PUNCH
consulting engineers

182186: Priorsland Cherrywood SHD

Engineering Planning Report

March 2022

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PL0	Planning Issue	31/03/2022	MC. Daly	P. Casey	P. Casey

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1.0 Introduction

This report was prepared to accompany a planning application for the proposed development on the site located at Priorsland, Cherrywood, Dublin 18. This report deals specifically with the surface water drainage, foul water drainage and watermain design for this application. This report has been prepared in compliance with the "*Greater Dublin Regional Code of Practice for Drainage Works*", "*Greater Dublin Strategic Drainage Study*" and the "*Irish Water Code of Practice for Wastewater Infrastructure*".

The subject site is currently a greenfield site, with low intensity agricultural use. The Carrickmines river runs through the site from west to east.

The Priorsland site within the Client's ownership has an area of approximately 8.751 hectares in total. The proposal outlined in this planning application is for the development of approximately 6.8 hectares of the Priorsland site. The proposed works are outlined in a series of architectural drawings prepared by MOLA Architects and engineering drawings prepared by PUNCH Consulting Engineers - supplied as part of the planning documentation.

The development will comprise a mixed-use village centre and residential development of 443 no. units comprising 6 no. blocks (A-F) of apartments (up to 5 storeys with basement/undercroft parking) providing 402 no. apartments units (146 no. 1-beds; 218 no. 2-beds and 38 no. 3-beds), and 41 no. houses (19 no. 3-beds and 22 no. 4-beds). All apartments provided with private balconies/terraces. Provision of indoor residential facilities to serve apartment residents.

The Village Centre and non-residential elements will comprise a supermarket, local retail/retail service units, non-retail commercial units, creche, gym, community space, and offices (High Intensity Employment) use.

Provision of car/bicycle/motorcycle parking; ESB sub-stations; bin storages areas, and all associated plant areas.

Provision of the first phase of Priorsland Park (on lands within the applicant's ownership) and other public and communal open spaces.

Construction of Castle Street through the subject lands and two road bridges across the Carrickmines Stream, one to serve the future school site/ park, the second to provide pedestrian and cyclist access to the Carrickmines Luas station and future Transport Interchange to the north. Provision of an additional pedestrian bridge to the park. Provision of an acoustic barrier along the southern/western edge of the site.

All associated site development works, landscaping, boundary treatments and services provision.

Figure 1-1 and Figure 1-2 below indicates the location of the proposed development at Priorsland.

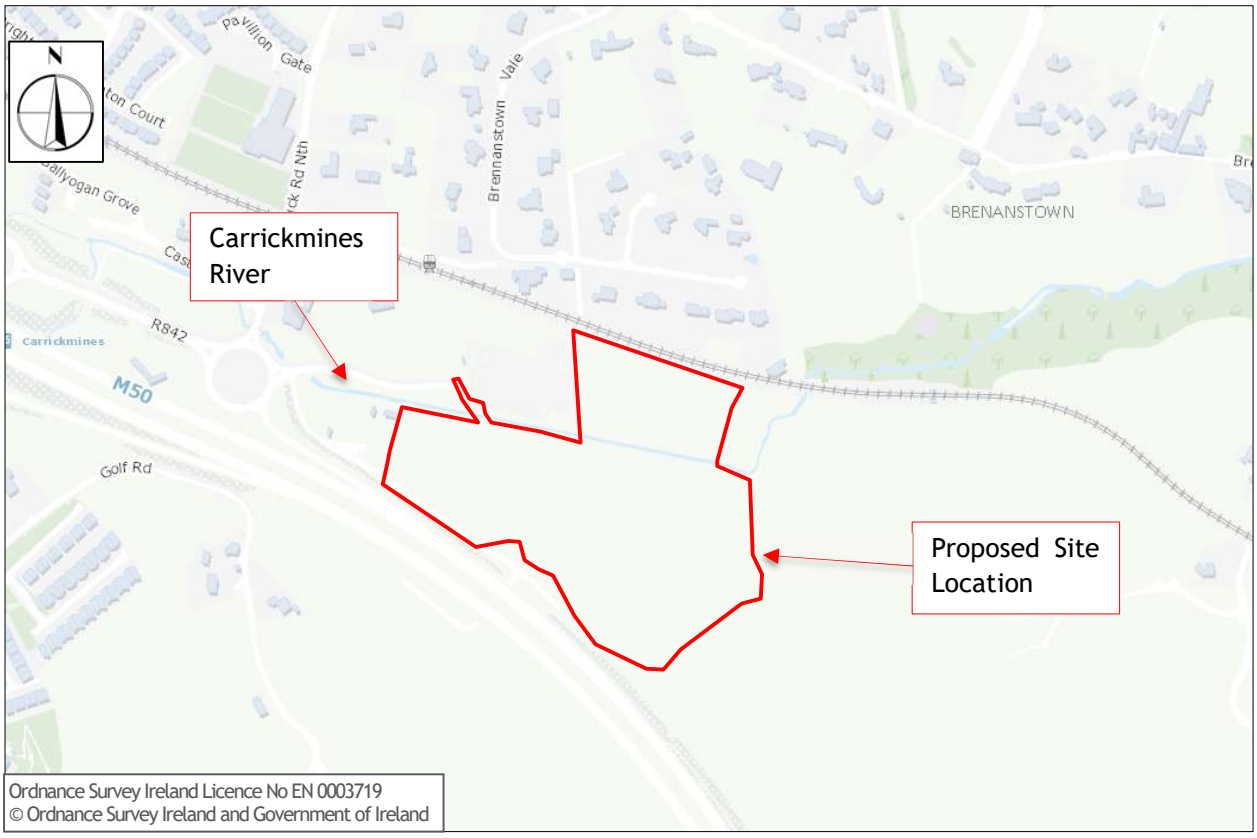

Figure 1-1: Plan View of Site Location at Priorsland, Cherrywood, Dublin 18

Figure 1-2: Aerial View of Existing Site at Priorsland, Cherrywood, Dublin 18

In preparation of this report, and design of the development, PUNCH Consulting Engineers have liaised with the following parties:

1. Dún Laoghaire Rathdown County Council, Development Agency Project Team, Cherrywood SDZ
2. Irish Water

2.0 Foul Water Drainage Design

2.1 Existing Foul Water Drainage

On the basis of available records, the following foul water drainage exists in the vicinity of the development site

1. A 750mm concrete public sewer runs from east to west through the site parallel to the Carrickmines River.
2. A 225mm diameter uPVC public sewer connects from a housing estate to the north of the development into the 750mm sewer within the proposed development site.

Refer to Figure 2-1 below and Appendix A for illustration of the existing combined sewer network.

As the site is a greenfield site, there are no existing/baseline foul water flow rates from the site.

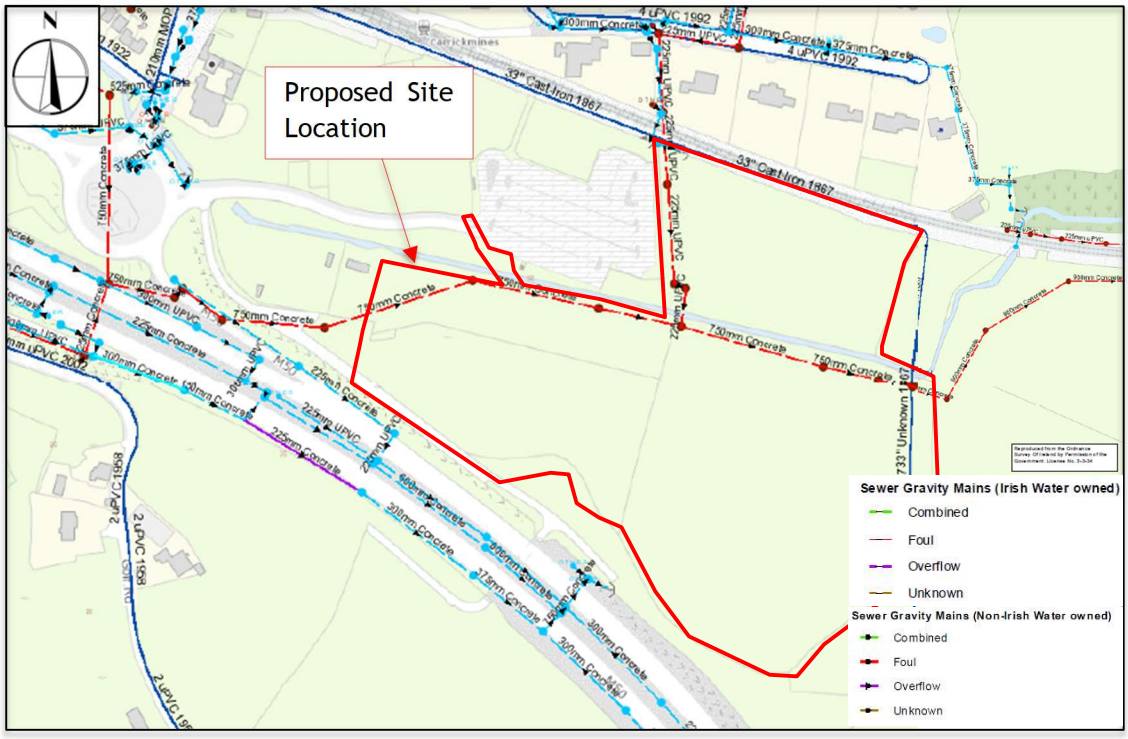

Figure 2-1: Existing Public Watermain & Foul Drainage in the Vicinity of the Priorsland Site (According to Irish Water Records)

2.2 Proposed Foul Water Drainage

2.2.1 General

It is proposed to connect the development sewerage to the existing 750mm concrete sewer that traverses the site, from west to east.

Foul water drainage has been designed with reference to the following documentation:

1. DLRCC Cherrywood Planning Scheme Chapter 4: Physical Infrastructure
2. DLRCC Cherrywood Planning Scheme Chapter 6: Development Areas
3. Greater Dublin Strategic Drainage Study (GDSDS)
4. Recommendations for Site Development Works for Housing Areas, published by Department of the Environment and Local Government
5. Code of Practise for Wastewater Infrastructure, published by Irish Water
6. Design Recommendations for Multi-storey and Underground Car Parks, published by the Institution of Structural Engineers.
7. Greater Dublin Regional Code of Practice for Drainage Works
8. Wastewater Engineering: Metcalf & Eddy

2.2.2 Irish Water Confirmation of Feasibility

Two *Confirmation of Feasibility* letters have been obtained from Irish Water for the connections for the proposed development. The first, obtained in February 2020 confirms a development of 454no. units can connect to the water and wastewater public infrastructure without upgrades being required to the public networks. The second, obtained in March 2020 confirms a development of 2,902no. units can connect to the water and wastewater public infrastructure without upgrades being required to the public networks. These Confirmation of Feasibility letters have both been included in Appendix E.

2.2.3 Proposed Foul Water Flows

On the basis of the documentation referenced in section 2.2.1 above, the following wastewater characteristics have been taken:

I. 150 litres/person/day ('Standard Residential')
II. Allowance of 2.7 persons per dwelling
III. 10% increase in flow to allow for infiltration

Table 1 presents the foul flows for the development, indicating existing, total and net increase. The total dry weather flow (DWF) was calculated as 2.564 l/s. The sewers are designed for the peak flow of 6DWF with 10% infiltration, which was calculated as 16.921 l/s.

It is noted that the development will incorporate water conservation measures in the sanitary facilities throughout. These will include low flow dual flush toilets, and monobloc low volume push taps. These will reduce the foul discharge from the development.

Table 1: Foul Sewerage Dry Weather Flow

Source	Quantity	Unit	Flow	Flow unit	Daily	DWF	DWF	6 DWF	6 DWF + 10% infiltration
					(litres/ day)	m^3/day	litres/ sec	litres/ sec	litres/ sec
Domestic	443	units	446	l/unit/day	197578	197.578	2.287	13.721	15.093
Supermarket	1306	m^2	400	l/day/100m^2	5224	5.224	0.060	0.363	0.399
Retail	715	m^2	400	l/day/100m^2	2860	2.860	0.033	0.199	0.218
Non-retail	213	m^2	300	l/day/100m^2	639	0.639	0.007	0.044	0.049
Creche	513	m^2	750	l/day/100m^2	3848	3.848	0.045	0.267	0.294
Gym	155	m^2	750	l/day/100m^2	1163	1.163	0.013	0.081	0.089
Residential Facilities	551.8	m^2	750	l/day/100m^2	4139	4.139	0.048	0.287	0.316
High Intensity Employment	708	m^2	750	l/day/100m^2	5310	5.310	0.061	0.369	0.406
Community Facilities	252	m^2	300	l/day/100m^2	756	0.756	0.009	0.053	0.058
Total					221516	221.516	2.564	15.383	16.921

2.2.4 Proposed Foul Water Drainage System

The proposed foul water drainage system will have two principal components:

I. Foul water from the ground and upper levels of all buildings, discharging by gravity.
II. Foul water from Block A/Block B's basement, pumped from the basement.

These are explained further below.

Foul water from the terraced houses and apartment blocks – from ground floor to roof level – will be discharged to the proposed foul drainage network. The foul drainage network is proposed to ultimately discharge to the existing 750mm foul sewer the runs parallel to the Carrickmines River within the site boundary.

The proposed access route to the Priorsland site will be via the Luas Park & Ride Access Road (via the M50 Southbound Roundabout) and is an interim arrangement for construction access.

Once the Castle Street extension becomes viable, and is completed in its entirety, Castle Street to the east of Priorsland will become the standard, on-going access route for the Priorsland development. This will have no effect on the proposed foul water drainage arrangement or discharge point for the site.

Please refer to PUNCH Drawing No. 182186-023, 182186-024 and 182186-025 for details of the proposed foul water drainage system.

2.2.5 Compliance with CPS Chapter 4

The proposed works are in compliance with the requirements of Chapter 4 of the CPS.

Table 2: Specific Objectives set out in Chapter 4 Section 4.1.2 of the CPS

Specific Objective	Response
PI 12 It is an objective that significant foul trunk sewer infrastructure is provided within the Planning Scheme area.	The existing 750mm trunk sewer located within the Priorsland site is proposed to remain as per the existing regime. This is in line with Map 4.4 of the CPS. Please find extract of Map 4.4 in Figure 2-2 below.

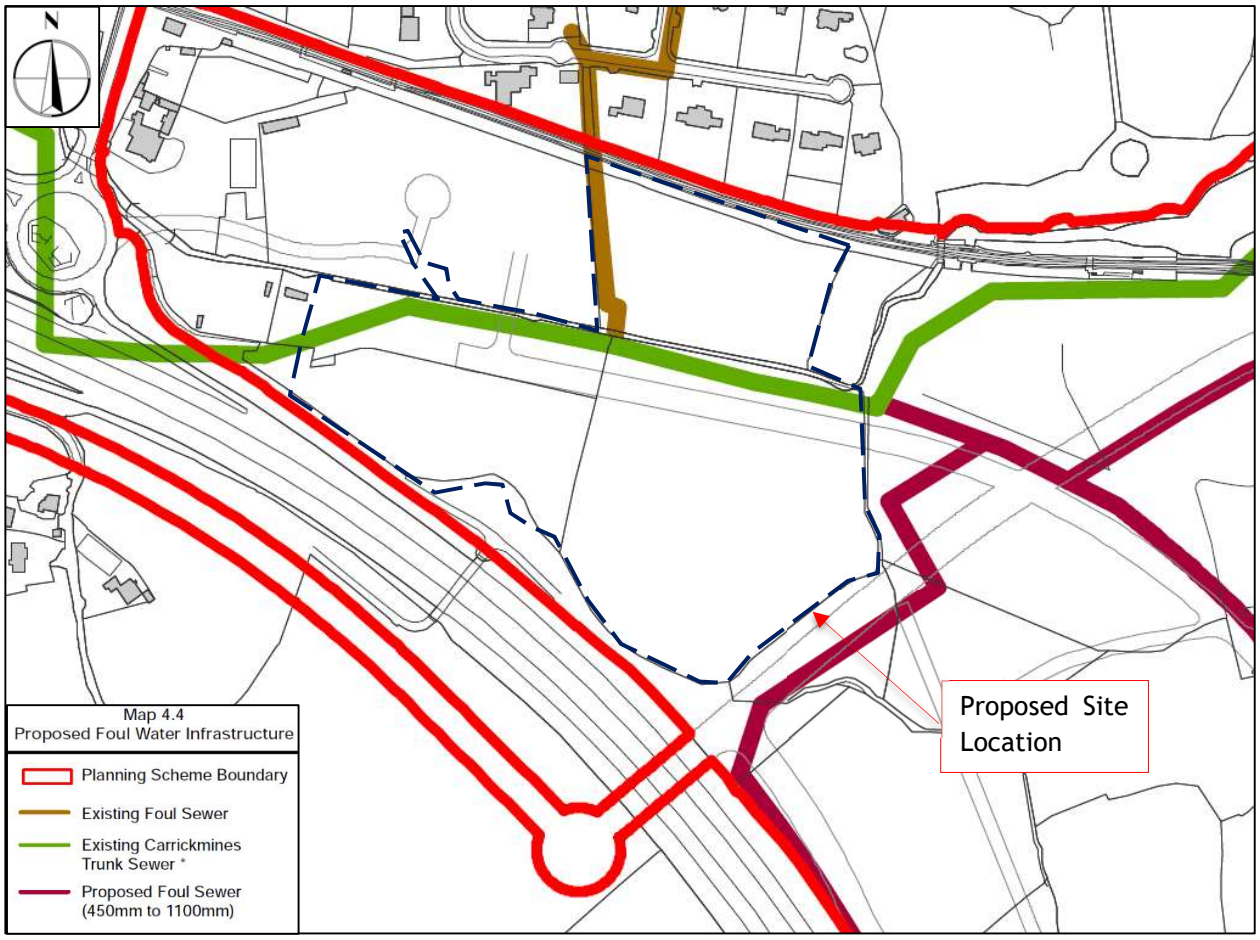

Figure 2-2: Extract from Map 4.4 of the Cherrywood Planning Scheme Chapter 4

3.0 Surface Water Drainage Design

3.1 Existing Surface Water Drainage

3.1.1 Public Surface Water Sewerage

As the Priorsland site is a greenfield site, there is no existing surface water drainage system within the site boundary. A surface water drainage system has been developed to the east of the site, as per Planning Application Reference: DZ15A/0758. However, due to the flow path and levels of the Carrickmines River and Ticknick Stream it is not feasible to propose a connection to the existing drainage system to the east of the Priorsland site.

