.524	89.258	5.844727128	83.413
60 min	30	17.9	1.85	1	33.078	111.314	11.68945426	99.625
2 hour	38	22.6	1.78	1	40.313	135.663	23.37890851	112.284
4 hour	48	28.6	1.73	1	49.492	166.550	46.75781702	119.792
6 hour	55	32.8	1.71	1	56.054	188.632	70.13672553	118.496
12 hour	68	40.5	1.62	1	65.655	220.944	140.2734511	80.670
24 hour	85	50.7	1.58	1	80.043	269.360	280.5469021	-11.187
48 hour	106	63.2	1.53	1	96.659	325.278	561.0938043	-235.816
Size of Attenuation for 1 in 100 year flood event m³								**119.792**

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.

<u>Required Interception Storage</u>

Overall Impermeable area is 3365.2 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' 16.15 m³

<u>Interception Storage Provided</u> *Only fill in SuDS on your site

Permeable Paving	Area	4181.0	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	125.4285	m³

*Storage depth will depend on your site

Swale	Area	0.0	m²
	*75mm	0.075	m
	Storage Volume	0	m³

Total interception volume provided for the overall site 125.43 m³

which exceeds the required volume calculated of 16.15 m³

APPENDIX C – SURFACE WATER PIPE NETWORK CALCULATIONS

Drainage Design Report

Flow+

v10.8

Network	Storm Network
Filename	2024-02-22 Flow.pfd
Username	Kezia Adanza (kadanza@morce.ie)
Last analysed	14/06/2024 11:16:07
Report produced on	14/06/2024 11:16:49

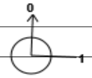
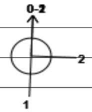
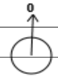
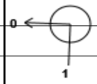
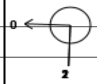
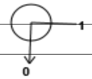
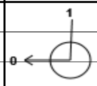
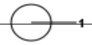
Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.400
Ratio-R	0.280
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	0.70
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	No
Enforce best practice design rules	No

	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
✓	SW06	0.030	4.00		63.300	Manhole	Adoptable	1200			712329.194	738868.728	1.425	
✓	SW07	0.030	4.00		63.300	Manhole	Adoptable	1200			712299.551	738869.893	1.573	
✓	SW08	0.030	4.00		63.300	Manhole	Adoptable	1200			712300.573	738895.894	1.714	
✓	SW05	0.030	4.00		63.300	Manhole	Adoptable	1200			712332.299	738869.628	1.425	
✓	SW04	0.030	4.00		63.300	Manhole	Adoptable	1200			712333.281	738894.608	1.550	
✓	SW03	0.030	4.00		63.650	Manhole	Adoptable	1200			712301.350	738915.740	2.163	
✓	SW02	0.030	4.00		63.685	Manhole	Adoptable	1200			712264.545	738917.083	2.382	
✓	SW01-HB	0.030	4.00		62.505	Manhole	Adoptable	1200			712262.385	738861.077	1.482	
✓	EXSW MH				62.230	Manhole	Adoptable	1200			712240.425	738861.077	1.425	

	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)
✓	2.000	SW06	SW07	29.666	0.600	Colebrook-White	61.875	61.727	0.148	200.0	225	Circular	4.54	50.0					
✓	2.001	SW07	SW08	26.021	0.600	Colebrook-White	61.727	61.597	0.130	200.0	300	Circular	4.93	50.0					
✓	1.002	SW08	SW03	19.861	0.600	Colebrook-White	61.586	61.487	0.099	200.0	300	Circular	5.24	48.9					
✓	1.000	SW05	SW04	24.999	0.600	Colebrook-White	61.875	61.750	0.125	200.0	225	Circular	4.45	50.0					
✓	1.001	SW04	SW08	32.733	0.600	Colebrook-White	61.750	61.586	0.164	200.0	300	Circular	4.94	50.0					
✓	3.000	SW08	SW03	19.861	0.600	Colebrook-White	61.800	61.701	0.099	200.0	300	Circular	4.30	50.0					
✓	1.003	SW03	SW02	36.829	0.600	Colebrook-White	61.487	61.303	0.184	200.0	225	Circular	5.91	46.7					
✓	1.004	SW02	SW01-HB	56.048	0.600	Colebrook-White	61.303	61.023	0.280	200.0	225	Circular	6.93	43.7					
✓	1.005	SW01-HB	EXSW MH	21.960	0.600	Colebrook-White	61.023	60.805	0.218	100.7	225	Circular	7.21	43.0					

