INXN DUB15/16

Engineering Report

280503-00

Planning | 28 July 2021

Job number 280503-00

Ove Arup & Partners Ireland Ltd

Arup
50 Ringsend Road
Dublin 4
D04 T6X0
Ireland
www.arup.com

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Document Verification

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Job title		INXN DUB15/16		Job number 280503-00
Document title		Engineering Report		File reference
Document ref		280503-00		
Revision	**Date**	**Filename**	INXN_DUB1516_Engineering Report_Planning	
Plannnig	28 Jul 2021	**Description**	Planning Issue	
			Prepared by	Checked by	Approved by
		Name	Cid dos Santos Jr.	Kieran Dowdall	John MacCarthy
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
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1 Introduction

The planning application proposes two data centres, energy generation and all other associate works on a site of 6.181ha at Profile Park, Nangor Road, Clondalkin, Dublin 22.

The application proposes two data centres, one to the south west of the site and the other to the south east of the site.

The first, known as DUB 15, is located to the south west of the site. This data centre comprises a total Gross Floor Area of 16,865m2 over two floors. The building is rectangular in shape with the main body of the building comprising data halls, with ancillary office and welfare space to the north over two floors. Proposed at ground floor is 7,340m2 of data hall space with 940m2 ancillary space to the north. At first floor there will be 7,333m2 data hall space with 1,049m2 ancillary space to the north. Roof level will comprise three small elements of staircore totalling 74m2 with ancillary space measuring 131m2 to the north.

The data halls within DUB 15 comprise a large data hall area with smaller technical rooms to the west. The ancillary space comprises various uses such as a loading bay, conference room, welfare, security and technical room at ground floor with office, switchrooms, welfare and breakout space at first floor. Staircores, ancillary roof and roof mounted mechanical plant are proposed at roof level.

A single storey screened generator compound is proposed to the south and west of DUB 15.

DUB 15 comprises two storeys with ancillary plant at roof level. The proposed building reaches a height of 20m. The parapet level will be at 96.7mOD.

The second data centre, named DUB 16, is proposed to the south east of the site. This data centre comprises a total Gross Floor Area of 16,712m2 over two floors. The building is also rectangular in shape with the main body of the building comprising data halls, with ancillary office and welfare space to the north over three floors. At first floor there will be 7,279m2 data hall space with 940m2 ancillary space to the north. At first floor there will be 7,274m2 data hall space with 1,028m2 ancillary space to the north. The third floor will comprise two small elements of data hall at the south east and south west corners totalling 56m2 with 133m2 ancillary floorspace to the north.

The data halls within DUB 16 comprise a large data hall area with smaller technical rooms to the south. The ancillary space comprises a range of uses such as loading bay, security, entrance lobby, conference room and welfare at ground floor with offices, switchrooms and welfare at first floor. Staircores, ancillary roof and roof mounted mechanical plant are proposed at roof level.

A single storey screened generator compound is proposed to the south of DUB 16.

DUB 16 comprises two storeys with ancillary plant at roof level. The proposed building reaches a height of 20m. The parapet level will be at 97.69mOD.

An energy generation compound is proposed to the north east. This will comprise five generators in their own acoustic containers, the heat recovery plant room (c.35m2), the distribution gas compound building (c.23m2), electrical substation (c.623m2) building within this compound.

The generators provide the first phase of DUB 15 with power. Future phases will import power from the grid. This will allow the data centre to use renewable power when available. During times of low renewable generation or grid constraints, the site will import power from the new natural gas power station in Profile Park.
Drainage will be provided across the site as well as Sustainable Urban Drainage measures to control run-off from the site.
There is a watercourse which runs through the site having been repositioned there during works to facilitate DUB 13 and 14. The application proposes to reroute this watercourse to the east of the site. The relocation of the watercourse has several ecological benefits which are set out in the accompanying documentation. In order to ensure that the watercourse is suitably accommodated, additional work to the watercourse is proposed to the north of the site. This widening and clearing of the watercourse will have ecological and flood risk benefits.
The application proposes two significant buildings on EE zoned land. Significant planting is proposed around the site and in particular to the south to ensure the visual impact of the proposals are softened.
Access to the site will be from existing roads to the north west. New access roads are proposed throughout the site to provide access for employees, visitors, deliveries where relevant and for emergency services should they require it. The development will be provided of 71 car parking spaces among which 52 are new proposed and 19 existing. This level of car parking will ensure that the sufficient parking will be provided for employees and there will be no overflow onto the surrounding roads. Of the 71 spaces, 4 are disabled spaces. 8 spaces will be available for the charging of electric vehicles. Covered cycle parking is provided on site, 13 Sheffield stands will provide parking for 26 bicycles.
Other ancillary buildings throughout the site will include a pump room (c.52m2) and two refuse stores (c.25m2). The total floor area of all ancillary structures measures circa 2,717m2.
Security fencing and entrances are proposed around the site as required.
Due to the scale of the development, it is requested that the applicant be allowed 10 years in which to implement the permission.