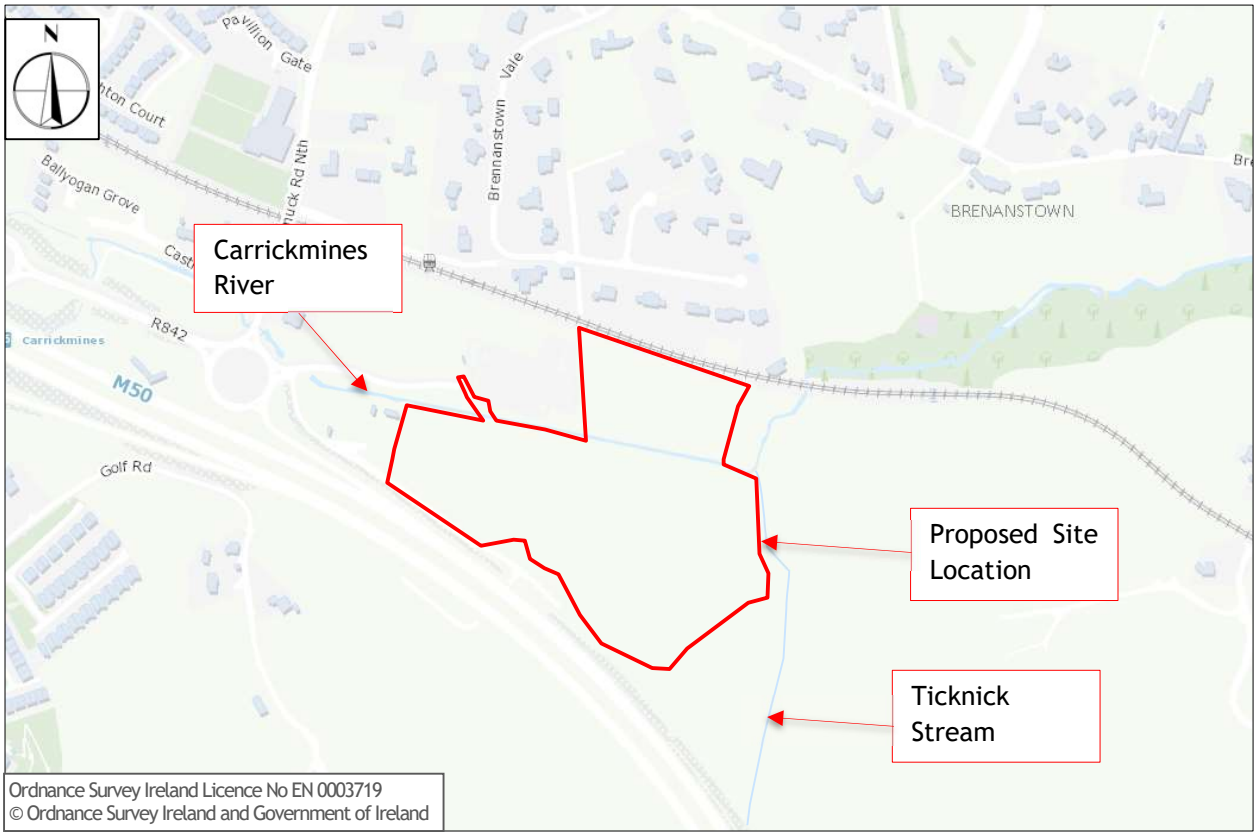

Figure 3-1: Water Courses in the vicinity of the Proposed Development

3.2 Proposed Surface Water Drainage

3.2.1 General

A new surface water sewer network shall be provided for the proposed development which will be entirely separated from the foul water sewer network.

The proposed surface water drainage system has been designed with reference to the following documents:

I. DLRCC Cherrywood Planning Scheme Chapter 4: Physical Infrastructure
II. DLRCC Cherrywood Planning Scheme Chapter 6: Development Areas
III. CIRIA SuDS Manual 2015 C753 – The SuDS Manual
IV. CIRIA Publications C644 – Building Greener
V. Greater Dublin Strategic Drainage Study (GDSDS)
VI. Greater Dublin Regional Code of Practice for Drainage Works
VII. Recommendations for Site Development Works for Housing Areas - Department of the Environment and Local Government

3.2.2 Design Parameters

Table 3 outlines the design parameters that have been used throughout the design process.

IGSL Limited carried out site investigations in November 2018 at the Priorsland site. Testing was performed in accordance with BRE Digest 365 'Soakaway Design'. Infiltration rates in 4no. instances were between 0.00017m/min and 0.00097m/min. In one other instance an infiltration rate of 0m/min was observed. This was due to high rock in the location of the test. The measured infiltration rates were therefore moderate and infiltration SuDS systems were therefore deemed acceptable for this site. It is noted that the levels on site will be raised by approx. 1-2m for flood risk mitigation at the site. To ensure that the infiltration rate is not compromised where infiltration systems are proposed, an appropriate granular engineering fill material will be specified, and a method statement will be prepared to ensure it is compacted appropriately but retains high infiltration rates at the site. Infiltration testing will be carried out during the works to ensure a high infiltration rate has been achieved.

Groundwater was encountered during the site investigation works at various depths in the boreholes, rising to within 0.6m of the existing surface level in places. Standpipes were installed in selected locations to facilitate long-term monitoring.

It should be noted however, that to facilitate the flood risk protection of the site, the site is proposed to be raised in level. Therefore, the proposed finished level of the site is circa 1m to 2m greater than the existing site levels. Therefore, groundwater should not be an issue for proposed infiltration elements.

Table 3: Design Parameters Used in the Drainage Design

Parameter	Value	Notes
Total Site Area	8.751 ha	Total site area owned by the Client.
Development Site Area	6.8 ha	The lands within the Client's ownership to the north of the Carrickmines River are not proposed to be developed as part of this application.
SOIL	3	Confirmed by geotechnical investigation works carried out by IGSL Limited in November 2018.
SPR Value (% runoff)	0.37	As per the FSR procedure
M5-60	16.900	Value obtained from Met Éireann
M5-2day	62.100	Value obtained from Met Éireann
Ratio R	0.273	M5-60/ M5-2day
Climate Change	10%	GDSDS

3.2.3 Causeway Flow Modelling - General

The proposed surface water drainage system has been designed using Causeway Flow software in accordance with the Department of Environment and Local Government's guidance document

"Recommendations for Site Development Works for Housing Areas", with guidance taken from the "Greater Dublin Strategic Drainage Study" (GDSDS) and the Dún Laoghaire-Rathdown County Council Cherrywood SDZ Planning Scheme.

The model has analysed a range of storms at the 1% AEP (1 in 100-year return period storm), with a 10% additional rainfall to allow for climate change in accordance with the requirements of the Cherrywood SDZ Planning Scheme.

The network has been modelled with the proposed attenuation tank volumes and associated hydrobrake flow control outlets included.

The contributing areas are as follows:

Location	Buildings, paved areas (contribution rate of 100%)	Soft Landscaping (contribution rate of 40%)	Total Contributing Area	Effective Contribution Area
Plot A & B	0.777 ha	-	0.777 ha	0.777 ha
Plot C	0.353 ha	-	0.353 ha	0.353 ha
Plot D	0.172 ha	-	0.172 ha	0.172 ha
Plot E	0.477 ha	-	0.477 ha	0.477 ha
Plot F	0.214 ha	-	0.214 ha	0.214 ha
Plot G	1.003 ha	0.328 ha	1.330 ha	1.134 ha
Roads, footpaths, public areas	1.703 ha	-	1.703 ha	1.703 ha
Total	4.699 ha	0.328 ha	5.027 ha	4.830 ha

In line with the Cherrywood SDZ Planning Scheme requirement of a discharge rate of 1 l/s/ha, the discharge from the proposed development has been limited to 5 l/s due to the contributing area of 5.027 ha.

Depths of water in the network model (including pipework, manholes, the attenuation tanks and hydrobrakes) have been assessed for surcharging and flood risk. The model is established such that a flood risk is identified in the model results if the water rises to within 300mm of the cover level. If the water level rises to a level below this, it is identified as a surcharge within the model results. It is important to note that this warning is given related to proposed ground level at the node and not related to Finished Floor level. All proposed drainage is within roadways, and the adjacent Floor levels will be higher than the road level at that location.

Causeway includes a design setting called "additional storage". This is included in the software to account for storage volume in the network provided by secondary drainage including access junctions, inspection chambers, service connections etc. This provides additional storage in the network above the storage provided within the attenuation tank and primary drainage network. $20m^3$/ha is the standard allowance provided for in Causeway Flow and was utilised for this design.

Please refer to detailed Causeway calculations (inputs and outputs) enclosed in Appendix C for details. It should be noted that attenuation tanks for Plots A & B, Plot C, Plot D, Plot E and Plot F have been sized individually, and outflows from each tank have been included in the main site Causeway Flow model as additional inflows to the model. Storage calculations for each plot have been included in Appendix C also.

In order to achieve a flow rate of 5 l/s at the discharge point from the site to Ticknick stream, it is necessary to include flow restrictions throughout the site. High level overflows with high level alarms will be included in each hydrobrake chamber and linked to the building management system so the site management will be alerted if a hydrobrake is blocked.

3.2.4 Surface Water Management Objectives: CPS Chapter 4 and Chapter 6

PUNCH has held pre-planning consultation with DLRCC.

Map 4.2 of the CPS illustrates the overall proposed storm water network intention for the CPS. Please refer to Figure 3-2 below for the storm water intention in relation to the catchment in which the Priorsland site is located. A detention basin is indicated along the southern boundary of the Priorsland site, bordering the M50. The red-line boundary, i.e. lands within the Client's ownership, dissects the proposed detention basin location. Therefore, the full detention basin proposal cannot be delivered with this planning application. However, an alternative proposal of swales and a detention basin has been proposed to serve the Priorsland site. When the owner of the lands of the remaining section of the detention basin is in a position to develop his lands, it will be possible to link the detention basins in both areas to conform with the CPS requirements.

The Carrickmines River runs from east to west through the site and the Ticknick Stream borders the site to the east. Due to site topography and the locations of the Carrickmines River and the Ticknick Stream the detention basis associated with the proposed development will not be able to serve other adjacent developments. It would not be feasible to cross the Carrickmines River and the Ticknick Stream with a surface water network to connect to the proposed detention basin. Therefore, the detention basin proposed for the Priorsland site will only serve the Priorsland site.

A 1d-2d linked hydraulic model has been prepared for the proposed development. The results of this modelling have been presented in a Site-Specific Flood Risk Assessment under separate cover submitted with this planning application. The model indicates the proposed detention basin are located outside of a floodplain.

Table 4: Specific Objectives set out in Chapter 4 Section 4.1.2 of the CPS

Specific Objective	Response
PI 6 *It is an objective to promote Sustainable Urban Drainage Systems (SuDS) to manage surface and groundwater regimes sustainably.*	SuDS are being used throughout the development. Castle Street is being treated as a Public Realm area as it will ultimately be taken in charge. The following SuDS measures have been used on Castle Street: 1. Infiltration trenches 2. Engineered swales 3. Tree Root Structural Cell Systems The surface water network then connects to the private drainage within the development, to the south of Castle Street. This strategy was taken as Castle Street is "land locked", i.e. bordered to the north by the Carrickmines River and to the east by the Ticknick Stream. Therefore, the network could not be discharged by gravity

	to the public drainage network to the east of the Ticknick Stream and therefore cannot discharge to Pond 2A/2B. As the surface water could not be discharged to a watercourse without treatment it was agreed with DLRCC representatives that the best strategy was to connect to the networks to the south of Castle Street, which are deemed as Private Development. The following SuDS measures are proposed within Private Development Site Boundaries, i.e. to the south of Castle Street: 1. Green Roofs 2. Pervious Paving, where water enters the storage sub-base layer via gullies/drainage channels 3. Infiltration Trenches 4. Engineered swales 5. Tree Root Structural Cell Systems The networks will then outfall to a detention basin proposed along the southern boundary of the site. This will be within the public realm. The network will then ultimately outfall to the Ticknick Stream to the east of the proposed development. The runoff from the development will be restricted to 1l/s/ha and the final outfall pipe from the site will be 150mm in diameter.
PI 7 *It is an objective to ensure that stormwater management, flood attenuation and Sustainable (Urban) Drainage Measures (SuDS), including a requirement to undertake Stormwater Audits, shall form part of the pre-planning, planning and post construction stages of any application.*	A stormwater management strategy has been developed for the site, which includes a SuDS management train. Flood attenuation measures for the Carrickmines River has been included with this development. This is detailed further in the Site-Specific Flood Risk Assessment submitted under separate cover with this planning application. JBA Consulting were appointed to carry out a Stormwater Audit for this development. DLRCC were engaged with during the pre-planning stage of the project.
PI 8 *It is an objective to ensure that SuDS measures shall be fully implemented on all sites to 1 litre per second per hectare runoff rates, unless otherwise agreed with Dún Laoghaire Rathdown County Council. In this regard solutions other than tanking systems shall be required for all developments. For larger*	The surface water proposals for the site incorporate SuDS and flow restrictions to restrict positive discharge from the development to 1l/s/ha. SuDS that allow infiltration to ground have been included in the design as far as possible. Green roofs have been included in the residential blocks. Intensive green roofs have been incorporated to the designs at podium level in the apartment blocks and extensive green roofs have been incorporated in the apartment blocks at roof level. 60% roof coverage has been attained with the green roof proposals.

applications Green Roofs shall be used in accordance with Dún Laoghaire-Rathdown County Council's Green Roofs Guidance Document.	
***PI 9** It is an objective to ensure urban areas are designed to accommodate surface water flood flow at times of extreme events through the dual use of roads and pathways as flood conveyance channels and low value areas (parkland, car parks, large paved areas etc) used as temporary flood ponding areas.*	Entrances to all buildings are above the adjacent road levels. The site generally slopes from north to south. Therefore, surface water flood flow at times of extreme events will be running water and will not have the depth to enter buildings. The water will be conveyed to the landscaped strip lining the southern boundary of the site. This is where engineered swales and detention basins are located. Therefore, these SuDS measure could be surcharged for a time, but these systems will enable the surface water to be discharged to the Ticknick Stream as the extreme weather event subsides.
***PI 10** It is an objective to ensure that all trees planted in/adjacent to hard paved areas (footpaths, parking areas etc) incorporate tree root structural cell systems.*	Trees planted in or adjacent to hard paved areas incorporate tree root structural cell systems.
***PI 11** It is an objective to ensure that predicted flooding in the Priorsland area does not pose an unacceptable risk to persons or property. In this regard a flood containment zone shall be constructed in the Priorsland area by raising adjacent ground levels approx. 500mm and by incorporating a large diameter (1650mm) bypass culvert.*	A flood containment zone and bypass culvert for the Carrickmines River has been included with this development. This is detailed further in the Site-Specific Flood Risk Assessment submitted under separate cover with this planning application. Site levels are a minimum of 500mm above the 1 in 1000 year flood event in the Carrickmines River.

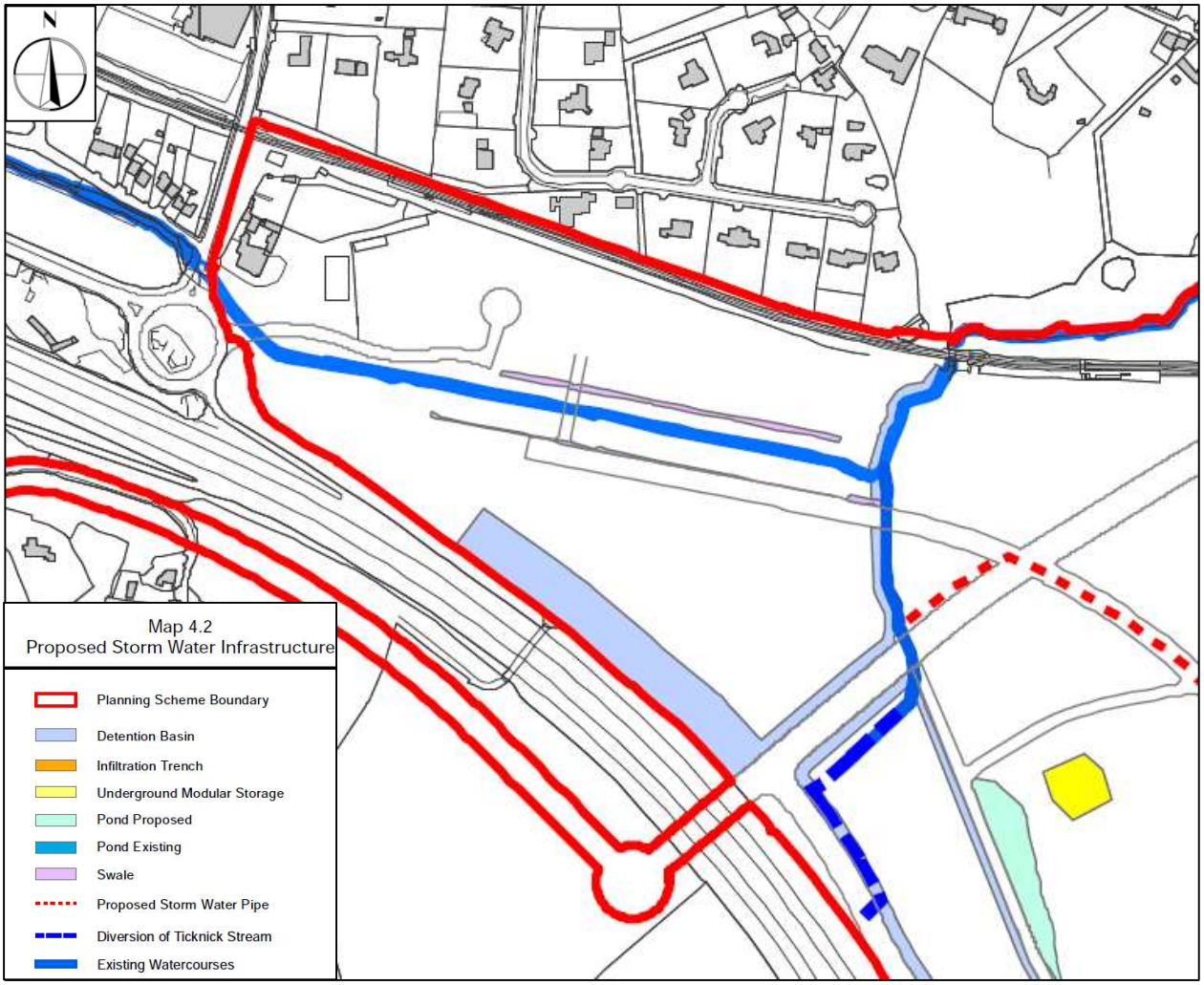

Figure 3-2: Extract from Map 4.2 of the Cherrywood Planning Scheme Chapter 4

3.2.5 Compliance with the GDSDS

There are 4 criteria as set out in the GDSDS-RDP Volume 2 Section 6.3.4 (table 6.3).

1) River water quality protection: the initial 5-10mm of rainfall is to be intercepted or treated (<1 year return period)
2) River regime protection: the discharge rate from the site will be 1l/s/ha and will cater for the 1 in 100 year event. This is as per the CPS and is stricter than the GDSDS.
3) Level of service (flooding) for the site:
    a. No flooding on site, except where planned (30 year high estimated rainfall).
    b. No internal property flooding (100 year high intensity rainfall event).
    c. No internal flooding (100 year river event and critical duration for site).
    d. No flooding off site except where specifically planned (100 year high intensity rainfall event).
4) River flood protection: Attenuation storage is provided with a discharge rate of 1l/s/ha. This is as per the CPS and is stricter than the GDSDS.

The mitigation measures proposed as part of the Site-Specific Flood Risk Assessment and the SuDS management train will allow the development to comply with the items 1-4 noted above.

3.2.6 Proposed Drainage Network

The surface water runoff from the proposed development is to be entirely separate from the development's foul sewerage network development drainage.