	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
✓	2.000	SW06	SW07	0.921	36.6	4.1	1.200	1.348	1.200	1.348	0.030	0.0	51	0.611	
✓	2.001	SW07	SW08	1.108	78.3	8.1	1.273	1.403	1.273	1.403	0.060	0.0	65	0.722	
✓	1.002	SW08	SW03	1.108	78.3	19.9	1.414	1.863	1.414	1.863	0.150	0.0	103	0.930	
✓	1.000	SW05	SW04	0.921	36.6	4.1	1.200	1.325	1.200	1.325	0.030	0.0	51	0.611	
✓	1.001	SW04	SW08	1.108	78.3	8.1	1.250	1.414	1.250	1.414	0.060	0.0	65	0.722	
✓	3.000	SW08	SW03	1.108	78.3	0.0	1.200	1.649	1.200	1.649	0.000	0.0	0	0.000	
✓	1.003	SW03	SW02	0.921	36.6	22.8	1.938	2.157	1.938	2.157	0.180	0.0	129	0.970	
✓	1.004	SW02	SW01-HB	0.921	36.6	24.9	2.157	1.257	1.257	2.157	0.210	0.0	137	0.989	
✓	1.005	SW01-HB	EXSW MH	1.302	51.8	28.0	1.257	1.200	1.200	1.257	0.240	0.0	118	1.328	

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
2.000	29.666	200.0	225	Circular	63.300	61.875	1.200	63.300	61.727	1.348	SW06	1200			Manhole	Adoptable	SW07	1200			Manhole	Adoptable
2.001	26.021	200.0	300	Circular	63.300	61.727	1.273	63.300	61.597	1.403	SW07	1200			Manhole	Adoptable	SW08	1200			Manhole	Adoptable
1.002	19.861	200.0	300	Circular	63.300	61.586	1.414	63.650	61.487	1.863	SW08	1200			Manhole	Adoptable	SW03	1200			Manhole	Adoptable
1.000	24.999	200.0	225	Circular	63.300	61.875	1.200	63.300	61.750	1.325	SW05	1200			Manhole	Adoptable	SW04	1200			Manhole	Adoptable
1.001	32.733	200.0	300	Circular	63.300	61.750	1.250	63.300	61.586	1.414	SW04	1200			Manhole	Adoptable	SW08	1200			Manhole	Adoptable
3.000	19.861	200.0	300	Circular	63.300	61.800	1.200	63.650	61.701	1.649	SW08	1200			Manhole	Adoptable	SW03	1200			Manhole	Adoptable
1.003	36.829	200.0	225	Circular	63.650	61.487	1.938	63.685	61.303	2.157	SW03	1200			Manhole	Adoptable	SW02	1200			Manhole	Adoptable
1.004	56.048	200.0	225	Circular	63.685	61.303	2.157	62.505	61.023	1.257	SW02	1200			Manhole	Adoptable	SW01-HB	1200			Manhole	Adoptable
1.005	21.960	100.7	225	Circular	62.505	61.023	1.257	62.230	60.805	1.200	SW01-HB	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
SW06	712329.194	738868.728	63.300	1.425	1200			Manhole	Adoptable						
											0	2.000	61.875	225	Circular
SW07	712299.551	738869.893	63.300	1.573	1200			Manhole	Adoptable		1	2.000	61.727	225	Circular
											0	2.001	61.727	300	Circular
SW08	712300.573	738895.894	63.300	1.714	1200			Manhole	Adoptable		1	2.001	61.597	300	Circular
											2	1.001	61.586	300	Circular
											0-1	1.002	61.586	300	Circular
											0-2	3.000	61.800	300	Circular
SW05	712332.299	738869.628	63.300	1.425	1200			Manhole	Adoptable						
											0	1.000	61.875	225	Circular
SW04	712333.281	738894.608	63.300	1.550	1200			Manhole	Adoptable		1	1.000	61.750	225	Circular
											0	1.001	61.750	300	Circular
SW03	712301.350	738915.740	63.650	2.163	1200			Manhole	Adoptable		1	3.000	61.701	300	Circular
											2	1.002	61.487	300	Circular
											0	1.003	61.487	225	Circular
SW02	712264.545	738917.083	63.685	2.382	1200			Manhole	Adoptable		1	1.003	61.303	225	Circular
											0	1.004	61.303	225	Circular
SW01-HB	712262.385	738861.077	62.505	1.482	1200			Manhole	Adoptable		1	1.004	61.023	225	Circular
											0	1.005	61.023	225	Circular
EXSW MH	712240.425	738861.077	62.230	1.425	1200			Manhole	Adoptable		1	1.005	60.805	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)	16.400		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 (m^3/ha)	20.0					
Storm Durations (mins)	15					
	30					
	60					
	120					
	180					
	240					
	360					
Check Discharge Rate(s)	No					
Check Discharge Volume	No					
100 year 360 minute (m^3)						