2 Existing Drainage Systems

There is an existing 225mm main spine foul drain discharging by gravity along an existing Profile Business Park estate road named The Fairways, which collects all the foul drainage discharge contribution from the existing DUB 13 and DUB 14 developments. According to the South Dublin County Council drainage records, Irish Water's ownership of this existing foul network begins immediately after the DUB 13 building, north of the access road as shown in Appendix C, from where approximately 60m downstream the pipe becomes a 300mm running towards Falcon Avenue. The segment upstream of the network taken in charge by Irish Water is in the ownership of Profile Business Park.

The existing DUB 13 and DUB14 Data Centres are served by a surface water drainage network which collects run-off coming from the existing buildings and surrounding hardstanding areas. The related surface water system runs by gravity from the rear of the existing buildings eastwards, combining into one outfall point

and discharging at a controlled rate into an existing watercourse which traverses the site from south to north. The related surface water network incorporates four existing attenuation facilities totalling an approximate storage volume of 826 m3. Also, there is another existing attenuation system of approximately 128 m3, meant to cater for an additional site development which will be incorporated into the proposed new drainage design layout through new attenuation tanks.

Downstream of the existing discharge point from the existing development, the watercourse is culverted northwards through a 1100mm diameter pipe up to the existing DUB 13 site boundary where it discharges off the site into an open channel. The watercourse is also culverted upstream a 1100mm diameter within the proposed site boundary. The watercourse will be diverted around the proposed development and this is detailed in the Arup Flood Risk Assessment, included with this application.

3 Proposed Drainage

Drainage from the proposed DUB 15, DUB 16 and Energy Centre development shall be drained by a completely separate system, with separate foul and surface water drains. The outfall of the proposed surface water system will discharge into the existing watercourse, which after completion of the proposed development will cater exclusively for surface water run-off coming from the proposed DUB 15, DUB 16, Energy Centre and existing DUB 13 and DUB 14 Data Centres. Foul water drainage will outfall and discharge into the existing Profile Business Park private foul drainage system along The Fairways estate road which subsequently discharges into the existing Irish Water Foul sewerage network. See Arup drawings in Appendix A.

Surface water discharges from the proposed development will be restricted in line with South Dublin County Council (SDCC) Water Services requirements. Surface water discharges from the site will be restricted to 2 litres/second/hectare with flows in excess of the allowable discharge rate being retained on site in underground attenuation facilities for storms up to and including the 1 in 100 year event + 20% climate change allowance. The proposed surface water drainage strategy is divided into three separate online attenuation systems which will serve buildings DUB 15, DUB 16 and the Energy Centre separately.

The drainage systems shall be designed in accordance with Part H Building Regulations, BSEN 752 Drain and Sewer Systems outside Buildings, the Greater Dublin Regional Code of Practice for Drainage Works, the Greater Dublin Strategic Drainage Study (GDSDS) and to the requirements of South Dublin County Council and Irish Water.

3.1 Proposed Foul Drainage

Foul drainage from the new data centres shall be drained by a separate system to that of the surface water drainage system. Foul drainage from the proposed development shall drain by gravity and discharge to the existing 225mm foul drainage system along The Fairways Road, in the ownership of Profile Business

Park, which subsequently discharges into Irish Water Foul sewerage network dowstream. See Arup drawings in Appendix A. No new connections will be required to the public sewerage system.

The foul drainage system will be designed to take discharges from office areas of both DUB 15 and DUB 16 Data Centre including discharges from both Data Hall areas which includes Reverse Osmosis system, Air Handling Units and testing / maintenance washdown of the Water Mist tanks. There are not chemicals added to the water supplying the Data Hall.

The buildings occupancy includes 59 staff for each data centre, totalling 118 staff at 50 litres/head/day (over a 24-hour period). The peak discharge from the Data Hall area of each Data Centre is estimated to be 1.87 litres/second and the peak discharge from the Water Mist tank 5.2 litres/second. Totalling an industrial peak discharge of 14.14 litres / second (2 x 1.87 l/s and 2 x 5.2 l/s) for the proposed site.