All surface water run-off from roof areas and hardstanding areas shall be collected 4no. networks that drain from north to south through the site. The networks have a restricted flow rate and will discharge to a series of engineered swales and a detention basin to the south of the site. The detention basin then ultimately discharges to the Ticknick Stream to the east of the site.

Please refer to PUNCH Drawings No.182186-020, 182186-021, and 182186-022 for details of the proposed surface water drainage system. The networks have been modelled using Causeway Flow. Calculation and results are included in Appendix C.

The proposed access route to the Priorsland site will be via the Luas Park & Ride Access Road (via the M50 Southbound Roundabout) and is an interim arrangement only.

Once the Castle Street extension becomes viable, and is completed in its entirety, Castle Street to the east of Priorsland will become the standard, on-going access route for the Priorsland development. This will have no effect on the proposed surface water drainage arrangement or discharge point for the site.

The SuDS management train is outlined in Section 3.3.

3.2.7 Suds Audit

As part of the planning stage design development, an independent Stage 1 SuDS Audit was undertaken by JBA Consulting Engineers in accordance with the Dun Laoghaire Rathdown County Council (DLRCC) Water Services procedure. The results of this audit were considered and incorporated where appropriate into the initial planning submission. This report has been submitted with this application under separate cover.

3.3 Sustainable Drainage Systems

3.3.1 Sustainable urban Drainage Systems

SuDS have been proposed in accordance with CIRIA SuDS Manual 2015 C753 – The SuDS Manual. SuDS elements have been identified for each area based on their suitability. Chapter 4 of the CPS identifies SuDS elements that are suitable for public areas and SuDS elements that are suitable for private areas. The SuDS management train has been developed within these requirements. Castle Street will ultimately be taken in charge, and therefore the SuDS on Castle Street are in line with Measures in Public Realm Areas as per Section 4.1.2 of the CPS. The proposed terraced houses, apartment blocks and associated infrastructure to the south of Castle Street has been proposed as private development and therefore, SuDS in these locations are in line with Measures within Private Development Site Boundaries as per Section 4.1.2 of the CPS. Figure 3-3 outlines the separation of the public and private areas. The proposed detention basin/regional pond for the Priorsland site is proposed to the south of the site. All surface water that cannot be infiltrated within the Priorsland site will discharge to the proposed detention basin/regional pond for final treatment prior to being discharged to the Ticknick Stream.

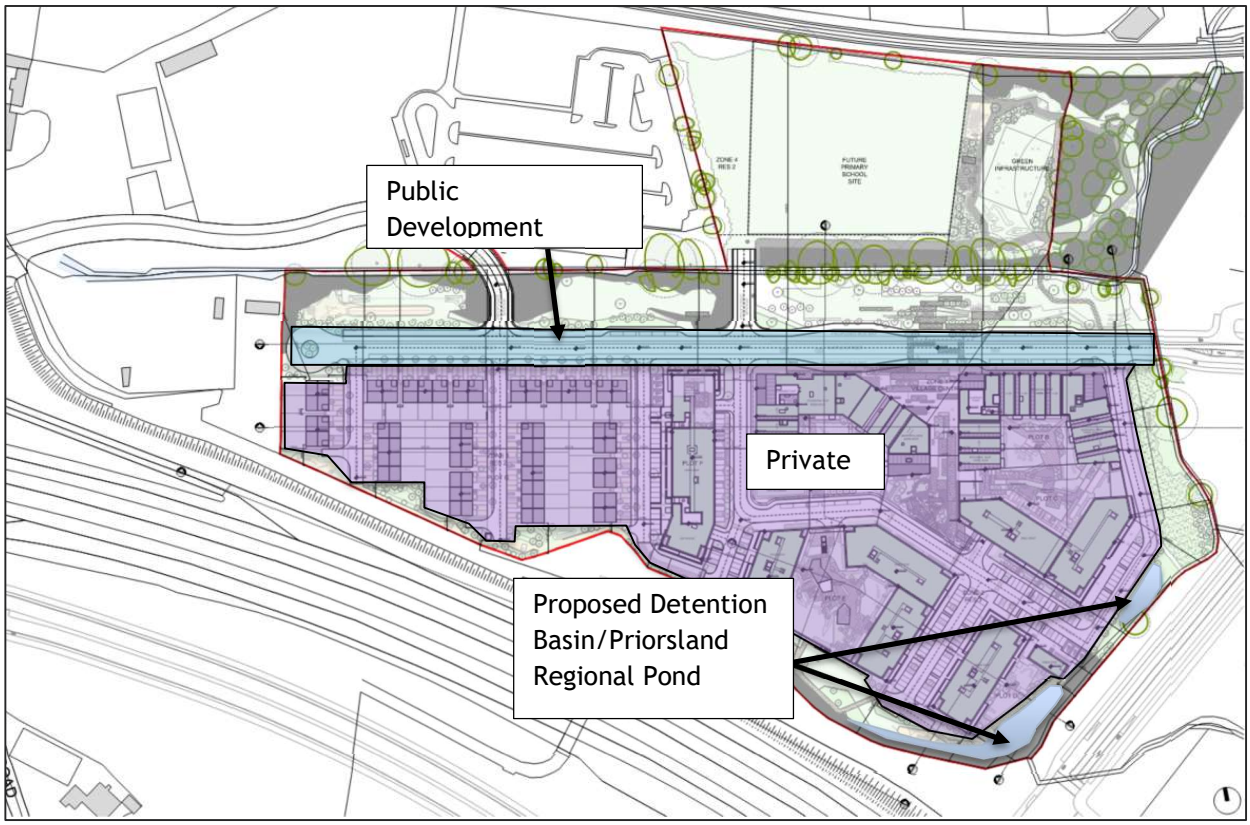

Figure 3-3: Public vs Private areas within the Proposed Development

Please refer to the flow chart below indicating the proposed SuDS train for the development. The blue cells indicate proposals that will be within the public realm and will therefore be taken in charge. The green cells indicate proposals within the private development, and therefore will not be taken in charge.

The SuDS Management Train

Castle Street

Interception:
1. Tree Root Structural Cell Systems
2. Infiltration trenches

Terraced Houses & Roads

Interception:
1. Rainwater harvesting (water butts) for housing
2. Infiltration trenches

Block F

Interception:
1. Green Roof (60% coverage of roof area)

Attenuation:
1. Tank, flow restricted to 1l/s/ha with hydrobrake

Blocks A&B

Interception:
1. Green Roof (60% coverage of roof area)

Attenuation:
1. Tank, flow restricted to 1l/s/ha with pump

Block C

Interception:
1. Green Roof (60% coverage of roof area)

Attenuation:
1. Tank, flow restricted to 1l/s/ha with hydrobrake

Block D

Interception:
1. Green Roof (60% coverage of roof area)

Attenuation:
1. Tank, flow restricted to 1l/s/ha with hydrobrake

Block E

Interception:
1. Green Roof (60% coverage of roof area)

Attenuation:
1. Tank, flow restricted to 1l/s/ha with hydrobrake

Legend:

To be taken in charge by DLRCC

Not to be taken in charge by DLRCC

Homezone (Terraced Housing) Roads

Interception:
1. Tree Root Structural Cell Systems
2. Infiltration trenches

Apartment Block Roads

Interception:
1. Tree Root Structural Cell Systems
2. Infiltration trenches

Attenuation:
1. Pervious paving
2. Attenuation Tank

Outflow restricted to 1l/s/ha

Attenuation:
1. Pervious paving & attenuation tanks. Restricted outflow to 1l/s/ha

Engineered Swales

Regional Pond/Detention Basin

Discharge to Ticknick Stream at 1l/s/ha = 5l/s

3.3.2 Surface Water Quantity Management

The proposed surface water network for the development has been modelled using Causeway Flow Software. Discharge from each of the plots and the overall development has been limited to 1l/s/ha. Please refer to Appendix C for outputs from WinDes demonstrating compliance with the discharge rate criteria. A 10% allowance for climate change has been included in the calculations.

The following sections indicate how each of the SuDS proposals contribute to reducing and restricting the discharge rate from the site.

3.3.2.1 Green Roofs

It is proposed to provide a large extent of both intensive and extensive green roofs within the proposed development. These shall be provided at roof level (Blocks A, B, C, D, E, F) and at podium level (Blocks A/B, C, E). Green roofs have been designed taking guidance from CIRIA Publications C644 – "*Building Greener*" and C697 – "*The SUDS Manual*".

Green roofs are widely recognised as an effective SuDS solution and an important tool in mitigating the adverse effects of development on rainfall run-off and for managing urban flood risk. Research in the UK by Kellagher and Lauchlan (2005)[1] and CIRIA C753 (The SuDS Manual) indicates that green roofs are effective in providing both attenuation and volume reduction in runoff for minor rainfall events.

It is proposed to use both Intensive and Extensive green roofs, which are defined as follows:

A. Intensive Green Roofs: These are typically landscaped environments with high amenity benefits, which include lawns, planters or trees and are usually accessible.

   Topsoil Substrate Depth: 450mm – 1000mm

B. Extensive Green Roof: These are typically areas containing vegetation such as sedums and small grasses, which require less maintenance than other green roof types, and no permanent irrigation system.

   Topsoil Substrate Depth: 100mm

The external areas at podium level include proposed landscaped areas, which shall be designed as an intensive green roof. The depth of the transfer slab located underneath the podium area will be reduced as much as possible in order to maximize the substrate depth available for the proposed green roofs. This area will act as an open green space for residents and a play area for children. This will improve water quality, reduces water quantity being discharged from the site, offers an amenity to residents and offers a biodiversity element to the site also (addressing the four pillars of SuDS design for the site).

There shall be an extensive sedum green roof provided at roof level for all the multi storey apartment blocks. The green roof areas proposed have been maximised, taking into account requirements for M&E plant at roof level. Where at the upper roof level there are areas that have not been covered with an extensive greenroof system, the surface water from these areas will be conveyed as far as possible to discharge to the intensive greenroof at podium level. Interception storage has therefore been maximised for roof areas on the site.

The overall site coverage for green roofs and soft landscaped areas (at podium level and upper roof level) is greater than the minimum required 60% of the roof area. Assuming 5% of the substrate depth is available for water storage, the green roofs shall provide interception storage for the first 10mm of rainfall, as required by the GDSDS criteria for River Water Quality Protection.

[1] Kellagher and Lauchlan (2005), *Use of SuDS in high density developments*

Please refer to PUNCH Drawings 182186-020, 182186-021 and 182186-022 for the locations of the green roofs, and Table 5 and Table 6 for interception storage calculations. Proposals should be read in conjunction with the Architect's and Landscape Architect's drawings for the proposed development.

3.3.2.2 Permeable Paving

IGSL Limited carried out site investigations in November 2018 at the Priorsland site. Testing was performed in accordance with BRE Digest 365 'Soakaway Design'. Infiltration rates in 4no. instances were between 0.00017m/min and 0.00097m/min. In one other instance an infiltration rate of 0m/min was observed. This was due to high rock in the location of the test. The measured infiltration rates were therefore moderate and infiltration SuDS systems were therefore deemed acceptable for this site.

Groundwater was encountered during the site investigation works at various depths in the boreholes, rising to within 0.6m of the existing surface level in places. Standpipes were installed in selected locations to facilitate long-term monitoring.

It should be noted however, that to facilitate the flood risk protection of the site, the site is proposed to be raised in level. Therefore, the proposed finished level of the site is circa 1m to 2m greater than the existing site levels. Therefore, groundwater should not be an issue for proposed infiltration elements.

Therefore, a pervious pavement system with partial infiltration is proposed, as per CIRIA C753 (The SuDS Manual). The base of the pervious pavement build-up will be permeable and a drainage network within the build-up will accommodate removal of excess water.

As proposals where surface water accesses the underground storage via gaps in interlocking paving will not be permitted, conventional impermeable surfaces will be provided. Grilles, gullies, or similar, that are easily maintained are proposed to carry the water from surface level and discharge it to the storage layer underneath.

CIRIA C753 (The SuDS Manual) notes that regarding interception design of pervious pavements, studies have shown that runoff typically does not occur from pervious pavements for rainfall events up to 5 mm. Please refer to Table 24.6 of CIRIA C753.

The subbase layer of the pervious pavements will provide attenuation for the proposed development. The pervious pavements have been modelled as part of the Causeway Flow software model produced for the development. The positive discharge from each zone has been limited to 1l/s/ha for the 1% AEP (1:100-year storm return period) storm, with 10% additional rainfall to allow for climate change.

3.3.2.3 Infiltration trenches

Proposed gullies along the development's roadways will discharge to a SuDS element for interception and treatment prior to entering the drainage network.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of infiltration trenches, roads drained by infiltration trenches can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

The infiltration trenches will then provide a level of attenuation storage within the voids in the stone within the trench. The infiltration trenches have been modelled as part of the Causeway Flow software model produced for the development. The positive discharge from each zone has been limited to 1l/s/ha for the 1% AEP (1:100-year storm return period) storm, with 10% additional rainfall to allow for climate change.

3.3.2.4 Engineered swales

The surface water network from the proposed terraced housing zone will discharge to a series of swales prior to outfalling to the detention basin/regional pond. Due to the moderately permeable nature of the site it is expected that a level of surface water can be filtrated to ground.

The engineered swales will provide a level of attenuation storage. The engineered swales have been modelled as part of the Causeway Flow software model produced for the development. The positive discharge from each zone has been limited to 1l/s/ha for the 1% AEP (1:100-year storm return period) storm, with 10% additional rainfall to allow for climate change.

3.3.2.5 Tree Root Structural Cell Systems

Proposed gullies along the development's roadways will discharge to a SuDS element for interception and treatment prior to entering the drainage network.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of Tree Root Structural Cell Systems, if unlined can be assumed to comply where the impermeable surface area is less than 5 times the vegetated surface area receiving the runoff. They can be designed to deliver Interception for larger areas, where suitable infiltration capacity is available.

The Tree Root Structural Cell Systems will then provide a level of attenuation storage within the voids in the stone within the trench. The Tree Root Structural Cell Systems have been modelled as part of the Causeway Flow software model produced for the development. The positive discharge from each zone has been limited to 1l/s/ha for the 1% AEP (1:100-year storm return period) storm, with 10% additional rainfall to allow for climate change.

3.3.2.6 Attenuation Tank

The proposed attenuation tanks within each of the apartment blocks, in conjunction with the proposed pump is sized to reduce the runoff from the site to 1l/s/ha for the 1% AEP (1:100 year storm return period) storm, with 10% additional rainfall to allow for climate change. The attenuation tanks are to be located under the basement or ground floor slab for each of the buildings.

3.3.2.7 Interception

Please refer to Table 5 and Table 6 below. Table 5 indicates the total contributing hardstanding area to be drained (50,403 m²) and the corresponding breakdown of areas from the total contributing hardstanding area captured by each SuDS type. Table 6 shows the total area that each proposed SuDS element could potentially cater for interception storage (56,632.5 m²). The area potential for interception storage calculated in Table 6 exceeds the required area to be intercepted in Table 5. Therefore, the interception requirement for the site is met. All areas are captured by an interception mechanism.

Table 5: Contributing Areas and Areas Intercepted by Each SuDS Type

Plot	Contributing Area from hard surfaces (m²)	Area Intercepted per SuDS Type				
		Greenroof (m²)	Bio-Retention (m²)	Infiltration Trenches (m²)	Storage stone under paved surface and structured tree pit systems (m²)	Swale and Detention ponds (m²)
Block A Roof	**2493**	1567				926
Block A Podium	**1094**		1094			
Block B Roof	**2310**	1384				926
Block B Podium	**809**		809			
Podium between Block A and Block B	**1410**		264			1146
Block C Roof	**1870**	1578				292
Block C Podium	**1598**		1598			
Block D Roof	**1010**	805				205
Block E Roof	**2638**	2131				507
Block E Podium	**1907**		1907			
Block F Roof	**1780**	1351				429
Block G Roof Areas	**2988**			1494	1494	
Block G Private Paved Areas	**1763**				1763	
Castle Street	**6034**			6034		
Shared Roads & Paving between plots	**20566**				20566	
TOTAL AREA (m²)	**50270**	**8816**	**5672**	**7528**	**23823**	**4431**

Table 6: Interception Storage Provided Per SuDS Type

SuDS Type	Coverage Area of SuDS on plan (m^2)	Potential Area SuDS Element can cater for Interception (m^2)	Reasoning
Greenroof	8816	8816	All surfaces that have green roofs can be assumed to be compliant for zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter as per Table 24.6 of the CIRIA SuDS Manual 2015.
Infiltration Trenches	284.5	7528	Table 24.6 of the CIRIA SuDS Manual 2015 notes that roads drained by infiltration trenches can be considered to provide Interception and therefore be assumed to be compliant for zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter as per Table 24.6 of the CIRIA SuDS Manual 2015. We are applying this principle for the terraced houses roofs that are connected to infiltration tranches.
Storage stone under paved surface and structured tree pit systems	5111	30666	Table 24.6 of the CIRIA SuDS Manual 2015 notes that where the infiltration capacity of the ground below the pavement is greater than 1 × 10−6 m/s, up to 5 times the permeable pavement area can be added as extra contributing area and therefore be assumed to be compliant for zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter as per Table 24.6 of the CIRIA SuDS Manual 2015. SI information indicates the infiltration capacity for the Priorsland site is greater than 1 × 10−6 m/s. Therefore, 5 times the permeable pavement area can be added as extra contributing area.
Swale	546	13650	Table 24.6 of the CIRIA SuDS Manual 2015 notes that any filter strip/swale that is unlined, has a gradient less than 1 in 100 and has an infiltration capability greater than 1 × 10−6 m/s can be assumed to comply with Interception for a contributing area up to 25 times the area, or a larger area where infiltration capacities and design characteristics allow. SI information indicates the infiltration capacity for the Priorsland site is greater than 1 × 10−6 m/s. The proposed swale has a gradient of 1:300. Therefore, 25 times the swale area can be added as extra contributing area.
TOTAL INTERCEPTION POTENTIAL FOR THE SITE (m^2)		**56632.5**	

3.3.3 Surface Water Quality Management

Typical key SuDS components permanence in reducing urban runoff contamination have been outlined in Table 7, and follow Chapter 26 of the CIRIA C753 (The SuDS Manual).

Table 7: Performance of SuDS components in reducing urban runoff contamination

	Concentration ranges: 25%ile - 75%ile				
	TSS	Total cadmium	Total copper	Total zinc	Total nickel
	(mg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
Inflow from urban surface (average values)	20-114	0.2-0.6	6-22	29-112	3-8
Selected environmental standards (Tables 26.1 to 26.5):					
Surface water	25	0.66	66	506	206
Groundwater		0.1	1.5	5	15
Outflows from SuDS components:					
Bioretention/tree pit systems	5-20	0.04-0.1	4-10	5-29	3-8
Swales	10-43	0.2-0.3	4-15	18-55	2-5
Detention basins	10-47	0.1-0.4	2-12	6-58	2-4
Permeable pavements	14-44	0.3-0.5	4-11	2-29	1-3
Filtration	7-26		3-10	19-59	
Oil separators	16-87		6-18	60-121	

3.3.4 Amenity & Biodiversity

Many of the proposed SuDS will provide potential for amenity and biodiversity. The green roofs will provide an amenity area for resident of the apartment blocks. The sedum in the extensive and proposed planting in the intensive roofs provide opportunity for biodiversity.