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)
SW01-HB	No	Online		Yes		61.023	1.000	3.2	(HE) Minimise upstream storage	Yes	CTL-SHE-0085-3200-1000-3200	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)**
SW03	0.00000	0.00000	2.0	1.00	61.487	0	0.000	471.4	0.0
							0.610	471.4	0.0
							0.611	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	128.203	36.277
2 year +20% CC 15 minute winter	89.967	36.277
2 year +20% CC 30 minute summer	87.493	24.758
2 year +20% CC 30 minute winter	61.399	24.758
2 year +20% CC 60 minute summer	62.018	16.390
2 year +20% CC 60 minute winter	41.203	16.390
2 year +20% CC 120 minute summer	40.241	10.634
2 year +20% CC 120 minute winter	26.735	10.634
2 year +20% CC 180 minute summer	31.761	8.173
2 year +20% CC 180 minute winter	20.646	8.173
2 year +20% CC 240 minute summer	25.735	6.801
2 year +20% CC 240 minute winter	17.097	6.801
2 year +20% CC 360 minute summer	20.411	5.252
2 year +20% CC 360 minute winter	13.267	5.252
30 year +20% CC 15 minute summer	235.601	66.667
30 year +20% CC 15 minute winter	165.334	66.667
30 year +20% CC 30 minute summer	161.531	45.708
30 year +20% CC 30 minute winter	113.355	45.708
30 year +20% CC 60 minute summer	112.631	29.765
30 year +20% CC 60 minute winter	74.829	29.765
30 year +20% CC 120 minute summer	71.543	18.907
30 year +20% CC 120 minute winter	47.531	18.907
30 year +20% CC 180 minute summer	55.931	14.393
30 year +20% CC 180 minute winter	36.357	14.393
30 year +20% CC 240 minute summer	44.806	11.841
30 year +20% CC 240 minute winter	29.768	11.841
30 year +20% CC 360 minute summer	34.864	8.972
30 year +20% CC 360 minute winter	22.662	8.972
100 year +20% CC 15 minute summer	305.462	86.435
100 year +20% CC 15 minute winter	214.359	86.435

100 year +20% CC 30 minute summer	210.852	59.664
100 year +20% CC 30 minute winter	147.966	59.664
100 year +20% CC 60 minute summer	146.367	38.681
100 year +20% CC 60 minute winter	97.243	38.681
100 year +20% CC 120 minute summer	92.229	24.373
100 year +20% CC 120 minute winter	61.275	24.373
100 year +20% CC 180 minute summer	71.670	18.443
100 year +20% CC 180 minute winter	46.587	18.443
100 year +20% CC 240 minute summer	57.163	15.106
100 year +20% CC 240 minute winter	37.977	15.106
100 year +20% CC 360 minute summer	44.178	11.368
100 year +20% CC 360 minute winter	28.717	11.368

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 99.20%																		
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event (Outflow)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**	**Note**
15 minute winter	SW06	10	61.932	0.057	5.2	0.0881	0.0000	OK	15 minute winter	2.000	SW07	5.2	0.522	0.141	0.4547		
15 minute winter	SW07	10	61.853	0.126	10.4	0.1901	0.0000	OK	15 minute summer	2.001	SW08	13.5	0.363	0.172	1.1321		
15 minute summer	SW08	11	61.842	0.256	25.3	0.3790	0.0000	OK	15 minute winter	1.002	SW03	36.6	1.670	0.467	0.6285		
									15 minute summer	3.000	SW03	3.0	0.524	0.038	0.1141		
15 minute winter	SW05	10	61.932	0.057	5.2	0.0881	0.0000	OK	15 minute winter	1.000	SW04	5.2	0.551	0.142	0.3024		
15 minute winter	SW04	11	61.849	0.099	10.4	0.1506	0.0000	OK	15 minute summer	1.001	SW08	12.2	0.340	0.156	1.3412		
360 minute winter	SW03	248	61.542	0.055	5.4	25.7952	0.0000	OK	180 minute winter	1.003	SW02	3.6	0.446	0.097	0.8576		
180 minute winter	SW02	124	61.543	0.240	4.5	0.3321	0.0000	SURCHARGED	15 minute winter	1.004	SW01-HB	4.9	0.255	0.134	1.4961		Surcharge due to flow behind hydro-brake
180 minute winter	SW01-HB	124	61.544	0.521	4.8	0.8008	0.0000	SURCHARGED	15 minute summer	Hydro-Brake®	EXSW MH	3.2				10.3	Surcharge due to flow behind hydro-brake
15 minute summer	EXSW MH	1	60.805	0.000	3.2	0.0000	0.0000	OK									