Therefore, the design peak foul flow rate is defined as 118 x 50 / (24 x 60 x 60) + 10.4 + 3.74 = 14.21 litres / sec based on a 4.5 Peaking Factor for Domestic Element of Industrial.

The foul wastewater discharge calculated represents the worst-case scenario with maximum possible occupancy levels, simultaneous washdown discharge from both the Water Mist Tanks and discharge from both Data Hall's (Reverse Osmosis system and Air Handling Units) occurring and will therefore be usually lower.

The Irish Water Pre-connection Enquiry Application has been lodged under Reference Number CDS21004551 and a copy of the form can be seen on Appendix D.

3.2 Proposed Surface Water Drainage

Surface water run-off for DUB 15 attenuation system comprises two different sub catchments and consequently two separate attenuation facilities each one provided with flow restricting devices. As part of the proposed new surface water drainage layout, approximately 20 m of the existing attenuation system for DUB 14 will need to be locally removed and reinstated and reconnected back into the existing attenuation pipes. DUB 16 attenuation system has its own catchment area and consequently separate attenuation facility and flow restricting device. The Energy Centre attenuation system caters for surface water run-off from two different sub catchments and comprises one separate attenuation facility and flow restricting device limiting the discharge to greenfield run-off rates. The three separate attenuation systems discharge into the same network which ultimately drains by gravity towards the existing open channel. See Arup Drawings in Appendix A.

Surface water discharges from the site will be restricted in line with the Greater Dublin Regional Code of Practice for Drainage Works and South Dublin County Council Water Services requirements. The allowable outflow from the development will be restricted to 2 litres/second/hectare.

Flows in excess of the allowable discharge rate will be stored on site in the form of underground storm attenuation reinforced concrete tanks. Additionally, SuDS

measures will be incorporated into the development to improve the quality of waters discharging into the receiving surface water systems, see Section 3.2.2 below.

Peak surface water discharges from the site (particularly during storm events) will be substantially reduced due to the restricted outflow from the development, thereby reducing the impact on the receiving drainage network. Also, the proposed watercourse diversion will significantly improve the existing surface water strategy throughout the site, with benefits related to the quantity and quality of the water discharging and improving amenity value and biodiversity on the site.

3.2.1 Storm Attenuation and Online Control

The proposed storm attenuation facilities for DUB 15 and DUB 16 are mostly located below the generator yards of each proposed Data Centre. For the Energy Centre the attenuation facility will be mostly located below the proposed road. See Arup Drawings Appendix A. The attenuation systems are designed to store a volume with equivalent storage for a 1 in 100-year storm event plus 20% allowance for climate change. See Appendix B for Micro-drainage source control attenuation tank calculations.

The outflow from the attenuation facilities will be gravitational and at a controlled rate of flow. The sub catchment area of DUB 15 Attenuation Tank No. 1 is 0.756 hectares, and the total allowable discharge will be 1.51 litres / second, resulting in a storage volume of 586.1 m3. The sub catchment area of DUB 15 Attenuation Tank No. 2 is 0.819 hectares, and the total allowable discharge will be 1.63 litres / second, resulting in a storage volume of 640.2 m3. The catchment area of DUB 16 Attenuation Tank is 1.421 hectares, and the total allowable discharge will be 2.99 litres / second, resulting in a storage volume of 1167.3 m3. The catchment area of Energy Centre Attenuation Tank is subdivided in two different catchments, one comprising the carpark in front of DUB 16 plus landscaped surrounding with an overall area of 0.287 hectares, and another one comprising the energy centre area of 0.368 hectares. Totalling the catchment area for the Energy Centre Attenuation Tank of 0.655 hectares and the total allowable discharge will be 1.31 litres / second, resulting in a storage volume of 396.3 m3. All attenuation outfall manholes will be installed with a hydro-brake or similar approved flow restricting devices to limit discharges, as outlined above, prior to final discharge, via a 225mm surface water drain into the existing open channel on the site, which formed part of the now diverted watercourse. See Arup drawings in Appendix A.

3.2.2 SuDS

SuDS features will be incorporated into the development and will include permeable paving, surface water treatment systems and swale.

The attenuation tanks proposed will provide interception of the surface water run-off reducing the flow rate of water discharging into the receiving systems. Any run-off from the roads collected by the surface water network will be treated through Class 1 petrol interceptors prior to storage within the attenuation facilities, providing oil/hydrocarbons removal which will improve the quality of

water discharging into the receiving systems in compliance with best drainage practice and SuDS requirements. These systems will provide interception of run-off and deliver removal efficiency rates of up to 80% for oil and total suspended solids.