The engineered swales and Tree Root Structural Cell Systems provide potential for biodiversity. The provision of soft landscaping associated with the swales and tree pit systems provides amenity for the residents also.

The proposed detention basin/regional pond provides great potential for biodiversity also, both for semi-wet and wet environments.

Please refer to the Landscape drawings and reports for further details in relation to amenity and biodiversity provision through proposed landscaping throughout the development.

3.3.5 Operation & Maintenance

Typical key SuDS components operation and maintenance activities have been outlined in Table 8 and follow Chapter 32 of the CIRIA C753 (The SuDS Manual). A detailed operation and maintenance plan will be prepared for the Client at detailed design stage.

Regular maintenance is to be carried out typically every 1 to 3 months. Occasional maintenance is to be carried out every 6months to 1 year. Remedial maintenance is to be carried out as required.

Table 8: Typical key SuDS components operation and maintenance activities

Operation and maintenance activity	SuDS component					
	Green roofs	Pervious pavement	Infiltration trench	Swale//trees	Modular storage	Detention basin
Regular maintenance						
Inspection	✓	✓	✓	✓	✓	✓
Litter and debris removal		✓	✓	✓	✓	✓
Grass cutting			✓	✓		✓
Weed and invasive plant control	✓	✓	✓	✓		✓
Shrub management (including pruning)		✓		✓		✓
Shoreline vegetation management						✓
Aquatic vegetation management						✓
Occasional maintenance						
Sediment management	✓	✓	✓	✓	✓	✓
Vegetation replacement	✓			✓		✓
Vacuum sweeping and brushing		✓				
Remedial maintenance						
Structure rehabilitation /repair	✓	✓	✓	✓	✓	✓
Infiltration surface reconditioning		✓	✓	✓		

3.4 Surface Water Impact Assessment

3.4.1 The Existing Receiving Environment

The existing site is a greenfield site. The topography is very flat in nature. This site is a floodplain for the Carrickmines River, which dissects the site. Its existing use is low-level agriculture, used for grazing. The site is bounded to the south by the M50, to the east by the Ticknick Stream, to the North by the Luas Green line and the Carrickmines Luas carpark, and to the west by the Carrickmines South Roundabout.

3.4.2 Characteristics of the Proposed Development

The proposed development comprises the construction of terraced houses and 6no. apartment blocks within units denoted Blocks A, B, C, D, E and F. There will be retail and community facilities within the ground floor of Blocks A and B. Blocks A and B will have basement parking. Blocks C, E and F will have under croft parking.

3.4.3 Construction Impacts and Mitigation

During the construction phase of the proposed development there are several potential impacts that could impact the existing surface water quality negatively:

1. Elevated silt load caused by construction activities
2. Hydrocarbons from accidental spills

The contractor for the proposed works will be required to implement the following measures to protect the surface water:

1. Discharge permits & licenses
2. Preparing appropriate construction method statements
3. Settlement ponds
4. Bunding of hydrocarbons or any liquids that could adversely affect the receiving environment

These measures will be addressed within the Contractors method statements for the works.

3.4.4 Operational Impacts and Mitigation

Due to the low flow rate from the site (1l/s/ha) and the high quality of the surface water that will be discharge from the site through treatment from onsite SuDS, the operational impacts on the surrounding surface water will be positive.

4.0 Watermain Design

4.1 Existing Water Infrastructure

4.1.1 Existing Public Water Infrastructure

The following existing public watermain infrastructure exists adjacent to the development

- 300mm nominal diameter HDPE watermain is located at Castle Street to the east of the Ticknick Stream.
- 33" trunk watermain running from south to north through the site boundary

Please refer to Appendix A for Irish Water Record drawings illustrating the existing watermain arrangement.

4.2 Proposed Water Infrastructure

4.2.1 Proposed Water Supply Connection

It is proposed to provide a new 225mm OD diameter connection to the existing 300mm nominal diameter HDPE watermain is located at Castle Street to the east of the Ticknick Stream, to facilitate the proposed development. The new connection is to be provided to cater for the proposed development and associated loading. This supply arrangement is as per Chapter 4 of the Cherrywood Planning Scheme.

This water supply connection will service the on-site fire, sprinkler and potable water supply.

A bulk water meter shall be provided for each of the apartment blocks. The apartments will all be metered internally. Boundary boxes shall be supplied for each of the proposed terraced houses. The watermain layout has been designed in accordance with *"Irish Water Code of Practice for Water Infrastructure"*. All watermains are to be constructed in accordance with Irish Water and the Local Authority's requirements.

Please refer to PUNCH Drawing No. 182186-030 for details of the proposed watermain layout.

4.2.2 Irish Water Confirmation of Feasibility

Two Confirmation of Feasibility letters have been obtained from Irish Water for the connections for the proposed development. The first, obtained in February 2020 confirms a development of 454no. units can connect to the water and wastewater public infrastructure without upgrades being required to the public networks. The second, obtained in March 2020 confirms a development of 2,902no. units can connect to the water and wastewater public infrastructure without upgrades being required to the public networks. These Confirmation of Feasibility letters have both been included in Appendix E.

4.2.3 Water Supply Demand

Irish Water's Code of Practice for Water Infrastructure was used to calculate the water demand for the proposed development. On this basis, the following parameters were used:

- An average daily domestic demand per-capita consumption of 150 litres/person/day
- Domestic occupancy ratio of 2.7 persons per dwelling
- An average day/peak week demand of 1.25 times the average daily domestic demand
- A peak demand for sizing of the pipe network of 5.0 times the average day/ peak week demand (for network sizing purposes only).

Table 9 below presents the water supply demands for the development.

The total daily flow (DWF) was calculated as 2.564 l/s with a peak flow of 3.205 l/s. The daily water supply loading is 221.516 m^3.

Table 9: Water Consumption Rates

Source	Quantity	Unit	Flow	Flow unit	Daily (litres/ day)	PE (@ 150 l/person /day)	DWF m^3/day	DWF litres/ sec	Average day/peak week demand litres/ sec (@1.25 x DWF)	Peak litres/ sec (@5.0 x DWF)
Domestic	443	units	446	l/unit/day	197578	1317.19	197.578	2.287	2.858	11.434
Supermarket	1306	m^2	400	l/day/100m^2	5224	34.83	5.224	0.060	0.076	0.302
Retail	715	m^2	400	l/day/100m^2	2860	19.07	2.860	0.033	0.041	0.166
Non-retail	213	m^2	300	l/day/100m^2	639	4.26	0.639	0.007	0.009	0.037
Creche	513	m^2	750	l/day/100m^2	3848	25.65	3.848	0.045	0.056	0.223
Gym	155	m^2	750	l/day/100m^2	1163	7.75	1.163	0.013	0.017	0.067
Residential Facilities	551.8	m^2	750	l/day/100m^2	4139	27.59	4.139	0.048	0.060	0.239
High Intensity Employment	708	m^2	750	l/day/100m^2	5310	35.40	5.310	0.061	0.077	0.307
Community Facilities	252	m^2	300	l/day/100m^2	756	5.04	0.756	0.009	0.011	0.044
Total					221516	1476.77	221.516	2.564	3.205	12.819

4.2.4 Water Reduction Measures

To reduce the water demand on Local Authority water supplies and to reduce the water consumption of the development, water conservation measures will be incorporated in the sanitary facilities throughout the development, e.g. dual flush toilets, monobloc low volume push taps and waterless urinals.

4.2.5 Compliance with CPS Chapter 4

The proposed works are in compliance with the requirements of Chapter 4 of the CPS.

Table 10: Specific Objectives set out in Chapter 4 Section 4.1.2 of the CPS

Specific Objective	Response
PI 1 In common with all development in the Dublin region, development in the county is dependent on an adequate supply of water for the Dublin region. It is an objective to liaise with the Department of Environment Community and Local Government (DECLG) and Dublin City Council on regional water supply availability.	Irish Water have confirmed via the Pre-Connection Enquiry process that the development can be supported by the public watermain network.
PI 2 It is an objective to reach agreement with Dublin City Council on measures to reprioritise water allocation to Rathmichael reservoir. *This may also involve installation of a new strategic watermain to Shankill to reduce over-reliance on Roundwood Water Treatment Works.*	N/A. This is beyond the boundary of the proposed development's footprint.
PI 3 Development beyond 4ml/day capacity in the Planning Scheme and other new developments in the supply area (including Shankill, Shanganagh and Woodbrook) will require construction of the Old Connaught Woodbrook Water Supply Scheme. It is an objective to progress this scheme which is currently awaiting approval of the DECLG.	N/A. This is beyond the development's scope as it pertains to strategic infrastructure.
PI 4 It is an objective to ensure a planned approach is taken to the local distribution network within the zone to facilitate co-ordinated development. To support the use of water saving systems and landscaping. Where national standards are adopted, under the Water Services Act	Landscaped areas have been maximised where possible. Rainwater harvesting in the form of water butts are proposed for the terraced houses within the development. To reduce the water demand on Local Authority water supplies and to reduce the water consumption of the development, water conservation measures will be incorporated in the sanitary facilities throughout the development, e.g. dual flush toilets, monobloc low volume push taps and waterless urinals.

2007 or otherwise, for rainwater harvesting and/or greywater recycling for use within buildings, these will be incorporated to the maximum practicable extent.	
PI 5 It is an objective to replace a short portion of critical trunk main from Bride's Glen Road at an early stage to secure supply.	N/A. This is beyond the development's scope as it pertains to strategic infrastructure.

4.3 Existing 33" Watermain

The existing 33" watermain that runs from south to north along the eastern border of the Priorsland site will be cordoned off for protection during the development of the Priorsland site. The proposed construction access route to the Priorsland site will be via the Luas Park & Ride Access Road (via the M50 Southbound Roundabout) and is an interim arrangement only. This interim access represents an 'alternative use of infrastructure' pursuant to the adopted amendment to the SDZ which states the following in Section 7.2.2:

> *"However, it is acknowledged that there may be exceptional or unforeseen circumstances beyond the reasonable control of an individual developer or the local authority, whereby a piece of infrastructure necessary to progress the development of a Growth Area cannot be provided in the short to medium term (circa 0-3 years). In such instances, there may be an appropriate alternative utilising other infrastructure as provided for under the Planning Scheme, as an interim measure to facilitate the early delivery of housing, and early engagement with the Development Agency will be an essential prerequisite."*

Once the Castle Street extension into the Priorsland site becomes viable, and the existing 33" watermain is diverted by others, Castle Street will become the standard, on-going access route for the Priorsland development. The layout associated with the proposed development covered by this planning application does not require vehicles to traverse the existing 33" watermain. Please refer to drawing 182186-031 for an illustrative layout of this future diversion.

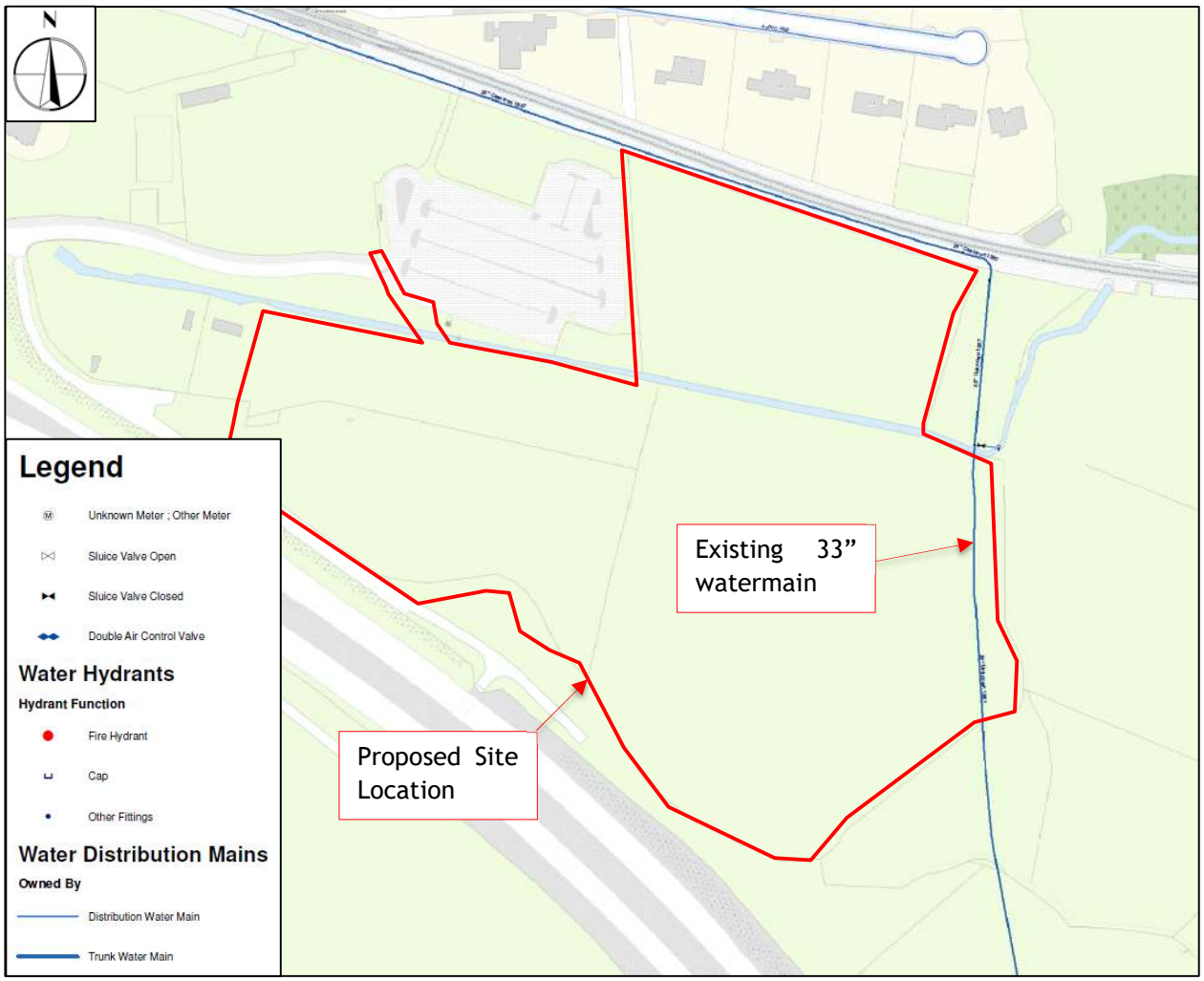

Figure 4-1: Location of Existing 33" Watermain at Priorsland

Appendix A Existing Services Record Drawings

priorsland

1:3,000

0 0.0375 0.075 0.15 mi

0.05 0.1 0.2 km

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Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

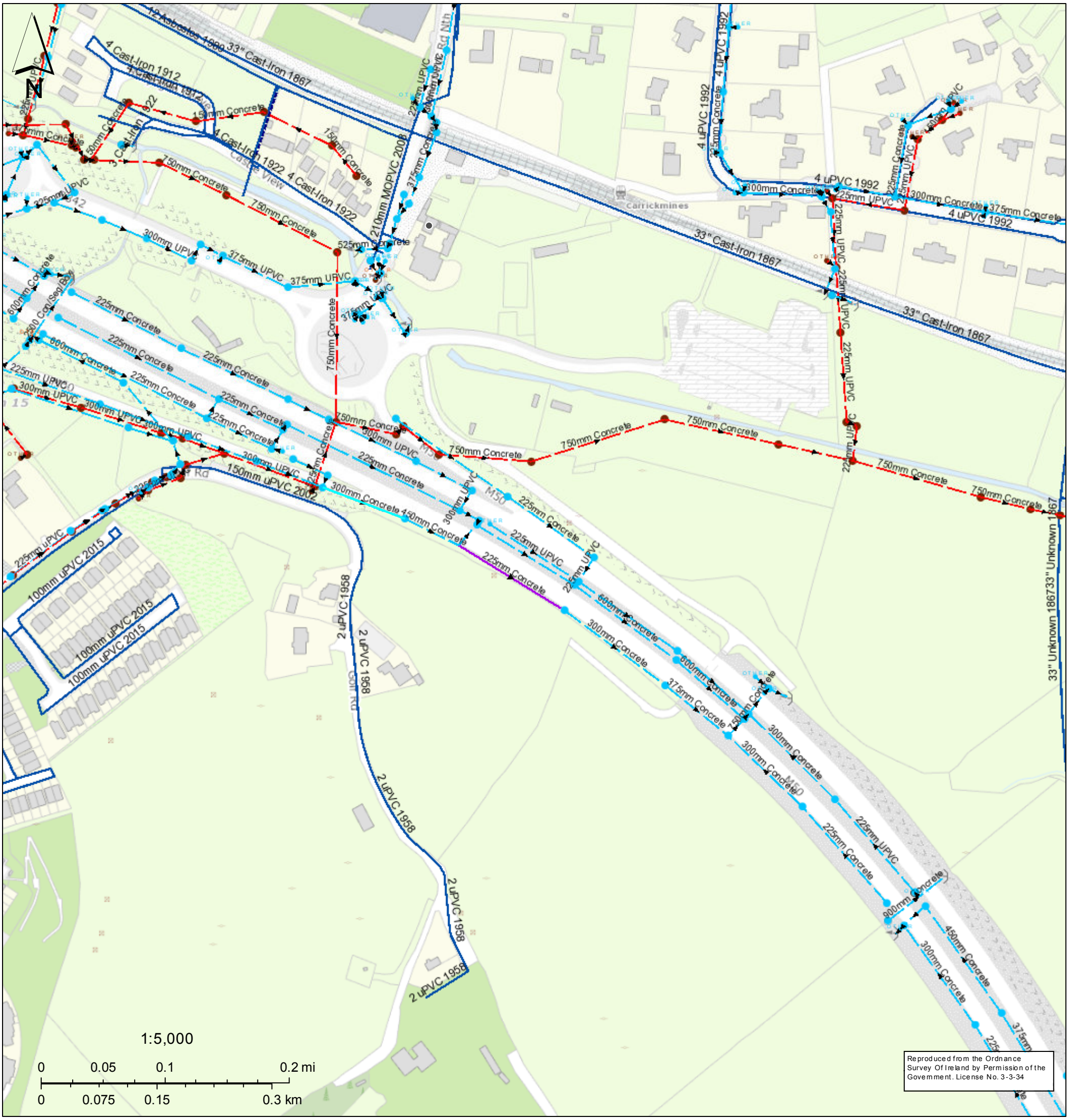
Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

priorsland - 2



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Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown
- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated.