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.20%																
Node Event	**US Node**	**Peak (mins)**	**Level (m)**	**Depth (m)**	**Inflow (l/s)**	**Node Vol (m³)**	**Flood (m³)**	**Status**	**Link Event (Outflow)**	**Link**	**DS Node**	**Outflow (l/s)**	**Velocity (m/s)**	**Flow/Cap**	**Link Vol (m³)**	**Discharge Vol (m³)**
15 minute winter	SW06	10	61.953	0.078	9.6	0.1209	0.0000	OK	15 minute winter	2.000	SW07	9.6	0.565	0.262	0.6213	
15 minute summer	SW07	10	61.889	0.162	19.2	0.2451	0.0000	OK	15 minute winter	2.001	SW08	22.6	0.499	0.288	1.3725	
15 minute winter	SW08	9	61.881	0.295	57.2	0.4375	0.0000	OK	15 minute winter	1.002	SW03	57.4	1.969	0.733	0.7034	
									15 minute summer	3.000	SW03	11.8	0.813	0.151	0.2882	
15 minute winter	SW05	10	61.953	0.078	9.6	0.1209	0.0000	OK	15 minute winter	1.000	SW04	9.6	0.591	0.262	0.4856	
15 minute summer	SW04	10	61.903	0.153	19.2	0.2318	0.0000	OK	15 minute winter	1.001	SW08	25.1	0.473	0.320	1.6685	
360 minute winter	SW03	288	61.614	0.127	10.3	59.8904	0.0000	OK	15 minute winter	1.003	SW02	-11.7	0.447	-0.319	0.8669	
360 minute winter	SW02	288	61.613	0.310	5.3	0.4289	0.0000	SURCHARGED	15 minute winter	1.004	SW01-HB	-9.3	0.264	-0.255	2.2291	
60 minute summer	SW01-HB	34	61.622	0.599	9.9	0.9195	0.0000	SURCHARGED	60 minute summer	Hydro-Brake®	EXSW MH	3.2				43.3
15 minute summer	EXSW MH	1	60.805	0.000	3.2	0.0000	0.0000	OK								