Permeable surfacing for the new car park spaces throughout the new development will be provided. It is intended that the permeable surfacing system will allow for partial infiltration to ground pending water table levels and to the extent that soil infiltration rates in the location of these permeable surfaces allow. Permeable paving systems will reduce peak discharges into the drainage system and will provide 70-90% removal efficiency rates for hydrocarbons and 60-95% removal of suspended solids thereby improving the quality of water discharging into the systems.

Swales will be incorporated into the drainage system along proposed roads east of DUB 16 and south of DUB 15. The grass swales will collect run-off from road areas and reduce contaminant loading by providing a 2-stage level of treatment. It is intended that the swales will allow for partial infiltration to ground pending water table levels and to the extent that soil infiltration rates in the location of the swales allow.

To improve the quality of surface water discharging into the receiving system proprietary surface water treatment systems like a "Downstream Defender" or "First Defense" will be incorporated into the drainage system prior to discharge. This measure will improve the quality of surface water run-off discharging into the receiving system, in compliance with best drainage practice and SuDS requirements. The "First Defense or Downstream Defender" will provide removal efficiency rates of 50% for suspended solids and 80% for hydrocarbons. Refer to Appendix E for Hydro-International Guide to Surface Water Treatment System and their compliance with SuDS Manual C753. Third party testing has confirmed Mitigation Indices for proprietary surface water treatment systems similar to swales and ponds. All surface water run-off from the site will discharge by gravity through these treatment systems prior to discharge to the receiving system.

3.2.3 Flood Risk Assessment

A separate Flood Risk Assessment Report has been provided by Arup for the proposed development. This is submitted with the Planning Application documentation.

4 Watermain

4.1 Existing Watermain System

There is a 160mm watermain loop running along the existing Profile Business Park estate road named The Fairways, which supplies all the water for the existing DUB 13 and DUB 14 buildings. According to the South Dublin County Council watermain records, Irish Water ownership of this water main starts immediately after the existing DUB 13 Building, north of the same road as shown in Appendix C. The 160mm water main within Profile Park boundary is fed from the 700 mm main on the New Nangor Road. The section of main upstream of the mains taken in-charge by Irish Water is in the ownership of Profile Business Park and is a 160mm diameter.

The watermains within the existing DUB 13 and DUB14 Data Centres are mainly 150mm and have one metered connection into the existing 160mm looped main along The Fairways Road.

4.2 Proposed Watermain System

As part of the proposed development a new 150mm internal diameter ring main will be constructed around the DUB 15 and DUB 16 buildings as part of a ring main system, see Arup Drawings in Appendix A. A new metered connection will be provided to the existing 160mm main on The Fairways Road. The watermain system shall be installed throughout the development with sluice valves, hydrants and air valves located in accordance with the requirements of Part B Building Regulations and the Local Fire Officer's requirements.

The peak flow demand for the proposed development is expected to be in the region of 0.38 litres / second. This is based on number of staff of 59 for each Data Centre, totalling 118. The daily consumption per head is 45 litres and peaking factor 6.25 (average day peak week of 1.25 and pipe sizing peak factor of 5).

Also, there will be a water demand of 0.80 litres / second for process humidification storage replenishment (5,800 litres over 4 hours at peak demand for each data centre building). Totalling 4 litres / second with peaking factor of 5.

The fire flow requirements are expected to be a replenishment rate of 20.83 litres / second for a 600,000 litres Sprinkler Tank over 8 hours at peak demand. Also, an operational Fire Hydrant with flow rate of 25 litres / second and Hose Reel System with flow rate of 1.56 litres / second.

Pressure and flow tests will be carried out on the existing 160mm main on the The Fairways Road to confirm adequacy of supply for fire-fighting.

The Irish Water Pre-connection Enquiry Application has been lodged under Reference Number CDS21004551 and a copy of the form can be seen in Appendix D.

Appendix A

Arup Drainage and Watermain Drawings

Appendix E

Hydro-International Guide to Surface Water Treatment System

Hydro StormTrain® Series of Surface Water Treatment Devices

A Guide to The SuDS Manual (C753) Simple Index Approach

Author: Mark Goodger, Regional Technical Manager
Hydro International

Hydro International®

The SuDS Manual (C753) Simple Index Approach

Introduction

In Table 26.1 of The SuDS Manual (C753) four risk based approaches for water quality management are specified:

1. Simple Index Approach
2. Risk Screening (generally used to determine if Simple Index Approach is appropriate)
3. Detailed Risk Assessment
4. Process-Based Treatment Modelling

With the intention that the simpler approaches are applied in lower risk scenarios, with more sophisticated assessments only used when appropriate to the risk.