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

UISCE ÉIREANN : IRISH WATER

Legend

- Unknown Meter ; Other Meter
- Sluice Valve Open
- Sluice Valve Closed
- Double Air Control Valve

Water Hydrants

Hydrant Function

- Fire Hydrant
- Cap
- Other Fittings

Water Distribution Mains

Owned By

- Distribution Water Main
- Trunk Water Main

1:1,000 at A0

Last edited: 13/09/2018

Metres

0 25 50 100

Appendix B Rainfall Supporting Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 322331, Northing: 223905,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.6,	4.2,	5.2,	5.8,	6.3,	7.9,	9.8,	11.1,	12.9,	14.5,	15.7,	17.7,	19.2,	20.5,	N/A ,
10 mins	3.5,	5.1,	5.9,	7.2,	8.1,	8.8,	11.1,	13.7,	15.4,	17.9,	20.2,	21.9,	24.6,	26.7,	28.5,	N/A ,
15 mins	4.1,	5.9,	6.9,	8.5,	9.5,	10.3,	13.0,	16.1,	18.2,	21.1,	23.7,	25.8,	29.0,	31.5,	33.5,	N/A ,
30 mins	5.4,	7.8,	9.0,	10.9,	12.2,	13.2,	16.5,	20.2,	22.7,	26.3,	29.4,	31.9,	35.7,	38.6,	41.1,	N/A ,
1 hours	7.2,	10.1,	11.7,	14.0,	15.6,	16.9,	20.9,	25.5,	28.5,	32.7,	36.5,	39.4,	43.9,	47.4,	50.3,	N/A ,
2 hours	9.5,	13.2,	15.2,	18.1,	20.0,	21.6,	26.5,	32.0,	35.7,	40.7,	45.2,	48.7,	54.0,	58.2,	61.6,	N/A ,
3 hours	11.2,	15.4,	17.6,	21.0,	23.2,	24.9,	30.4,	36.6,	40.7,	46.3,	51.3,	55.2,	61.0,	65.6,	69.3,	N/A ,
4 hours	12.6,	17.2,	19.7,	23.3,	25.7,	27.6,	33.6,	40.3,	44.7,	50.7,	56.1,	60.2,	66.5,	71.4,	75.4,	N/A ,
6 hours	14.8,	20.1,	22.9,	27.0,	29.7,	31.8,	38.6,	46.1,	50.9,	57.7,	63.6,	68.2,	75.1,	80.5,	84.9,	N/A ,
9 hours	17.4,	23.5,	26.6,	31.3,	34.4,	36.7,	44.3,	52.7,	58.1,	65.6,	72.2,	77.2,	84.9,	90.7,	95.6,	N/A ,
12 hours	19.6,	26.2,	29.7,	34.7,	38.1,	40.7,	48.9,	57.9,	63.8,	71.8,	78.9,	84.3,	92.5,	98.8,	104.0,	N/A ,
18 hours	23.0,	30.6,	34.5,	40.3,	44.0,	46.9,	56.2,	66.3,	72.7,	81.7,	89.5,	95.4,	104.5,	111.4,	117.0,	N/A ,
24 hours	25.9,	34.2,	38.5,	44.7,	48.8,	52.0,	62.0,	72.9,	79.9,	89.5,	97.8,	104.2,	113.9,	121.3,	127.3,	148.0,
2 days	32.5,	42.1,	46.9,	53.9,	58.5,	62.0,	72.9,	84.7,	92.1,	102.3,	111.2,	117.8,	127.9,	135.5,	141.7,	162.9,
3 days	37.9,	48.5,	53.8,	61.4,	66.3,	70.1,	81.8,	94.3,	102.2,	113.0,	122.2,	129.2,	139.6,	147.5,	154.0,	175.8,
4 days	42.7,	54.1,	59.8,	67.9,	73.2,	77.1,	89.5,	102.7,	111.0,	122.2,	131.8,	139.1,	149.9,	158.1,	164.8,	187.2,
6 days	51.1,	63.9,	70.3,	79.3,	85.1,	89.5,	103.0,	117.3,	126.3,	138.4,	148.6,	156.4,	167.9,	176.6,	183.6,	207.2,
8 days	58.5,	72.6,	79.5,	89.3,	95.6,	100.3,	114.8,	130.1,	139.6,	152.4,	163.3,	171.4,	183.6,	192.7,	200.0,	224.7,
10 days	65.4,	80.6,	88.0,	98.4,	105.1,	110.1,	125.6,	141.7,	151.7,	165.2,	176.6,	185.1,	197.7,	207.2,	214.9,	240.5,
12 days	71.8,	88.0,	95.9,	106.9,	114.0,	119.3,	135.5,	152.4,	162.9,	177.0,	188.8,	197.7,	210.8,	220.7,	228.6,	255.0,
16 days	83.8,	101.7,	110.4,	122.6,	130.3,	136.1,	153.8,	172.1,	183.4,	198.5,	211.2,	220.7,	234.7,	245.1,	253.6,	281.6,
20 days	94.9,	114.5,	123.9,	137.0,	145.3,	151.5,	170.5,	190.0,	202.1,	218.1,	231.6,	241.6,	256.3,	267.4,	276.2,	305.6,
25 days	108.0,	129.4,	139.6,	153.8,	162.8,	169.5,	189.9,	210.8,	223.7,	240.7,	255.0,	265.6,	281.3,	292.9,	302.2,	333.1,

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

M5-60 = 16.9, Ratio R = 16.9/62 = 0.273

Appendix C Surface Water Calculations – Causeway Flow Modelling

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	100.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.80
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.000
Ratio-R	0.273	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S10-0	0.037	4.00		65.417	1200	722125.614	724001.592	1.500
S10-1	0.053	4.00		65.138	1200	722179.953	723990.796	1.589
S10-2	0.103	4.00		65.022	1200	722177.846	723979.532	1.530
S10-3	0.057	4.00		64.858	1200	722171.846	723949.595	1.536
S10-4	0.179	4.00		64.575	1350	722162.627	723903.099	1.433
S10-5	0.003	4.00		64.304	1350	722190.066	723897.660	1.302
S20-0	0.036	4.00		65.402	1200	722109.621	723993.139	1.602
S20-1	0.154	4.00		65.043	1200	722099.412	723942.074	1.591
S20-2	0.000			65.090	1200	722108.477	723934.617	1.746
S20-3	0.000			64.565	1200	722167.730	723893.220	1.509
S10-6	0.001	4.00		64.565	1200	722212.564	723896.896	1.815
S30-0	0.051	4.00		65.060	1200	722195.584	723987.616	1.530
S30-1	0.084	4.00		64.802	1200	722246.055	723977.524	1.615
S30-2	0.071	4.00		64.586	1350	722243.377	723965.091	1.483
S30-3	0.226	4.00		64.431	1350	722228.039	723888.579	1.719
S10-7	0.001	4.00		64.406	1200	722229.041	723882.276	1.736
S40-0	0.025	4.00		64.790	1200	722254.624	723970.066	1.425
S40-1	0.090	4.00		64.514	1200	722289.701	723963.352	1.378
S41-0	0.000	4.00	0.5	64.445	1200	722268.568	723899.252	1.425
S40-2	0.123	4.00		64.526	1200	722277.468	723897.394	1.656
S40-3	0.094	4.00		64.253	1200	722255.484	723857.862	1.559
S10-8	0.017	4.00		64.253	1500	722258.809	723853.218	1.747
Swale1a				63.800	1500	722292.204	723797.676	1.479
swale1b				63.600	1500	722308.685	723780.912	1.338
S50-0	0.000	4.00	0.8	64.355	1200	722297.008	723884.448	1.425
S50-1	0.000		0.6	64.182	1200	722322.288	723880.846	1.420
S50-2	0.124	4.00		64.084	1200	722338.483	723878.539	1.428
S51-0	0.000	4.00	0.6	63.654	1200	722401.250	723808.254	1.025
S51-1	0.000			63.823	1200	722382.442	723826.983	1.350
S52-0	0.000	4.00	0.6	63.697	1200	722391.405	723846.814	1.197
S51-2	0.149	4.00		63.664	1200	722381.967	723836.474	1.230
S50-3	0.155	4.00		63.695	1350	722378.733	723839.603	1.275
S50-4	0.161	4.00		63.966	1350	722327.423	723786.985	1.791
S10-9	0.113	4.00		63.300	1500	722346.209	723762.258	1.205
S10-10	0.066	4.00		63.373	1500	722409.594	723784.346	1.470
S60-0	0.025	4.00		64.457	1200	722297.617	723961.752	1.407
S60-1	0.074	4.00		64.202	1200	722336.708	723953.939	1.449
S60-2	0.074	4.00		63.881	1200	722373.388	723946.612	1.235
S60-3	0.111	4.00		63.578	1200	722418.818	723937.051	1.253
S60-4	0.111	4.00		63.300	1350	722461.907	723928.206	1.101
S60-5	0.037	4.00		63.181	1350	722461.834	723909.996	1.125

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S60-6	0.063	4.00		63.346	1350	722462.183	723838.360	1.382
S61-0		4.00		63.558	1200	722392.344	723826.054	1.258
S61-1	0.042	4.00		63.347	1200	722415.747	723803.795	1.237
S61-2	0.000			63.325	1200	722422.109	723798.002	1.403
S60-7	0.045	4.00		63.324	1350	722432.434	723808.771	1.465
S10-11	0.000			63.485	1350	722437.143	723805.561	1.747
S10-12	0.000			63.200	1500	722477.814	723837.284	1.601
S10-13	0.000			63.143	1500	722482.147	723863.703	1.633
Stream				63.000	1200	722484.447	723867.690	2.065

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S10.000	S10-0	S10-1	55.209	0.600	63.917	63.549	0.368	150.0	300	4.72	64.3
S10.001	S10-1	S10-2	11.455	0.600	63.549	63.492	0.057	200.0	375	4.87	63.6
S10.002	S10-2	S10-3	34.043	0.600	63.492	63.322	0.170	200.0	375	5.31	61.6
S10.003	S10-3	S10-4	36.060	0.600	63.322	63.142	0.180	200.0	375	5.78	59.7
S10.004	S10-4	S10-5	27.973	0.600	63.142	63.002	0.140	200.0	375	6.15	58.3
S10.005	S10-5	S10-6	50.411	0.600	63.002	62.750	0.252	200.0	375	6.81	55.9
S20.000	S20-0	S20-1	52.141	0.600	63.800	63.452	0.348	150.0	225	4.82	63.8
S20.001	S20-1	S20-2	12.009	0.600	63.452	63.344	0.108	110.9	225	4.98	63.1
S20.002	S20-2	S20-3	71.913	0.600	63.344	63.056	0.288	250.0	300	6.19	58.1
S20.003	S20-3	S10-6	44.958	0.600	63.056	62.872	0.184	245.0	300	6.94	55.5
S10.006	S10-6	S10-7	22.143	0.600	62.750	62.676	0.074	300.0	375	7.29	54.4
S30.000	S30-0	S30-1	51.491	0.600	63.530	63.187	0.343	150.0	300	4.67	64.5
S30.001	S30-1	S30-2	12.558	0.600	63.187	63.103	0.084	150.0	375	4.81	63.8
S30.002	S30-2	S30-3	78.140	0.600	63.103	62.712	0.391	200.0	375	5.83	59.5
S30.003	S30-3	S10-7	6.254	0.600	62.712	62.670	0.042	150.0	375	5.90	59.2
S10.007	S10-7	S10-8	53.155	0.600	62.670	62.506	0.164	325.0	450	8.08	52.0
S40.000	S40-0	S40-1	34.328	0.600	63.365	63.136	0.229	149.9	225	4.54	65.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S10.000	1.281	90.6	6.4	1.200	1.289	0.037	0.0	54	0.747
S10.001	1.277	141.1	15.5	1.214	1.155	0.090	0.0	83	0.848
S10.002	1.277	141.1	32.2	1.155	1.161	0.193	0.0	121	1.042
S10.003	1.277	141.1	40.4	1.161	1.058	0.250	0.0	137	1.106
S10.004	1.277	141.1	67.7	1.058	0.927	0.429	0.0	183	1.264
S10.005	1.277	141.1	65.5	0.927	1.440	0.432	0.0	180	1.255
S20.000	1.065	42.3	6.2	1.377	1.366	0.036	0.0	58	0.768
S20.001	1.241	49.3	32.5	1.366	1.521	0.190	0.0	133	1.321
S20.002	0.990	70.0	29.9	1.446	1.209	0.190	0.0	137	0.952
S20.003	1.000	70.7	28.6	1.209	1.393	0.190	0.0	133	0.949
S10.006	1.041	114.9	91.8	1.440	1.355	0.623	0.0	255	1.151
S30.000	1.281	90.6	8.9	1.230	1.315	0.051	0.0	63	0.822
S30.001	1.477	163.1	23.4	1.240	1.108	0.135	0.0	96	1.061
S30.002	1.277	141.1	33.2	1.108	1.344	0.206	0.0	123	1.051
S30.003	1.477	163.1	69.3	1.344	1.361	0.432	0.0	170	1.418
S10.007	1.122	178.4	148.9	1.286	1.297	1.056	0.0	316	1.250
S40.000	1.065	42.4	4.4	1.200	1.153	0.025	0.0	49	0.693

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S40.001	S40-1	S40-2	77.227	0.600	63.136	62.870	0.266	290.0	225	6.22	58.0
S41.000	S41-0	S40-2	9.092	0.600	63.020	62.959	0.061	150.0	225	4.14	67.3
S40.002	S40-2	S40-3	29.955	0.600	62.870	62.694	0.176	170.0	225	6.72	56.2
S40.003	S40-3	S10-8	19.475	0.600	62.694	62.579	0.115	170.0	300	6.99	55.3
S10.008	S10-8	Swale1a	64.808	0.600	62.506	62.321	0.185	350.0	500	9.02	49.6
Swale1a	Swale1a	swale1b	23.509	0.600	62.321	62.262	0.059	400.0	500	9.38	48.7
swale1b	swale1b	S10-9	41.905	0.600	62.262	62.157	0.105	400.0	500	10.03	47.2
S50.000	S50-0	S50-1	25.836	0.600	62.930	62.762	0.168	154.2	225	4.41	65.8
S50.001	S50-1	S50-2	16.408	0.600	62.762	62.656	0.106	154.2	225	4.67	64.5
S50.002	S50-2	S50-3	55.990	0.600	62.656	62.469	0.187	300.0	225	5.92	59.1
S51.000	S51-0	S51-1	26.543	0.600	62.629	62.473	0.156	170.0	225	4.44	65.7
S51.001	S51-1	S51-2	9.503	0.600	62.473	62.434	0.039	245.0	300	4.60	64.9
S52.000	S52-0	S51-2	14.364	0.600	62.500	62.452	0.048	300.0	300	4.27	66.6
S51.002	S51-2	S50-3	4.226	0.600	62.434	62.420	0.014	300.0	375	4.67	64.5
S50.003	S50-3	S50-4	73.494	0.600	62.420	62.175	0.245	300.0	375	7.09	55.0
S50.004	S50-4	S10-9	27.928	0.600	62.175	62.095	0.080	350.0	375	7.58	53.5
S10.009	S10-9	S10-10	67.123	0.600	62.095	61.903	0.192	350.0	600	10.89	45.4
S10.010	S10-10	S10-11	65.926	0.600	61.903	61.738	0.165	400.0	400	12.06	43.2
S60.000	S60-0	S60-1	77.269	0.600	63.050	62.753	0.297	260.0	300	5.33	61.5
S60.001	S60-1	S60-2	37.405	0.600	62.753	62.646	0.107	350.0	300	6.07	58.5
S60.002	S60-2	S60-3	96.319	0.600	62.646	62.325	0.321	300.0	300	7.85	52.7
S60.003	S60-3	S60-4	43.987	0.600	62.325	62.199	0.126	350.0	300	8.73	50.3
S60.004	S60-4	S60-5	49.919	0.600	62.199	62.056	0.143	350.0	375	9.60	48.2
S60.005	S60-5	S60-6	32.081	0.600	62.056	61.964	0.092	350.0	375	10.15	46.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S40.001	0.763	30.3	18.1	1.153	1.431	0.115	0.0	125	0.795
S41.000	1.065	42.3	0.5	1.200	1.342	0.000	0.5	17	0.357
S40.002	1.000	39.7	36.8	1.431	1.334	0.238	0.5	172	1.131
S40.003	1.203	85.0	50.3	1.259	1.374	0.332	0.5	166	1.251
S10.008	1.155	226.8	189.2	1.247	0.979	1.405	0.5	351	1.286
Swale1a	1.080	212.0	185.9	0.979	0.838	1.405	0.5	365	1.211
swale1b	1.080	212.0	180.3	0.838	0.643	1.405	0.5	356	1.206
S50.000	1.050	41.8	0.8	1.200	1.195	0.000	0.8	22	0.410
S50.001	1.050	41.8	1.4	1.195	1.203	0.000	1.4	29	0.492
S50.002	0.750	29.8	21.3	1.203	1.001	0.124	1.4	141	0.813
S51.000	1.000	39.7	0.6	0.800	1.125	0.000	0.6	19	0.358
S51.001	1.000	70.7	0.6	1.050	0.930	0.000	0.6	20	0.306
S52.000	0.902	63.8	0.6	0.897	0.912	0.000	0.6	21	0.286
S51.002	1.041	114.9	27.3	0.855	0.900	0.149	1.2	124	0.859
S50.003	1.041	114.9	66.4	0.900	1.416	0.428	2.6	205	1.077
S50.004	0.963	106.3	88.0	1.416	0.830	0.589	2.6	261	1.071
S10.009	1.296	366.3	262.5	0.605	0.870	2.107	3.1	377	1.403
S10.010	0.937	117.8	257.8	1.070	1.347	2.173	3.1	400	0.949
S60.000	0.970	68.6	4.2	1.107	1.149	0.025	0.0	50	0.542
S60.001	0.834	59.0	15.7	1.149	0.935	0.099	0.0	105	0.708
S60.002	0.902	63.8	24.7	0.935	0.953	0.173	0.0	129	0.846
S60.003	0.834	59.0	38.7	0.953	0.801	0.284	0.0	178	0.889
S60.004	0.963	106.3	51.6	0.726	0.750	0.395	0.0	184	0.956
S60.005	0.963	106.3	55.0	0.750	1.007	0.432	0.0	192	0.971

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S60.006	S60-6	S60-7	41.958	0.600	61.964	61.859	0.105	400.0	375	10.93	45.3
S61.000	S61-0	S61-1	32.298	0.600	62.300	62.110	0.190	170.0	225	4.54	65.2
S61.001	S61-1	S61-2	47.090	0.600	62.110	61.922	0.188	250.0	300	5.33	61.5
S61.002	S61-2	S60-7	14.919	0.600	61.922	61.861	0.061	245.0	300	5.58	60.5
S60.007	S60-7	S10-11	5.699	0.600	61.859	61.843	0.016	350.0	375	11.03	45.1
S10.011	S10-11	S10-12	51.580	0.600	61.738	61.599	0.139	370.0	400	12.94	41.8
S10.012	S10-12	S10-13	26.772	0.600	61.599	61.510	0.089	300.0	600	13.26	41.3
S10.013	S10-13	Stream	4.603	0.600	61.510	60.935	0.575	8.0	225	13.28	41.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S60.006	0.900	99.4	60.8	1.007	1.090	0.495	0.0	212	0.943
S61.000	1.000	39.7	0.0	1.033	1.012	0.000	0.0	0	0.000
S61.001	0.990	70.0	7.0	0.937	1.103	0.042	0.0	64	0.637
S61.002	1.000	70.7	6.9	1.103	1.163	0.042	0.0	63	0.641
S60.007	0.963	106.3	71.2	1.090	1.267	0.582	0.0	225	1.029
S10.011	0.975	122.5	315.0	1.347	1.201	2.755	3.1	400	0.988
S10.012	1.400	396.0	311.2	1.001	1.033	2.755	3.1	403	1.543
S10.013	4.654	185.1	311.0	1.408	1.840	2.755	3.1	225	4.740