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.20%																	
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link Event (Outflow)	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW06	10	61.965	0.090	12.5	0.1393	0.0000	OK	15 minute winter	2.000	SW07	12.5	0.614	0.341	0.7286	
15 minute winter	SW07	9	61.911	0.184	25.0	0.2782	0.0000	OK	15 minute summer	2.001	SW08	28.5	0.541	0.364	1.5015	
15 minute summer	SW08	9	61.900	0.314	71.6	0.4654	0.0000	SURCHARGED	15 minute winter	1.002	SW03	69.6	2.065	0.889	0.7262	
									15 minute summer	3.000	SW03	15.9	0.852	0.204	0.3832	
15 minute winter	SW05	10	61.965	0.090	12.5	0.1393	0.0000	OK	15 minute winter	1.000	SW04	12.5	0.633	0.341	0.5924	
15 minute winter	SW04	9	61.924	0.174	25.0	0.2645	0.0000	OK	15 minute summer	1.001	SW08	30.6	0.532	0.391	1.8154	
360 minute winter	SW03	336	61.667	0.180	13.1	85.1873	0.0000	OK	15 minute winter	1.003	SW02	-17.9	-0.674	-0.489	0.9437	
15 minute winter	SW02	11	61.704	0.401	22.6	0.5552	0.0000	SURCHARGED	15 minute summer	1.004	SW01-HB	-11.3	-0.285	-0.310	2.2291	
15 minute summer	SW01-HB	11	61.698	0.675	17.4	1.0367	0.0000	SURCHARGED	30 minute winter	Hydro-Brake®	EXSW MH	3.2				46.4
15 minute summer	EXSW MH	1	60.805	0.000	3.2	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	SW06	10	61.932	0.057	5.2	0.0881	0.0000	OK	15 minute summer	2.000	SW07	5.2	0.549	0.141	0.4165	
15 minute summer	SW07	11	61.844	0.117	10.4	0.1769	0.0000	OK	15 minute summer	2.001	SW08	13.5	0.363	0.172	1.1321	
15 minute summer	SW08	11	61.842	0.256	25.3	0.3790	0.0000	OK	15 minute summer	1.002	SW03	33.6	1.603	0.429	0.6409	
									15 minute summer	3.000	SW03	3.0	0.524	0.038	0.1141	
15 minute summer	SW05	10	61.932	0.057	5.2	0.0881	0.0000	OK	15 minute summer	1.000	SW04	5.2	0.554	0.142	0.2767	
15 minute summer	SW04	11	61.841	0.091	10.4	0.1375	0.0000	OK	15 minute summer	1.001	SW08	12.2	0.340	0.156	1.3412	
15 minute summer	SW03	21	61.511	0.024	36.4	11.4255	0.0000	OK	15 minute summer	1.003	SW02	0.9	0.384	0.024	0.1832	
15 minute summer	SW02	14	61.362	0.059	5.2	0.0813	0.0000	OK	15 minute summer	1.004	SW01-HB	4.8	0.260	0.130	1.3453	
15 minute summer	SW01-HB	13	61.365	0.342	10.0	0.5247	0.0000	SURCHARGED	15 minute summer	Hydro-Brake®	EXSW MH	3.2				10.3
15 minute summer	EXSW MH	1	60.805	0.000	3.2	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 (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 winter	SW06	10	61.932	0.057	5.2	0.0881	0.0000	OK	15 minute winter	2.000	SW07	5.2	0.522	0.141	0.4547	
15 minute winter	SW07	10	61.853	0.126	10.4	0.1901	0.0000	OK	15 minute winter	2.001	SW08	12.2	0.377	0.156	1.1396	
15 minute winter	SW08	11	61.835	0.249	26.2	0.3693	0.0000	OK	15 minute winter	1.002	SW03	36.6	1.670	0.467	0.6285	
									15 minute winter	3.000	SW03	2.8	0.552	0.035	0.0993	
15 minute winter	SW05	10	61.932	0.057	5.2	0.0881	0.0000	OK	15 minute winter	1.000	SW04	5.2	0.551	0.142	0.3024	
15 minute winter	SW04	11	61.849	0.099	10.4	0.1506	0.0000	OK	15 minute winter	1.001	SW08	10.7	0.316	0.137	1.3567	
15 minute winter	SW03	21	61.514	0.027	39.9	12.8649	0.0000	OK	15 minute winter	1.003	SW02	1.1	0.409	0.031	0.2963	
15 minute winter	SW02	16	61.388	0.085	5.2	0.1169	0.0000	OK	15 minute winter	1.004	SW01-HB	4.9	0.255	0.134	1.4961	
15 minute winter	SW01-HB	15	61.390	0.367	10.1	0.5635	0.0000	SURCHARGED	15 minute winter	Hydro-Brake®	EXSW MH	3.2				12.1
15 minute winter	EXSW MH	1	60.805	0.000	3.2	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	SW06	17	61.929	0.054	4.8	0.0836	0.0000	OK	30 minute summer	2.000	SW07	4.7	0.536	0.127	0.2593	
30 minute summer	SW07	18	61.796	0.069	9.4	0.1042	0.0000	OK	30 minute summer	2.001	SW08	9.3	0.415	0.118	0.5934	
30 minute summer	SW08	18	61.741	0.155	23.0	0.2296	0.0000	OK	30 minute summer	1.002	SW03	24.4	1.588	0.311	0.3776	
									30 minute summer	3.000	SW03	0.0	0.000	0.000	0.0000	
30 minute summer	SW05	17	61.929	0.054	4.8	0.0838	0.0000	OK	30 minute summer	1.000	SW04	4.7	0.539	0.128	0.2183	
30 minute summer	SW04	18	61.819	0.069	9.5	0.1045	0.0000	OK	30 minute summer	1.001	SW08	9.3	0.386	0.118	0.8002	
30 minute summer	SW03	34	61.519	0.032	28.9	15.0260	0.0000	OK	30 minute summer	1.003	SW02	1.6	0.450	0.043	0.3008	
30 minute summer	SW02	23	61.387	0.084	5.0	0.1157	0.0000	OK	30 minute summer	1.004	SW01-HB	4.7	0.236	0.128	1.4910	
30 minute summer	SW01-HB	22	61.393	0.370	9.2	0.5682	0.0000	SURCHARGED	30 minute summer	Hydro-Brake®	EXSW MH	3.2				15.7
30 minute summer	EXSW MH	1	60.805	0.000	3.2	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 (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 winter	SW06	17	61.925	0.050	4.1	0.0779	0.0000	OK	30 minute winter	2.000	SW07	4.0	0.512	0.110	0.2362	
30 minute winter	SW07	18	61.791	0.064	8.1	0.0974	0.0000	OK	30 minute winter	2.001	SW08	8.1	0.441	0.103	0.5129	
30 minute winter	SW08	17	61.724	0.138	20.2	0.2048	0.0000	OK	30 minute winter	1.002	SW03	21.4	1.566	0.273	0.3270	
									30 minute winter	3.000	SW03	0.0	0.000	0.000	0.0000	
30 minute winter	SW05	17	61.925	0.050	4.1	0.0779	0.0000	OK	30 minute winter	1.000	SW04	4.1	0.513	0.111	0.1988	
30 minute winter	SW04	18	61.814	0.064	8.2	0.0977	0.0000	OK	30 minute winter	1.001	SW08	8.1	0.405	0.103	0.6984	
30 minute winter	SW03	33	61.522	0.035	25.4	16.7087	0.0000	OK	30 minute winter	1.003	SW02	2.0	0.460	0.054	0.4619	
30 minute winter	SW02	30	61.422	0.119	5.7	0.1640	0.0000	OK	30 minute winter	1.004	SW01-HB	4.3	0.237	0.117	1.7087	
30 minute winter	SW01-HB	29	61.423	0.400	8.3	0.6146	0.0000	SURCHARGED	30 minute winter	Hydro-Brake®	EXSW MH	3.2				18.1
30 minute winter	EXSW MH	1	60.805	0.000	3.2	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	SW06	32	61.922	0.047	3.6	0.0729	0.0000	OK	60 minute summer	2.000	SW07	3.5	0.492	0.097	0.2154	
60 minute summer	SW07	33	61.787	0.060	7.1	0.0912	0.0000	OK	60 minute summer	2.001	SW08	7.1	0.456	0.090	0.4098	
60 minute summer	SW08	33	61.700	0.114	17.7	0.1690	0.0000	OK	60 minute summer	1.002	SW03	17.9	1.505	0.229	0.2660	
									60 minute summer	3.000	SW03	0.0	0.000	0.000	0.0000	
60 minute summer	SW05	32	61.922	0.047	3.6	0.0730	0.0000	OK	60 minute summer	1.000	SW04	3.6	0.493	0.097	0.1813	
60 minute summer	SW04	33	61.810	0.060	7.2	0.0915	0.0000	OK	60 minute summer	1.001	SW08	7.1	0.417	0.090	0.5671	
60 minute summer	SW03	60	61.525	0.038	21.4	18.0831	0.0000	OK	60 minute summer	1.003	SW02	2.3	0.474	0.064	0.4483	
60 minute summer	SW02	51	61.416	0.113	4.2	0.1562	0.0000	OK	60 minute summer	1.004	SW01-HB	4.1	0.239	0.111	1.6731	
60 minute summer	SW01-HB	52	61.415	0.392	7.5	0.6021	0.0000	SURCHARGED	60 minute summer	Hydro-Brake®	EXSW MH	3.2				22.8
60 minute summer	EXSW MH	1	60.805	0.000	3.2	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 (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 winter	SW06	33	61.917	0.042	2.8	0.0649	0.0000	OK	60 minute winter	2.000	SW07	2.8	0.456	0.076	0.1831	
60 minute winter	SW07	33	61.781	0.054	5.6	0.0814	0.0000	OK	60 minute winter	2.001	SW08	5.6	0.450	0.071	0.3306	
60 minute winter	SW08	32	61.684	0.098	14.0	0.1449	0.0000	OK	60 minute winter	1.002	SW03	14.1	1.397	0.181	0.2225	
									60 minute winter	3.000	SW03	0.0	0.000	0.000	0.0000	
60 minute winter	SW05	33	61.917	0.042	2.8	0.0649	0.0000	OK	60 minute winter	1.000	SW04	2.8	0.456	0.076	0.1541	
60 minute winter	SW04	33	61.804	0.054	5.6	0.0816	0.0000	OK	60 minute winter	1.001	SW08	5.6	0.404	0.071	0.4655	
60 minute winter	SW03	58	61.529	0.042	16.9	19.8987	0.0000	OK	60 minute winter	1.003	SW02	2.8	0.452	0.077	0.7831	
60 minute winter	SW02	62	61.504	0.201	3.9	0.2779	0.0000	OK	60 minute winter	1.004	SW01-HB	3.6	0.236	0.099	2.1640	
60 minute winter	SW01-HB	62	61.502	0.479	6.3	0.7362	0.0000	SURCHARGED	60 minute winter	Hydro-Brake®	EXSW MH	3.2				25.8
60 minute winter	EXSW MH	1	60.805	0.000	3.2	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
Filename	2024-02-22 Flow.pfd
Username	Kezia Adanza (kadanza@morce.ie)