Pipeline Schedule

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)
S10.000	55.209	150.0	300	Circular	65.417	63.917	1.200	65.138	63.549	1.289
S10.001	11.455	200.0	375	Circular	65.138	63.549	1.214	65.022	63.492	1.155
S10.002	34.043	200.0	375	Circular	65.022	63.492	1.155	64.858	63.322	1.161
S10.003	36.060	200.0	375	Circular	64.858	63.322	1.161	64.575	63.142	1.058
S10.004	27.973	200.0	375	Circular	64.575	63.142	1.058	64.304	63.002	0.927
S10.005	50.411	200.0	375	Circular	64.304	63.002	0.927	64.565	62.750	1.440
S20.000	52.141	150.0	225	Circular	65.402	63.800	1.377	65.043	63.452	1.366
S20.001	12.009	110.9	225	Circular	65.043	63.452	1.366	65.090	63.344	1.521
S20.002	71.913	250.0	300	Circular	65.090	63.344	1.446	64.565	63.056	1.209
S20.003	44.958	245.0	300	Circular	64.565	63.056	1.209	64.565	62.872	1.393
S10.006	22.143	300.0	375	Circular	64.565	62.750	1.440	64.406	62.676	1.355
S30.000	51.491	150.0	300	Circular	65.060	63.530	1.230	64.802	63.187	1.315

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S10.000	S10-0	1200	Manhole	Adoptable	S10-1	1200	Manhole	Adoptable
S10.001	S10-1	1200	Manhole	Adoptable	S10-2	1200	Manhole	Adoptable
S10.002	S10-2	1200	Manhole	Adoptable	S10-3	1200	Manhole	Adoptable
S10.003	S10-3	1200	Manhole	Adoptable	S10-4	1350	Manhole	Adoptable
S10.004	S10-4	1350	Manhole	Adoptable	S10-5	1350	Manhole	Adoptable
S10.005	S10-5	1350	Manhole	Adoptable	S10-6	1200	Manhole	Adoptable
S20.000	S20-0	1200	Manhole	Adoptable	S20-1	1200	Manhole	Adoptable
S20.001	S20-1	1200	Manhole	Adoptable	S20-2	1200	Manhole	Adoptable
S20.002	S20-2	1200	Manhole	Adoptable	S20-3	1200	Manhole	Adoptable
S20.003	S20-3	1200	Manhole	Adoptable	S10-6	1200	Manhole	Adoptable
S10.006	S10-6	1200	Manhole	Adoptable	S10-7	1200	Manhole	Adoptable
S30.000	S30-0	1200	Manhole	Adoptable	S30-1	1200	Manhole	Adoptable

Pipeline Schedule

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)
S30.001	12.558	150.0	375	Circular	64.802	63.187	1.240	64.586	63.103	1.108
S30.002	78.140	200.0	375	Circular	64.586	63.103	1.108	64.431	62.712	1.344
S30.003	6.254	150.0	375	Circular	64.431	62.712	1.344	64.406	62.670	1.361
S10.007	53.155	325.0	450	Circular	64.406	62.670	1.286	64.253	62.506	1.297
S40.000	34.328	149.9	225	Circular	64.790	63.365	1.200	64.514	63.136	1.153
S40.001	77.227	290.0	225	Circular	64.514	63.136	1.153	64.526	62.870	1.431
S41.000	9.092	150.0	225	Circular	64.445	63.020	1.200	64.526	62.959	1.342
S40.002	29.955	170.0	225	Circular	64.526	62.870	1.431	64.253	62.694	1.334
S40.003	19.475	170.0	300	Circular	64.253	62.694	1.259	64.253	62.579	1.374
S10.008	64.808	350.0	500	Circular	64.253	62.506	1.247	63.800	62.321	0.979
Swale1a	23.509	400.0	500	Circular	63.800	62.321	0.979	63.600	62.262	0.838
swale1b	41.905	400.0	500	Circular	63.600	62.262	0.838	63.300	62.157	0.643
S50.000	25.836	154.2	225	Circular	64.355	62.930	1.200	64.182	62.762	1.195
S50.001	16.408	154.2	225	Circular	64.182	62.762	1.195	64.084	62.656	1.203
S50.002	55.990	300.0	225	Circular	64.084	62.656	1.203	63.695	62.469	1.001
S51.000	26.543	170.0	225	Circular	63.654	62.629	0.800	63.823	62.473	1.125
S51.001	9.503	245.0	300	Circular	63.823	62.473	1.050	63.664	62.434	0.930
S52.000	14.364	300.0	300	Circular	63.697	62.500	0.897	63.664	62.452	0.912
S51.002	4.226	300.0	375	Circular	63.664	62.434	0.855	63.695	62.420	0.900
S50.003	73.494	300.0	375	Circular	63.695	62.420	0.900	63.966	62.175	1.416
S50.004	27.928	350.0	375	Circular	63.966	62.175	1.416	63.300	62.095	0.830
S10.009	67.123	350.0	600	Circular	63.300	62.095	0.605	63.373	61.903	0.870
S10.010	65.926	400.0	400	Circular	63.373	61.903	1.070	63.485	61.738	1.347
S60.000	77.269	260.0	300	Circular	64.457	63.050	1.107	64.202	62.753	1.149
S60.001	37.405	350.0	300	Circular	64.202	62.753	1.149	63.881	62.646	0.935

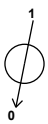
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S30.001	S30-1	1200	Manhole	Adoptable	S30-2	1350	Manhole	Adoptable
S30.002	S30-2	1350	Manhole	Adoptable	S30-3	1350	Manhole	Adoptable
S30.003	S30-3	1350	Manhole	Adoptable	S10-7	1200	Manhole	Adoptable
S10.007	S10-7	1200	Manhole	Adoptable	S10-8	1500	Manhole	Adoptable
S40.000	S40-0	1200	Manhole	Adoptable	S40-1	1200	Manhole	Adoptable
S40.001	S40-1	1200	Manhole	Adoptable	S40-2	1200	Manhole	Adoptable
S41.000	S41-0	1200	Manhole	Adoptable	S40-2	1200	Manhole	Adoptable
S40.002	S40-2	1200	Manhole	Adoptable	S40-3	1200	Manhole	Adoptable
S40.003	S40-3	1200	Manhole	Adoptable	S10-8	1500	Manhole	Adoptable
S10.008	S10-8	1500	Manhole	Adoptable	Swale1a	1500	Manhole	Adoptable
Swale1a	Swale1a	1500	Manhole	Adoptable	swale1b	1500	Manhole	Adoptable
swale1b	swale1b	1500	Manhole	Adoptable	S10-9	1500	Manhole	Adoptable
S50.000	S50-0	1200	Manhole	Adoptable	S50-1	1200	Manhole	Adoptable
S50.001	S50-1	1200	Manhole	Adoptable	S50-2	1200	Manhole	Adoptable
S50.002	S50-2	1200	Manhole	Adoptable	S50-3	1350	Manhole	Adoptable
S51.000	S51-0	1200	Manhole	Adoptable	S51-1	1200	Manhole	Adoptable
S51.001	S51-1	1200	Manhole	Adoptable	S51-2	1200	Manhole	Adoptable
S52.000	S52-0	1200	Manhole	Adoptable	S51-2	1200	Manhole	Adoptable
S51.002	S51-2	1200	Manhole	Adoptable	S50-3	1350	Manhole	Adoptable
S50.003	S50-3	1350	Manhole	Adoptable	S50-4	1350	Manhole	Adoptable
S50.004	S50-4	1350	Manhole	Adoptable	S10-9	1500	Manhole	Adoptable
S10.009	S10-9	1500	Manhole	Adoptable	S10-10	1500	Manhole	Adoptable
S10.010	S10-10	1500	Manhole	Adoptable	S10-11	1350	Manhole	Adoptable
S60.000	S60-0	1200	Manhole	Adoptable	S60-1	1200	Manhole	Adoptable
S60.001	S60-1	1200	Manhole	Adoptable	S60-2	1200	Manhole	Adoptable

Pipeline Schedule

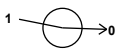
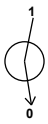
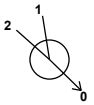
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S60.002	96.319	300.0	300	Circular	63.881	62.646	0.935	63.578	62.325	0.953
S60.003	43.987	350.0	300	Circular	63.578	62.325	0.953	63.300	62.199	0.801
S60.004	49.919	350.0	375	Circular	63.300	62.199	0.726	63.181	62.056	0.750
S60.005	32.081	350.0	375	Circular	63.181	62.056	0.750	63.346	61.964	1.007
S60.006	41.958	400.0	375	Circular	63.346	61.964	1.007	63.324	61.859	1.090
S61.000	32.298	170.0	225	Circular	63.558	62.300	1.033	63.347	62.110	1.012
S61.001	47.090	250.0	300	Circular	63.347	62.110	0.937	63.325	61.922	1.103
S61.002	14.919	245.0	300	Circular	63.325	61.922	1.103	63.324	61.861	1.163
S60.007	5.699	350.0	375	Circular	63.324	61.859	1.090	63.485	61.843	1.267
S10.011	51.580	370.0	400	Circular	63.485	61.738	1.347	63.200	61.599	1.201
S10.012	26.772	300.0	600	Circular	63.200	61.599	1.001	63.143	61.510	1.033
S10.013	4.603	8.0	225	Circular	63.143	61.510	1.408	63.000	60.935	1.840

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S60.002	S60-2	1200	Manhole	Adoptable	S60-3	1200	Manhole	Adoptable
S60.003	S60-3	1200	Manhole	Adoptable	S60-4	1350	Manhole	Adoptable
S60.004	S60-4	1350	Manhole	Adoptable	S60-5	1350	Manhole	Adoptable
S60.005	S60-5	1350	Manhole	Adoptable	S60-6	1350	Manhole	Adoptable
S60.006	S60-6	1350	Manhole	Adoptable	S60-7	1350	Manhole	Adoptable
S61.000	S61-0	1200	Manhole	Adoptable	S61-1	1200	Manhole	Adoptable
S61.001	S61-1	1200	Manhole	Adoptable	S61-2	1200	Manhole	Adoptable
S61.002	S61-2	1200	Manhole	Adoptable	S60-7	1350	Manhole	Adoptable
S60.007	S60-7	1350	Manhole	Adoptable	S10-11	1350	Manhole	Adoptable
S10.011	S10-11	1350	Manhole	Adoptable	S10-12	1500	Manhole	Adoptable
S10.012	S10-12	1500	Manhole	Adoptable	S10-13	1500	Manhole	Adoptable
S10.013	S10-13	1500	Manhole	Adoptable	Stream	1200	Manhole	Adoptable

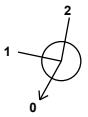
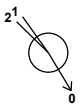
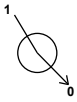
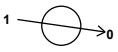
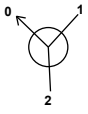
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S10-0	722125.614	724001.592	65.417	1.500	1200				
						0	S10.000	63.917	300
S10-1	722179.953	723990.796	65.138	1.589	1200	1	S10.000	63.549	300
									
						0	S10.001	63.549	375
S10-2	722177.846	723979.532	65.022	1.530	1200	1	S10.001	63.492	375
									
						0	S10.002	63.492	375
S10-3	722171.846	723949.595	64.858	1.536	1200	1	S10.002	63.322	375
									
						0	S10.003	63.322	375
S10-4	722162.627	723903.099	64.575	1.433	1350	1	S10.003	63.142	375
									
						0	S10.004	63.142	375

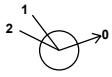
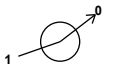
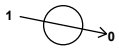
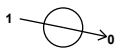
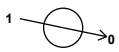
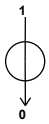
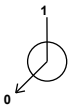
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S10-5	722190.066	723897.660	64.304	1.302	1350	1	S10.004	63.002	375
									
						0	S10.005	63.002	375
S20-0	722109.621	723993.139	65.402	1.602	1200				
									
						0	S20.000	63.800	225
S20-1	722099.412	723942.074	65.043	1.591	1200	1	S20.000	63.452	225
									
						0	S20.001	63.452	225
S20-2	722108.477	723934.617	65.090	1.746	1200	1	S20.001	63.344	225
									
						0	S20.002	63.344	300
S20-3	722167.730	723893.220	64.565	1.509	1200	1	S20.002	63.056	300
									
						0	S20.003	63.056	300
S10-6	722212.564	723896.896	64.565	1.815	1200	1	S20.003	62.872	300
						2	S10.005	62.750	375
									
						0	S10.006	62.750	375
S30-0	722195.584	723987.616	65.060	1.530	1200				
									
						0	S30.000	63.530	300
S30-1	722246.055	723977.524	64.802	1.615	1200	1	S30.000	63.187	300
									
						0	S30.001	63.187	375
S30-2	722243.377	723965.091	64.586	1.483	1350	1	S30.001	63.103	375
									
						0	S30.002	63.103	375
S30-3	722228.039	723888.579	64.431	1.719	1350	1	S30.002	62.712	375
									
						0	S30.003	62.712	375
S10-7	722229.041	723882.276	64.406	1.736	1200	1	S30.003	62.670	375
						2	S10.006	62.676	375
									
						0	S10.007	62.670	450
S40-0	722254.624	723970.066	64.790	1.425	1200				
									
						0	S40.000	63.365	225
S40-1	722289.701	723963.352	64.514	1.378	1200	1	S40.000	63.136	225
									
						0	S40.001	63.136	225

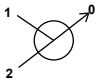
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S41-0	722268.568	723899.252	64.445	1.425	1200				
						0	S41.000	63.020	225
S40-2	722277.468	723897.394	64.526	1.656	1200		1	S41.000	62.959	225
							2	S40.001	62.870	225
							0	S40.002	62.870	225
S40-3	722255.484	723857.862	64.253	1.559	1200		1	S40.002	62.694	225
							0	S40.003	62.694	300
S10-8	722258.809	723853.218	64.253	1.747	1500		1	S40.003	62.579	300
							2	S10.007	62.506	450
							0	S10.008	62.506	500
Swale1a	722292.204	723797.676	63.800	1.479	1500		1	S10.008	62.321	500
							0	Swale1a	62.321	500
swale1b	722308.685	723780.912	63.600	1.338	1500		1	Swale1a	62.262	500
							0	swale1b	62.262	500
S50-0	722297.008	723884.448	64.355	1.425	1200				
						0	S50.000	62.930	225
S50-1	722322.288	723880.846	64.182	1.420	1200		1	S50.000	62.762	225
							0	S50.001	62.762	225
S50-2	722338.483	723878.539	64.084	1.428	1200		1	S50.001	62.656	225
							0	S50.002	62.656	225
S51-0	722401.250	723808.254	63.654	1.025	1200				
						0	S51.000	62.629	225
S51-1	722382.442	723826.983	63.823	1.350	1200		1	S51.000	62.473	225
							0	S51.001	62.473	300
S52-0	722391.405	723846.814	63.697	1.197	1200				
						0	S52.000	62.500	300
S51-2	722381.967	723836.474	63.664	1.230	1200		1	S52.000	62.452	300
							2	S51.001	62.434	300
							0	S51.002	62.434	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S50-3	722378.733	723839.603	63.695	1.275	1350		1 S51.002	62.420	375
							2 S50.002	62.469	225
							0 S50.003	62.420	375
S50-4	722327.423	723786.985	63.966	1.791	1350		1 S50.003	62.175	375
							0 S50.004	62.175	375
S10-9	722346.209	723762.258	63.300	1.205	1500		1 S50.004	62.095	375
							2 swale1b	62.157	500
							0 S10.009	62.095	600
S10-10	722409.594	723784.346	63.373	1.470	1500		1 S10.009	61.903	600
							0 S10.010	61.903	400
S60-0	722297.617	723961.752	64.457	1.407	1200		0 S60.000	63.050	300
S60-1	722336.708	723953.939	64.202	1.449	1200		1 S60.000	62.753	300
							0 S60.001	62.753	300
S60-2	722373.388	723946.612	63.881	1.235	1200		1 S60.001	62.646	300
							0 S60.002	62.646	300
S60-3	722418.818	723937.051	63.578	1.253	1200		1 S60.002	62.325	300
							0 S60.003	62.325	300
S60-4	722461.907	723928.206	63.300	1.101	1350		1 S60.003	62.199	300
							0 S60.004	62.199	375
S60-5	722461.834	723909.996	63.181	1.125	1350		1 S60.004	62.056	375
							0 S60.005	62.056	375
S60-6	722462.183	723838.360	63.346	1.382	1350		1 S60.005	61.964	375
							0 S60.006	61.964	375
S61-0	722392.344	723826.054	63.558	1.258	1200		0 S61.000	62.300	225
S61-1	722415.747	723803.795	63.347	1.237	1200		1 S61.000	62.110	225
							0 S61.001	62.110	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S61-2	722422.109	723798.002	63.325	1.403	1200	 1	S61.001	61.922	300
						0	S61.002	61.922	300
S60-7	722432.434	723808.771	63.324	1.465	1350	 1	S61.002	61.861	300
						2	S60.006	61.859	375
						0	S60.007	61.859	375
S10-11	722437.143	723805.561	63.485	1.747	1350	 1	S60.007	61.843	375
						2	S10.010	61.738	400
						0	S10.011	61.738	400
S10-12	722477.814	723837.284	63.200	1.601	1500	 1	S10.011	61.599	400
						0	S10.012	61.599	600
S10-13	722482.147	723863.703	63.143	1.633	1500	 1	S10.012	61.510	600
						0	S10.013	61.510	225
Stream	722484.447	723867.690	63.000	2.065	1200	 1	S10.013	60.935	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.900	Drain Down Time (mins)	480
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	10	0	0

Node Stream Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		
		Applies to All storms			

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.591	1740	0.585	3480	0.585	5220	0.585	6960	0.585	8700	0.585
60	0.591	1800	0.585	3540	0.585	5280	0.585	7020	0.585	8760	0.585
120	0.591	1860	0.585	3600	0.585	5340	0.585	7080	0.585	8820	0.585
180	0.591	1920	0.585	3660	0.585	5400	0.585	7140	0.585	8880	0.585
240	0.591	1980	0.585	3720	0.585	5460	0.585	7200	0.585	8940	0.585
300	0.591	2040	0.585	3780	0.585	5520	0.585	7260	0.585	9000	0.585
360	0.591	2100	0.585	3840	0.585	5580	0.585	7320	0.585	9060	0.585
420	0.591	2160	0.585	3900	0.585	5640	0.585	7380	0.585	9120	0.585
480	0.591	2220	0.585	3960	0.585	5700	0.585	7440	0.585	9180	0.585
540	0.585	2280	0.585	4020	0.585	5760	0.585	7500	0.585	9240	0.585
600	0.621	2340	0.585	4080	0.585	5820	0.585	7560	0.585	9300	0.585
660	0.798	2400	0.585	4140	0.585	5880	0.585	7620	0.585	9360	0.585
720	0.946	2460	0.585	4200	0.585	5940	0.585	7680	0.585	9420	0.585
780	1.037	2520	0.585	4260	0.585	6000	0.585	7740	0.585	9480	0.585
840	1.110	2580	0.585	4320	0.585	6060	0.585	7800	0.585	9540	0.585
900	1.129	2640	0.585	4380	0.585	6120	0.585	7860	0.585	9600	0.585
960	1.115	2700	0.585	4440	0.585	6180	0.585	7920	0.585	9660	0.585
1020	1.094	2760	0.585	4500	0.585	6240	0.585	7980	0.585	9720	0.585
1080	1.031	2820	0.585	4560	0.585	6300	0.585	8040	0.585	9780	0.585
1140	0.934	2880	0.585	4620	0.585	6360	0.585	8100	0.585	9840	0.585
1200	0.843	2940	0.585	4680	0.585	6420	0.585	8160	0.585	9900	0.585
1260	0.760	3000	0.585	4740	0.585	6480	0.585	8220	0.585	9960	0.585
1320	0.677	3060	0.585	4800	0.585	6540	0.585	8280	0.585	10020	0.585
1380	0.600	3120	0.585	4860	0.585	6600	0.585	8340	0.585	10080	0.585
1440	0.585	3180	0.585	4920	0.585	6660	0.585	8400	0.585		
1500	0.585	3240	0.585	4980	0.585	6720	0.585	8460	0.585		
1560	0.585	3300	0.585	5040	0.585	6780	0.585	8520	0.585		
1620	0.585	3360	0.585	5100	0.585	6840	0.585	8580	0.585		
1680	0.585	3420	0.585	5160	0.585	6900	0.585	8640	0.585		

Node S10-13 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	61.510	Product Number	CTL-SHE-0095-5000-1700-5000
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node S20-1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	63.452	Product Number	CTL-SHE-0034-4000-0450-4000
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

Node S10-5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	63.002	Product Number	CTL-SHE-0025-3000-0900-3000
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.3	Min Node Diameter (mm)	1200

Node S30-3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.712	Product Number	CTL-SHE-0042-6000-0450-6000
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.6	Min Node Diameter (mm)	1200

Node S40-3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.694	Product Number	CTL-SHE-0042-6000-0450-6000
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.6	Min Node Diameter (mm)	1200

Node S50-4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.175	Product Number	CTL-SHE-0085-2600-0450-2600
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.6	Min Node Diameter (mm)	1200

Node S50-0 Offline Orifice Control

Flap Valve	✓	Design Depth (m)	0.225	Discharge Coefficient	0.600
Loop to Node	S40-2	Design Flow (l/s)	35.0		
Invert Level (m)	63.500	Diameter (m)	0.223		

Node S50-4 Offline Depth/Flow Control

Flap Valve	✓	Invert Level (m)	62.800	Design Flow (l/s)	35.0
Loop to Node	Swale1a	Design Depth (m)	0.225		

Depth (m)	Flow (l/s)
0.225	35.000

Node S61-0 Offline Depth/Flow Control

Flap Valve	x	Invert Level (m)	62.600	Design Flow (l/s)	35.0
Loop to Node	S51-2	Design Depth (m)	0.225		

Depth (m)	Flow (l/s)
0.225	35.000

Node S20-1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01010	Safety Factor	2.0	Invert Level (m)	63.452
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	245.0	245.0	0.450	245.0	245.0	0.451	0.0	245.0

Node S10-4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01010	Safety Factor	2.0	Invert Level (m)	63.142
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	516.0	516.0	0.900	516.0	516.0	0.901	0.0	516.0

Node S30-3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01010	Safety Factor	2.0	Invert Level (m)	62.712
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	523.0	523.0	0.450	523.0	523.0	0.451	0.0	523.0

Node S40-3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01010	Safety Factor	2.0	Invert Level (m)	62.694
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	522.0	522.0	0.450	522.0	522.0	0.451	0.0	522.0

Node S50-4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01010	Safety Factor	2.0	Invert Level (m)	62.175
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	782.0	782.0	0.450	782.0	782.0	0.451	0.0	782.0

Node S60-6 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01010	Safety Factor	2.0	Invert Level (m)	61.964
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	350.0	350.0	0.450	350.0	350.0	0.451	0.0	350.0

Node S10-2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.622	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	6.760		

Node S10-3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.458	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	10.760		

Node S10-4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.175	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	24.720		

Node S20-0 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	65.020	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	1.920		

Node S20-1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.643	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	26.720		

Node S30-2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.186	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	4.800		

Node S30-3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.031	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	47.840		

Node S40-2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	64.082	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	20.160		

Node S40-3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	63.853	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	21.160		

Node S50-2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	63.684	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	18.080		

Node S61-1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	62.947	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	840	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	10.840		

Node S51-2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	63.264	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	600	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	34.040		

Node S50-3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	63.295	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	360	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	12.600		

Node S50-4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	63.566	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	35.280		

Node S60-7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	62.909	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	25.000	Inf Depth (m)	
Porosity	0.33	Length (m)	13.040		

Node S10-10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	61.903
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	75.0	0.0	1.500	491.0	0.0

Node S10-12 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	61.599
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	23.0	0.0	1.610	187.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 99.75%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S10-0	10	63.997	0.080	14.4	0.1297	0.0000	OK
15 minute winter	S10-1	10	63.709	0.160	35.0	0.2869	0.0000	OK
2160 minute winter	S10-2	2100	63.704	0.212	3.4	0.5249	0.0000	OK
2160 minute winter	S10-3	2100	63.704	0.382	4.4	0.7153	0.0000	SURCHARGED
2160 minute winter	S10-4	2100	63.704	0.562	7.4	277.6591	0.0000	SURCHARGED
2160 minute winter	S10-5	2100	63.704	0.702	0.5	1.0367	0.0000	SURCHARGED
1440 minute winter	S20-0	1320	63.897	0.097	0.9	0.1526	0.0000	OK
1440 minute winter	S20-1	1320	63.897	0.445	4.6	104.8427	0.0000	SURCHARGED
15 minute winter	S20-2	15	63.361	0.017	0.4	0.0195	0.0000	OK
4320 minute winter	S20-3	3660	63.164	0.108	0.4	0.1219	0.0000	OK
4320 minute winter	S10-6	3660	63.164	0.414	0.7	0.4725	0.0000	SURCHARGED
2160 minute winter	S30-0	1740	64.047	0.517	1.0	0.9296	0.0000	SURCHARGED
2160 minute winter	S30-1	1740	64.047	0.860	2.4	1.8671	0.0000	SURCHARGED
2160 minute winter	S30-2	1740	64.047	0.944	3.7	2.2552	0.0000	SURCHARGED
2160 minute winter	S30-3	1740	64.047	1.335	7.7	233.5727	0.0000	SURCHARGED
4320 minute winter	S10-7	3660	63.164	0.494	1.2	0.5639	0.0000	SURCHARGED
15 minute winter	S40-0	12	64.133	0.768	26.0	1.1376	0.0000	SURCHARGED
15 minute winter	S40-1	12	64.103	0.967	37.5	2.3570	0.0000	SURCHARGED
15 minute winter	S41-0	11	63.778	0.758	4.8	0.8576	0.0000	SURCHARGED
15 minute winter	S40-2	11	63.778	0.908	76.2	2.3740	0.0000	SURCHARGED
4320 minute winter	S40-3	3300	63.274	0.580	4.1	224.7586	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S10-0	S10.000	S10-1	14.3	0.563	0.158	1.4654	
15 minute winter	S10-1	S10.001	S10-2	33.8	0.673	0.240	0.6045	
15 minute winter	S10-2	S10.002	S10-3	72.8	1.070	0.516	2.3586	
15 minute winter	S10-3	S10.003	S10-4	95.4	2.167	0.676	1.6595	
15 minute winter	S10-4	S10.004	S10-5	9.9	0.303	0.070	1.8205	
15 minute summer	S10-4	Infiltration		0.7				
1440 minute winter	S10-5	Hydro-Brake®	S10-6	0.3				
15 minute summer	S20-0	S20.000	S20-1	14.4	1.211	0.341	0.7111	
30 minute summer	S20-1	Hydro-Brake®	S20-2	0.4				
15 minute summer	S20-1	Infiltration		0.3				
15 minute winter	S20-2	S20.002	S20-3	0.4	0.348	0.006	0.1080	
5760 minute winter	S20-3	S20.003	S10-6	0.4	0.289	0.006	1.8002	
60 minute winter	S10-6	S10.006	S10-7	0.8	0.285	0.007	0.0603	
15 minute winter	S30-0	S30.000	S30-1	19.8	0.648	0.219	1.5926	
15 minute winter	S30-1	S30.001	S30-2	52.0	0.870	0.319	0.7540	
15 minute winter	S30-2	S30.002	S30-3	79.3	1.968	0.562	3.3396	
1440 minute winter	S30-3	Hydro-Brake®	S10-7	0.9				
15 minute summer	S30-3	Infiltration		0.7				
60 minute summer	S10-7	S10.007	S10-8	1.6	0.284	0.009	0.4259	
15 minute winter	S40-0	S40.000	S40-1	-16.2	-0.412	-0.383	1.3653	
15 minute winter	S40-1	S40.001	S40-2	33.0	0.831	1.090	3.0714	
30 minute summer	S41-0	S41.000	S40-2	-4.7	0.360	-0.111	0.3616	
15 minute winter	S40-2	S40.002	S40-3	70.6	2.433	1.775	0.8375	
30 minute summer	S40-3	Hydro-Brake®	S10-8	0.6				
15 minute summer	S40-3	Infiltration		0.7				

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 99.75%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute winter	S10-8	3660	63.164	0.658	2.0	1.2905	0.0000	SURCHARGED
4320 minute winter	Swale1a	3660	63.164	0.843	36.8	1.4891	0.0000	SURCHARGED
4320 minute winter	swale1b	3720	63.161	0.899	36.8	1.5887	0.0000	SURCHARGED
15 minute winter	S50-0	11	63.373	0.443	8.0	0.5015	0.0000	SURCHARGED
4320 minute winter	S50-1	4020	63.368	0.606	1.5	0.6857	0.0000	SURCHARGED
4320 minute winter	S50-2	4020	63.368	0.712	2.8	2.0422	0.0000	SURCHARGED
4320 minute winter	S51-0	4020	63.372	0.743	0.6	0.8401	0.0000	FLOOD RISK
4320 minute winter	S51-1	4020	63.372	0.899	0.8	1.0164	0.0000	SURCHARGED
4320 minute winter	S52-0	4020	63.372	0.872	0.6	0.9859	0.0000	SURCHARGED
4320 minute winter	S51-2	4020	63.372	0.938	36.9	32.5970	0.0000	FLOOD RISK
4320 minute winter	S50-3	4020	63.367	0.947	38.7	11.0389	0.0000	SURCHARGED
4320 minute winter	S50-4	4020	63.337	1.162	38.7	338.4278	0.0000	SURCHARGED
4320 minute winter	S10-9	3720	63.157	1.062	39.8	3.8694	0.0000	FLOOD RISK
4320 minute winter	S10-10	3720	63.155	1.251	40.0	314.3839	0.0000	FLOOD RISK
4320 minute winter	S60-0	3720	63.129	0.079	0.3	0.1177	0.0000	OK
4320 minute winter	S60-1	3720	63.129	0.376	1.1	0.8096	0.0000	SURCHARGED
4320 minute winter	S60-2	3720	63.129	0.483	1.9	1.1254	0.0000	SURCHARGED
4320 minute winter	S60-3	3720	63.129	0.804	3.1	2.3346	0.0000	SURCHARGED
4320 minute winter	S60-4	3720	63.129	0.930	4.2	3.2073	0.0000	FLOOD RISK
4320 minute winter	S60-5	3720	63.129	1.073	4.7	2.2419	0.0000	FLOOD RISK
4320 minute winter	S60-6	3720	63.129	1.165	5.2	152.5213	0.0000	FLOOD RISK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	S10-8	S10.008	Swale1a	7.4	0.542	0.033	0.8979	
2160 minute winter	Swale1a	Swale1a	swale1b	37.1	0.351	0.175	4.5986	
2160 minute winter	swale1b	swale1b	S10-9	37.1	0.385	0.175	8.1970	
15 minute summer	S50-0	S50.000	S50-1	-13.8	-0.351	-0.331	1.0275	
15 minute summer	S50-0	Orifice	S40-2	0.0				0.0
15 minute summer	S50-1	S50.001	S50-2	-17.3	0.475	-0.414	0.6526	
15 minute winter	S50-2	S50.002	S50-3	39.3	0.989	1.319	2.2268	
15 minute summer	S51-0	S51.000	S51-1	-8.5	0.464	-0.214	1.0556	
15 minute summer	S51-1	S51.001	S51-2	-13.5	-0.236	-0.191	0.6692	
15 minute winter	S52-0	S52.000	S51-2	4.4	0.317	0.069	1.0115	
15 minute winter	S51-2	S51.002	S50-3	52.3	0.475	0.455	0.4661	
15 minute winter	S50-3	S50.003	S50-4	142.4	1.934	1.239	4.8385	
180 minute winter	S50-4	Hydro-Brake®	S10-9	2.6				
15 minute summer	S50-4	Infiltration		1.1				
2160 minute winter	S50-4	Depth/Flow	Swale1a	35.0				2606.7
15 minute winter	S10-9	S10.009	S10-10	44.9	1.064	0.122	3.3620	
30 minute winter	S10-10	S10.010	S10-11	41.0	0.598	0.348	7.2924	
15 minute winter	S60-0	S60.000	S60-1	9.4	0.343	0.137	2.7658	
15 minute winter	S60-1	S60.001	S60-2	35.1	0.712	0.594	2.4382	
15 minute winter	S60-2	S60.002	S60-3	54.5	0.800	0.855	6.7827	
15 minute winter	S60-3	S60.003	S60-4	78.2	1.111	1.326	3.0975	
15 minute winter	S60-4	S60.004	S60-5	117.3	1.106	1.103	5.2862	
15 minute winter	S60-5	S60.005	S60-6	133.3	2.120	1.254	1.9663	
30 minute winter	S60-6	S60.006	S60-7	47.6	0.735	0.480	3.5856	
15 minute summer	S60-6	Infiltration		0.5				

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 99.75%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute winter	S61-0	3720	62.880	0.580	35.0	0.6556	0.0000	SURCHARGED
4320 minute winter	S61-1	3720	63.053	0.943	35.2	10.4831	0.0000	FLOOD RISK
4320 minute winter	S61-2	3720	63.108	1.186	35.1	1.3409	0.0000	FLOOD RISK
4320 minute winter	S60-7	3720	63.129	1.270	35.3	26.1256	0.0000	FLOOD RISK
4320 minute winter	S10-11	3720	63.133	1.395	39.5	1.9968	0.0000	SURCHARGED
4320 minute winter	S10-12	3720	63.133	1.534	7.0	157.8697	0.0000	FLOOD RISK
4320 minute winter	S10-13	3720	63.133	1.623	4.9	2.8681	0.0000	FLOOD RISK
600 minute summer	Stream	900	62.064	1.129	4.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
4320 minute winter	S61-0	S61.000	S61-1	-35.0	-0.880	-0.881	1.2845	
2880 minute winter	S61-0	Depth/Flow	S51-2	35.0				3371.2
2880 minute winter	S61-1	S61.001	S61-2	-35.1	-0.498	-0.501	3.3160	
2880 minute winter	S61-2	S61.002	S60-7	-35.1	-0.498	-0.496	1.0506	
30 minute winter	S60-7	S60.007	S10-11	54.9	1.001	0.516	0.5941	
30 minute winter	S10-11	S10.011	S10-12	84.5	1.040	0.689	6.4573	
15 minute winter	S10-12	S10.012	S10-13	47.9	0.548	0.121	7.2243	
10080 minute winter	S10-13	S10.013	Stream	5.0	0.197	0.027	0.1831	2523.0

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.200
Ratio-R	0.273	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.777	5.00	59.645	11.387	70.660	1.545

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	16.900	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	10	0	0

Node Depth/Area 1 Online Pump Control

Flap Valve	x	Invert Level (m)	58.100	Switch off depth (m)	0.010
Replaces Downstream Link	✓	Switch on depth (m)	0.050		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.050	0.800	5.000	0.800

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	58.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	600.0	0.0	1.000	600.0	0.0	1.001	0.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1440	59.095	0.995	19.4	607.3085	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute summer	Depth/Area 1	Pump	0.8	11.8

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.200
Ratio-R	0.273	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.353	5.00	63.800	11.387	70.660	1.200

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	16.900	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	10	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.600	Product Number	CTL-SHE-0040-6000-0600-6000
Design Depth (m)	0.600	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.6	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	62.600
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	450.0	0.0	0.600	450.0	0.0	0.601	0.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1440	63.179	0.579	8.8	263.7579	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®	0.6	48.0

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.200
Ratio-R	0.273	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.172	5.00	63.950	11.387	70.660	1.450

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	16.900	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	10	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.500	Product Number	CTL-SHE-0042-6000-0450-6000
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.6	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	62.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	260.0	0.0	0.450	260.0	0.0	0.451	0.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1380	62.937	0.437	4.3	109.0792	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute summer	Depth/Area 1	Hydro-Brake®	0.6	9.2

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.200
Ratio-R	0.273	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.477	5.00	64.225	11.387	70.660	1.375

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	16.900	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	10	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.850	Product Number	CTL-SHE-0040-6000-0600-6000
Design Depth (m)	0.600	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.6	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	62.850
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	650.0	0.0	0.600	650.0	0.0	0.601	0.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1440	63.415	0.565	11.9	370.9238	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®	0.6	47.5

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.200
Ratio-R	0.273	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.215	5.00	64.450	11.387	70.660	1.250

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	16.900	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	10	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	63.200	Product Number	CTL-SHE-0034-5000-0800-5000
Design Depth (m)	0.800	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.5	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	63.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	200.0	0.0	0.800	200.0	0.0	0.801	0.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1410	63.957	0.757	5.4	153.9417	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®	0.5	38.7

Appendix D Foul Water Calculations – Causeway Flow Modelling

Design Settings

Frequency of use (kDU)	0.00	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	2763	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
F1-0	65.104	Adoptable	722101.481	723945.659	1.350
F1-1	65.298	Adoptable	722106.942	723973.445	2.016
F1-2	65.408	Adoptable	722112.433	724001.225	2.411
F1-3	65.305	Adoptable	722147.419	723994.211	2.518
F2-0	64.596	Adoptable	722165.981	723911.750	1.350
F2-1	64.819	Adoptable	722173.217	723947.944	2.263
F1-4	65.133	Adoptable	722181.117	723987.455	2.814
F1-5	64.958	Adoptable	722215.073	723980.613	2.843
F3-0	64.441	Adoptable	722232.450	723897.535	1.425
F3-1	64.608	Adoptable	722240.195	723935.942	2.245
F1-6	64.791	Adoptable	722248.019	723974.049	2.874
F4-0	64.269	Adoptable	722263.760	723866.382	1.425
F4-1	64.442	Adoptable	722277.093	723889.213	2.039
F1-7	64.561	Adoptable	722291.681	723965.298	2.906
F1-8	63.915	Adoptable	722366.837	723950.235	2.711
F1-9	63.547	Adoptable	722417.911	723939.998	2.649
F5-0	64.268	Adoptable	722310.733	723885.541	1.425
F5-1	64.056	Adoptable	722339.769	723881.469	1.702
F6-0	63.919	Adoptable	722337.216	723793.843	1.425
F7-0	63.752	Adoptable	722389.546	723848.033	1.425
F5-2	63.678	Adoptable	722382.198	723840.424	2.263
F5-3	63.333	Adoptable	722423.572	723802.692	2.247
F5-4	63.349	Adoptable	722459.574	723839.445	2.566
F5-5	63.138	Adoptable	722459.118	723884.800	2.622
F5-6	63.207	Adoptable	722459.169	723916.881	2.880
F5-7	63.263	Adoptable	722459.506	723927.027	2.996
F1-10	63.322	Adoptable	722458.429	723931.877	3.084
EXFMH	61.154	Adoptable	722464.757	723954.589	1.055