Report produced on	23/02/2024 10:28:17

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

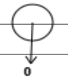
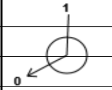
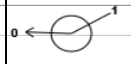
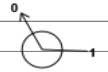
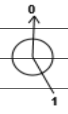
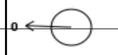
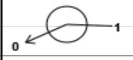
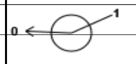
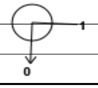
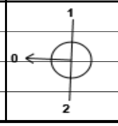
Frequency of use (kDU)	0.50
Flow per dwelling per day (l/day)	446
Domestic Flow (l/s/ha)	0.0
Industrial Flow (l/s/ha)	0.0
Additional Flow (%)	10
Minimum Velocity (m/s)	0.75
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	Yes

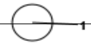
Name	Area (ha)	Dwellings	Units	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
FW07			0.0		63.630	Manhole	Adoptable	1200		712348.560	738903.959	1.425	
FW06			24.0		63.160	Manhole	Adoptable	1200		712346.787	738857.020	1.738	
FW05			0.0		63.200	Manhole	Adoptable	1200		712342.968	738854.766	1.852	
FW04			70.0		63.070	Manhole	Adoptable	1200		712278.300	738857.310	2.153	
FW03			0.0		63.070	Manhole	Adoptable	1200		712277.048	738859.720	2.171	
FW11			0.0		63.620	Manhole	Adoptable	1200		712344.488	738910.494	2.020	
FW10			0.0		63.610	Manhole	Adoptable	1200		712298.600	738912.310	2.775	
FW09			0.0		63.750	Manhole	Adoptable	1200		712294.440	738910.260	2.992	
FW08			36.0		63.610	Manhole	Adoptable	1200		712279.062	738910.980	2.955	
FW02			0.0		63.800	Manhole	Adoptable	1200		712277.870	738880.660	3.347	
FW01					62.830	Manhole	Adoptable	1200		712252.600	738881.810	2.546	