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
F1.000	F1-0	F1-1	28.318	1.500	63.754	63.282	0.472	60.0	150
F1.001	F1-1	F1-2	28.317	1.500	63.282	63.072	0.210	134.8	150
F1.002	F1-2	F1-3	35.682	1.500	62.997	62.787	0.210	170.0	225
F1.003	F1-3	F1-4	34.369	1.500	62.787	62.585	0.202	170.0	225
F2.000	F2-0	F2-1	36.910	1.500	63.246	62.631	0.615	60.0	150
F2.001	F2-1	F1-4	40.293	1.500	62.556	62.319	0.237	170.0	225
F1.004	F1-4	F1-5	34.638	1.500	62.319	62.115	0.204	170.0	225
F1.005	F1-5	F1-6	33.594	1.500	62.115	61.917	0.198	170.0	225
F3.000	F3-0	F3-1	39.180	1.500	63.016	62.363	0.653	60.0	225
F3.001	F3-1	F1-6	38.902	1.500	62.363	62.134	0.229	170.0	225
F1.006	F1-6	F1-7	44.530	1.500	61.917	61.655	0.262	170.0	225
F4.000	F4-0	F4-1	26.439	1.500	62.844	62.403	0.441	60.0	225
F4.001	F4-1	F1-7	77.471	1.500	62.403	61.947	0.456	170.0	225
F1.007	F1-7	F1-8	76.651	1.500	61.655	61.204	0.451	170.0	225
F1.008	F1-8	F1-9	52.090	1.500	61.204	60.898	0.306	170.0	225
F1.009	F1-9	F1-10	41.324	1.500	60.898	60.655	0.243	170.0	225
F5.000	F5-0	F5-1	29.320	1.500	62.843	62.354	0.489	60.0	225
F5.001	F5-1	F5-2	59.033	1.500	62.354	62.007	0.347	170.0	225
F6.000	F6-0	F5-2	64.755	1.500	62.494	61.415	1.079	60.0	225
F7.000	F7-0	F5-2	10.578	1.500	62.327	62.151	0.176	60.1	225
F5.002	F5-2	F5-3	55.996	1.500	61.415	61.086	0.329	170.0	225
F5.003	F5-3	F5-4	51.448	1.500	61.086	60.783	0.303	170.0	225
F5.004	F5-4	F5-5	45.357	1.500	60.783	60.516	0.267	170.0	225
F5.005	F5-5	F5-6	32.081	1.500	60.516	60.327	0.189	170.0	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
F1.000	0.000	1.132	20.0	0.0	1.200	1.866	0.000	0	0.0	0.0	0	0.000
F1.001	0.000	0.753	13.3	0.0	1.866	2.186	0.000	0	0.0	0.0	0	0.000
F1.002	0.000	0.879	35.0	0.0	2.186	2.293	0.000	0	0.0	0.0	0	0.000
F1.003	0.000	0.879	35.0	0.0	2.293	2.323	0.000	0	0.0	0.0	0	0.000
F2.000	0.000	1.132	20.0	0.0	1.200	2.038	0.000	0	0.0	0.0	0	0.000
F2.001	0.000	0.879	35.0	0.0	2.038	2.589	0.000	0	0.0	0.0	0	0.000
F1.004	0.000	0.879	35.0	0.0	2.589	2.618	0.000	0	0.0	0.0	0	0.000
F1.005	0.000	0.879	35.0	0.0	2.618	2.649	0.000	0	0.0	0.0	0	0.000
F3.000	0.000	1.483	59.0	0.0	1.200	2.020	0.000	0	0.0	0.0	0	0.000
F3.001	0.000	0.879	35.0	0.0	2.020	2.432	0.000	0	0.0	0.0	0	0.000
F1.006	0.000	0.879	35.0	0.0	2.649	2.681	0.000	0	0.0	0.0	0	0.000
F4.000	0.000	1.484	59.0	0.0	1.200	1.814	0.000	0	0.0	0.0	0	0.000
F4.001	0.000	0.879	35.0	0.0	1.814	2.389	0.000	0	0.0	0.0	0	0.000
F1.007	0.000	0.879	35.0	0.0	2.681	2.486	0.000	0	0.0	0.0	0	0.000
F1.008	0.000	0.879	35.0	0.0	2.486	2.424	0.000	0	0.0	0.0	0	0.000
F1.009	0.000	0.879	35.0	0.0	2.424	2.442	0.000	0	0.0	0.0	0	0.000
F5.000	0.000	1.484	59.0	0.0	1.200	1.477	0.000	0	0.0	0.0	0	0.000
F5.001	0.000	0.879	35.0	0.0	1.477	1.446	0.000	0	0.0	0.0	0	0.000
F6.000	0.000	1.483	59.0	0.0	1.200	2.038	0.000	0	0.0	0.0	0	0.000
F7.000	0.000	1.482	58.9	0.0	1.200	1.302	0.000	0	0.0	0.0	0	0.000
F5.002	0.000	0.879	35.0	0.0	2.038	2.022	0.000	0	0.0	0.0	0	0.000
F5.003	0.000	0.879	35.0	0.0	2.022	2.341	0.000	0	0.0	0.0	0	0.000
F5.004	0.000	0.879	35.0	0.0	2.341	2.397	0.000	0	0.0	0.0	0	0.000
F5.005	0.000	0.879	35.0	0.0	2.397	2.655	0.000	0	0.0	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
F5.006	F5-6	F5-7	10.152	1.500	60.327	60.267	0.060	170.0	225
F5.007	F5-7	F1-10	4.968	1.500	60.267	60.238	0.029	170.0	225
F1.010	F1-10	EXFMH	23.577	1.500	60.238	60.099	0.139	170.0	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
F5.006	0.000	0.879	35.0	0.0	2.655	2.771	0.000	0	0.0	0.0	0	0.000
F5.007	0.000	0.879	35.0	0.0	2.771	2.859	0.000	0	0.0	0.0	0	0.000
F1.010	0.000	0.879	35.0	0.0	2.859	0.830	0.000	0	0.0	0.0	0	0.000

Pipeline Schedule

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)
F1.000	28.318	60.0	150	Circular	65.104	63.754	1.200	65.298	63.282	1.866
F1.001	28.317	134.8	150	Circular	65.298	63.282	1.866	65.408	63.072	2.186
F1.002	35.682	170.0	225	Circular	65.408	62.997	2.186	65.305	62.787	2.293
F1.003	34.369	170.0	225	Circular	65.305	62.787	2.293	65.133	62.585	2.323
F2.000	36.910	60.0	150	Circular	64.596	63.246	1.200	64.819	62.631	2.038
F2.001	40.293	170.0	225	Circular	64.819	62.556	2.038	65.133	62.319	2.589
F1.004	34.638	170.0	225	Circular	65.133	62.319	2.589	64.958	62.115	2.618
F1.005	33.594	170.0	225	Circular	64.958	62.115	2.618	64.791	61.917	2.649
F3.000	39.180	60.0	225	Circular	64.441	63.016	1.200	64.608	62.363	2.020
F3.001	38.902	170.0	225	Circular	64.608	62.363	2.020	64.791	62.134	2.432
F1.006	44.530	170.0	225	Circular	64.791	61.917	2.649	64.561	61.655	2.681
F4.000	26.439	60.0	225	Circular	64.269	62.844	1.200	64.442	62.403	1.814
F4.001	77.471	170.0	225	Circular	64.442	62.403	1.814	64.561	61.947	2.389
F1.007	76.651	170.0	225	Circular	64.561	61.655	2.681	63.915	61.204	2.486
F1.008	52.090	170.0	225	Circular	63.915	61.204	2.486	63.547	60.898	2.424
F1.009	41.324	170.0	225	Circular	63.547	60.898	2.424	63.322	60.655	2.442
F5.000	29.320	60.0	225	Circular	64.268	62.843	1.200	64.056	62.354	1.477

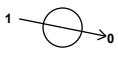
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
F1.000	F1-0	1200	Manhole	Adoptable	F1-1	1200	Manhole	Adoptable
F1.001	F1-1	1200	Manhole	Adoptable	F1-2	1200	Manhole	Adoptable
F1.002	F1-2	1200	Manhole	Adoptable	F1-3	1200	Manhole	Adoptable
F1.003	F1-3	1200	Manhole	Adoptable	F1-4	1200	Manhole	Adoptable
F2.000	F2-0	1200	Manhole	Adoptable	F2-1	1200	Manhole	Adoptable
F2.001	F2-1	1200	Manhole	Adoptable	F1-4	1200	Manhole	Adoptable
F1.004	F1-4	1200	Manhole	Adoptable	F1-5	1200	Manhole	Adoptable
F1.005	F1-5	1200	Manhole	Adoptable	F1-6	1200	Manhole	Adoptable
F3.000	F3-0	1200	Manhole	Adoptable	F3-1	1200	Manhole	Adoptable
F3.001	F3-1	1200	Manhole	Adoptable	F1-6	1200	Manhole	Adoptable
F1.006	F1-6	1200	Manhole	Adoptable	F1-7	1200	Manhole	Adoptable
F4.000	F4-0	1200	Manhole	Adoptable	F4-1	1200	Manhole	Adoptable
F4.001	F4-1	1200	Manhole	Adoptable	F1-7	1200	Manhole	Adoptable
F1.007	F1-7	1200	Manhole	Adoptable	F1-8	1200	Manhole	Adoptable
F1.008	F1-8	1200	Manhole	Adoptable	F1-9	1200	Manhole	Adoptable
F1.009	F1-9	1200	Manhole	Adoptable	F1-10	1200	Manhole	Adoptable
F5.000	F5-0	1200	Manhole	Adoptable	F5-1	1200	Manhole	Adoptable

Pipeline Schedule

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)
F5.001	59.033	170.0	225	Circular	64.056	62.354	1.477	63.678	62.007	1.446
F6.000	64.755	60.0	225	Circular	63.919	62.494	1.200	63.678	61.415	2.038
F7.000	10.578	60.1	225	Circular	63.752	62.327	1.200	63.678	62.151	1.302
F5.002	55.996	170.0	225	Circular	63.678	61.415	2.038	63.333	61.086	2.022
F5.003	51.448	170.0	225	Circular	63.333	61.086	2.022	63.349	60.783	2.341
F5.004	45.357	170.0	225	Circular	63.349	60.783	2.341	63.138	60.516	2.397
F5.005	32.081	170.0	225	Circular	63.138	60.516	2.397	63.207	60.327	2.655
F5.006	10.152	170.0	225	Circular	63.207	60.327	2.655	63.263	60.267	2.771
F5.007	4.968	170.0	225	Circular	63.263	60.267	2.771	63.322	60.238	2.859
F1.010	23.577	170.0	225	Circular	63.322	60.238	2.859	61.154	60.099	0.830

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
F5.001	F5-1	1200	Manhole	Adoptable	F5-2	1200	Manhole	Adoptable
F6.000	F6-0	1200	Manhole	Adoptable	F5-2	1200	Manhole	Adoptable
F7.000	F7-0	1200	Manhole	Adoptable	F5-2	1200	Manhole	Adoptable
F5.002	F5-2	1200	Manhole	Adoptable	F5-3	1200	Manhole	Adoptable
F5.003	F5-3	1200	Manhole	Adoptable	F5-4	1200	Manhole	Adoptable
F5.004	F5-4	1200	Manhole	Adoptable	F5-5	1200	Manhole	Adoptable
F5.005	F5-5	1200	Manhole	Adoptable	F5-6	1200	Manhole	Adoptable
F5.006	F5-6	1200	Manhole	Adoptable	F5-7	1200	Manhole	Adoptable
F5.007	F5-7	1200	Manhole	Adoptable	F1-10	1200	Manhole	Adoptable
F1.010	F1-10	1200	Manhole	Adoptable	EXFMH	1200	Manhole	Adoptable

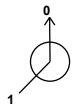
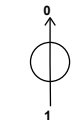
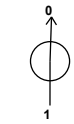
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F1-0	722101.481	723945.659	65.104	1.350	1200				
						0	F1.000	63.754	150
F1-1	722106.942	723973.445	65.298	2.016	1200		1	F1.000	63.282	150
							0	F1.001	63.282	150
F1-2	722112.433	724001.225	65.408	2.411	1200		1	F1.001	63.072	150
							0	F1.002	62.997	225
F1-3	722147.419	723994.211	65.305	2.518	1200		1	F1.002	62.787	225
							0	F1.003	62.787	225
F2-0	722165.981	723911.750	64.596	1.350	1200				
						0	F2.000	63.246	150
F2-1	722173.217	723947.944	64.819	2.263	1200		1	F2.000	62.631	150
							0	F2.001	62.556	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F1-4	722181.117	723987.455	65.133	2.814	1200	1	F2.001	62.319	225
						2	F1.003	62.585	225
						0	F1.004	62.319	225
F1-5	722215.073	723980.613	64.958	2.843	1200	1	F1.004	62.115	225
						0	F1.005	62.115	225
F3-0	722232.450	723897.535	64.441	1.425	1200	0	F3.000	63.016	225
F3-1	722240.195	723935.942	64.608	2.245	1200	1	F3.000	62.363	225
						0	F3.001	62.363	225
F1-6	722248.019	723974.049	64.791	2.874	1200	1	F3.001	62.134	225
						2	F1.005	61.917	225
						0	F1.006	61.917	225
F4-0	722263.760	723866.382	64.269	1.425	1200	0	F4.000	62.844	225
F4-1	722277.093	723889.213	64.442	2.039	1200	1	F4.000	62.403	225
						0	F4.001	62.403	225
F1-7	722291.681	723965.298	64.561	2.906	1200	1	F4.001	61.947	225
						2	F1.006	61.655	225
						0	F1.007	61.655	225
F1-8	722366.837	723950.235	63.915	2.711	1200	1	F1.007	61.204	225
						0	F1.008	61.204	225
F1-9	722417.911	723939.998	63.547	2.649	1200	1	F1.008	60.898	225
						0	F1.009	60.898	225
F5-0	722310.733	723885.541	64.268	1.425	1200	0	F5.000	62.843	225
F5-1	722339.769	723881.469	64.056	1.702	1200	1	F5.000	62.354	225
						0	F5.001	62.354	225
F6-0	722337.216	723793.843	63.919	1.425	1200	0	F6.000	62.494	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F7-0	722389.546	723848.033	63.752	1.425	1200				
						0	F7.000	62.327	225
F5-2	722382.198	723840.424	63.678	2.263	1200				
						1	F7.000	62.151	225
						2	F6.000	61.415	225
						3	F5.001	62.007	225
						0	F5.002	61.415	225
F5-3	722423.572	723802.692	63.333	2.247	1200				
						1	F5.002	61.086	225
						0	F5.003	61.086	225
F5-4	722459.574	723839.445	63.349	2.566	1200				
						1	F5.003	60.783	225
						0	F5.004	60.783	225
F5-5	722459.118	723884.800	63.138	2.622	1200				
						1	F5.004	60.516	225
						0	F5.005	60.516	225
F5-6	722459.169	723916.881	63.207	2.880	1200				
						1	F5.005	60.327	225
						0	F5.006	60.327	225
F5-7	722459.506	723927.027	63.263	2.996	1200				
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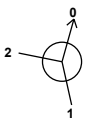
						0	F5.007	60.267	225
F1-10	722458.429	723931.877	63.322	3.084	1200				
						1	F5.007	60.238	225
						2	F1.009	60.655	225
						0	F1.010	60.238	225
EXFMH	722464.757	723954.589	61.154	1.055	1200				
						1	F1.010	60.099	225

Appendix E Irish Water Pre-Connection Enquiry Confirmation of Feasibility Letter

Marie Claire Daly
Carnegie House, Library Road
Dun Laoghaire
Dublin
A96C7W7

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

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

www.water.ie

19 February 2020

Dear Robert Miley,

Re: Connection Reference No CDS20000729 pre-connection enquiry -
Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 454 unit(s) at Priorsland, Cherrywood, Co. Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Priorsland, Cherrywood, Co. Dublin.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

Water:

New connection to the existing network is feasible without upgrade as per proposed layout.

A bulk meter has to be installed on the connection main. On site storage is required for a capacity of the non domestic average flow on a peak week for 24 hour period. This storage must also have the ability to refill completely in a 12 hour period.

Pressure and flow data is required before/with a connection application being received. The minimum pressure and maximum flow, from the nearest suitable hydrant from the Connection Point and CMP, are required.

This Confirmation of Feasibility to connect to the Irish Water infrastructure does not extend to your fire flow requirements. Please note that Irish Water can not guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.

In order to determine the potential flow that could be delivered during normal operational conditions, an on site assessment of the existing network is required.

Wastewater:

New connection to the existing network is feasible without upgrade.

There is an Irish Water infrastructure within and in close proximity of the site boundaries (33'' water trunkmain, 225mm and 750mm sewers). The Developer will be required to survey the site to determine

the exact location of the infrastructure. Any trial investigations shall be carried out with the agreement and in the presence of Dun Laoghaire-Rathdown County Council.

You are advised that structures or works over or in close proximity to IW infrastructure that will inhibit access for maintenance or endanger structural integrity of the infrastructure at any time are not allowed. Diversion of the infrastructure may be required subject to layout proposal of the development. The diversion will be subject to customer entering diversion agreement with IW. A wayleave in favour of Irish Water will be required over all Infrastructure that is not located within the Public Space.

For design submissions and queries related to diversion/buildover please contact IW Diversion Team via email address diversions@water.ie.

Strategic Housing Development

Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water for review.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Marko Komso from the design team on 022 54611 or email mkomso@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Marie Claire Daly
Carnegie House, Library Road
Dun Laoghaire
Dublin A96C7W7

16 March 2020

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

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

www.water.ie

Dear Marie Claire Daly,

Re: Connection Reference No CDS20001675 pre-connection enquiry -
Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 2,902 units at Priorsland, Cherrywood, Co. Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connection at Priorsland, Cherrywood, Co. Dublin.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the networks, as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water networks can be facilitated subject to following:

- The proposed development indicates that important Irish Water assets are present on the site (33'' Cast-Iron trunk water main and Carrickmines Trunk Sewer). The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the infrastructure during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the Development.
- Electronic copy of public water and wastewater network layout maps for the area can be requested from datarequests@water.ie The map should be used as a general guide only.
- This Confirmation of Feasibility to connect to the Irish Water infrastructure does not extend to your fire flow requirements. Please note that Irish Water can not guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.
- The Development is a part of Cherrywood Strategic Development Zone and prior to agreeing to the proposed connection, all relevant core water and wastewater infrastructures within the Zone have to be completed, connected to the Irish Water networks and in operation.

Strategic Housing Development

Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore:

A. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details.

B. You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed and appropriate connection fee paid at a later date.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Marina Zivanovic Byrne from the design team on 01 89 25991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services