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	FW07	FW06	46.972	1.500	Colebrook-White	62.205	61.422	0.783	60.0	225	Circular		
1.001	FW06	FW05	4.435	1.500	Colebrook-White	61.422	61.348	0.074	60.0	225	Circular		
1.002	FW05	FW04	64.718	1.500	Colebrook-White	61.348	60.917	0.431	150.0	225	Circular		
1.003	FW04	FW03	2.716	1.500	Colebrook-White	60.917	60.899	0.018	150.0	225	Circular		
1.004	FW03	FW02	20.956	1.500	Colebrook-White	60.899	60.453	0.446	47.0	225	Circular		
2.000	FW11	FW10	45.924	1.500	Colebrook-White	61.600	60.835	0.765	60.0	225	Circular		
2.001	FW10	FW09	4.638	1.500	Colebrook-White	60.835	60.758	0.077	60.0	225	Circular		
2.002	FW09	FW08	15.395	1.500	Colebrook-White	60.758	60.655	0.103	150.0	225	Circular		
2.003	FW08	FW02	30.343	1.500	Colebrook-White	60.655	60.453	0.202	150.0	225	Circular		
1.005	FW02	FW01	25.296	1.500	Colebrook-White	60.453	60.284	0.169	150.0	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	FW07	FW06	0.000	1.483	59.0	0.0	1.200	1.513	1.200	1.513	0.000	0	0.0	0.0	0	0.000	
1.001	FW06	FW05	0.534	1.483	59.0	2.7	1.513	1.627	1.513	1.627	0.000	0	24.0	0.0	33	0.748	Proportional Velocity @ 1/3 Flow is less than the specified minimum
1.002	FW05	FW04	0.385	0.936	37.2	2.7	1.627	1.928	1.627	1.928	0.000	0	24.0	0.0	41	0.540	Proportional Velocity @ 1/3 Flow is less than the specified minimum
1.003	FW04	FW03	0.479	0.936	37.2	5.3	1.928	1.946	1.928	1.946	0.000	0	94.0	0.0	58	0.664	Proportional Velocity @ 1/3 Flow is less than the specified minimum
1.004	FW03	FW02	0.708	1.677	66.7	5.3	1.946	3.122	1.946	3.122	0.000	0	94.0	0.0	44	1.007	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Downstream Depth is more than twice the specified minimum
2.000	FW11	FW10	0.000	1.483	59.0	0.0	1.795	2.550	1.795	2.550	0.000	0	0.0	0.0	0	0.000	Downstream Depth is more than twice the specified minimum
2.001	FW10	FW09	0.000	1.483	59.0	0.0	2.550	2.767	2.550	2.767	0.000	0	0.0	0.0	0	0.000	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
2.002	FW09	FW08	0.000	0.936	37.2	0.0	2.767	2.730	2.730	2.767	0.000	0	0.0	0.0	0	0.000	Upstream Depth is more than twice the specified minimum | Downstream Depth is more than twice the specified minimum
2.003	FW08	FW02	0.412	0.936	37.2	3.3	2.730	3.122	2.730	3.122	0.000	0	36.0	0.0	45	0.575	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
1.005	FW02	FW01	0.503	0.936	37.2	6.3	3.122	2.321	2.321	3.122	0.000	0	130.0	0.0	63	0.698	Proportional Velocity @ 1/3 Flow is less than the specified minimum | Upstream 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	46.972	60.0	225	Circular	63.630	62.205	1.200	63.160	61.422	1.513	FW07	1200			Manhole	Adoptable	FW06	1200			Manhole	Adoptable
1.001	4.435	60.0	225	Circular	63.160	61.422	1.513	63.200	61.348	1.627	FW06	1200			Manhole	Adoptable	FW05	1200			Manhole	Adoptable
1.002	64.718	150.0	225	Circular	63.200	61.348	1.627	63.070	60.917	1.928	FW05	1200			Manhole	Adoptable	FW04	1200			Manhole	Adoptable
1.003	2.716	150.0	225	Circular	63.070	60.917	1.928	63.070	60.899	1.946	FW04	1200			Manhole	Adoptable	FW03	1200			Manhole	Adoptable
1.004	20.956	47.0	225	Circular	63.070	60.899	1.946	63.800	60.453	3.122	FW03	1200			Manhole	Adoptable	FW02	1200			Manhole	Adoptable
2.000	45.924	60.0	225	Circular	63.620	61.600	1.795	63.610	60.835	2.550	FW11	1200			Manhole	Adoptable	FW10	1200			Manhole	Adoptable
2.001	4.638	60.0	225	Circular	63.610	60.835	2.550	63.750	60.758	2.767	FW10	1200			Manhole	Adoptable	FW09	1200			Manhole	Adoptable
2.002	15.395	150.0	225	Circular	63.750	60.758	2.767	63.610	60.655	2.730	FW09	1200			Manhole	Adoptable	FW08	1200			Manhole	Adoptable
2.003	30.343	150.0	225	Circular	63.610	60.655	2.730	63.800	60.453	3.122	FW08	1200			Manhole	Adoptable	FW02	1200			Manhole	Adoptable
1.005	25.296	150.0	225	Circular	63.800	60.453	3.122	62.830	60.284	2.321	FW02	1200			Manhole	Adoptable	FW01	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
FW07	712348.560	738903.959	63.630	1.425	1200			Manhole	Adoptable						
											0	1.000	62.205	225	Circular
FW06	712346.787	738857.020	63.160	1.738	1200			Manhole	Adoptable		1	1.000	61.422	225	Circular
											0	1.001	61.422	225	Circular
FW05	712342.968	738854.766	63.200	1.852	1200			Manhole	Adoptable		1	1.001	61.348	225	Circular
											0	1.002	61.348	225	Circular
FW04	712278.300	738857.310	63.070	2.153	1200			Manhole	Adoptable		1	1.002	60.917	225	Circular
											0	1.003	60.917	225	Circular
FW03	712277.048	738859.720	63.070	2.171	1200			Manhole	Adoptable		1	1.003	60.899	225	Circular
											0	1.004	60.899	225	Circular
FW11	712344.488	738910.494	63.620	2.020	1200			Manhole	Adoptable						
											0	2.000	61.600	225	Circular
FW10	712298.600	738912.310	63.610	2.775	1200			Manhole	Adoptable		1	2.000	60.835	225	Circular
											0	2.001	60.835	225	Circular
FW09	712294.440	738910.260	63.750	2.992	1200			Manhole	Adoptable		1	2.001	60.758	225	Circular
											0	2.002	60.758	225	Circular
FW08	712279.062	738910.980	63.610	2.955	1200			Manhole	Adoptable		1	2.002	60.655	225	Circular
											0	2.003	60.655	225	Circular
FW02	712277.870	738880.660	63.800	3.347	1200			Manhole	Adoptable		1	2.003	60.453	225	Circular
											2	1.004	60.453	225	Circular
											0	1.005	60.453	225	Circular

FW01	712252.600	738881.810	62.830	2.546	1200			Manhole	Adoptable		1	1.005	60.284	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 for public realm areas	Regular Maintenance	Brushing (Standard cosmetic sweep over whole surface)	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
			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
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