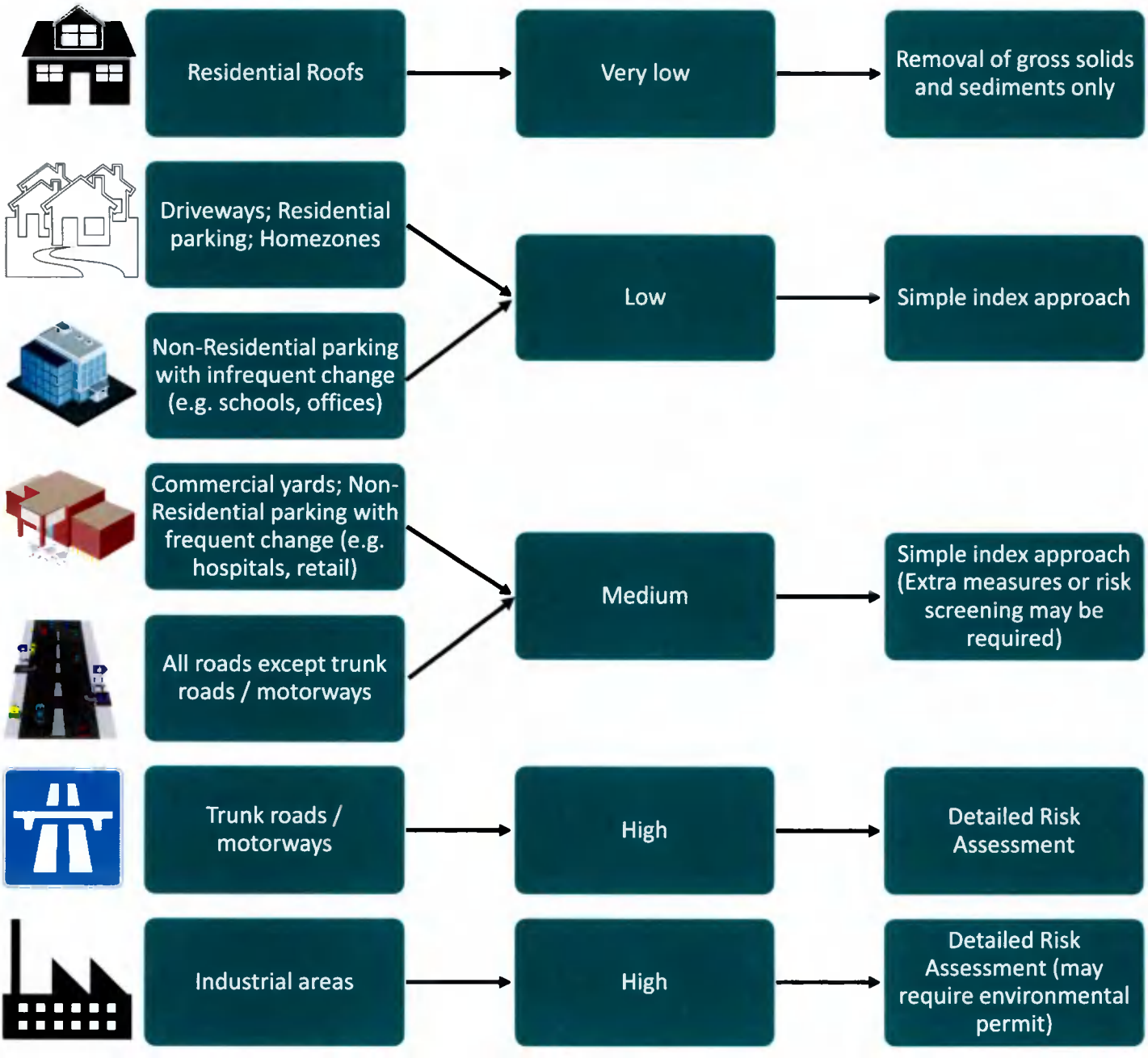


Figure 1: Applying the Risk Based Water Quality Management Approaches (Source: After Table 4.3 of the SuDS Manual)

Applying the Simple Index Approach (SIA)

The Simple Index Approach (SIA) recommended in Section 26.7.1 of The SuDS Manual (C753) was developed from that set out by Middlesex University (as outlined in Annex 5 of Chapter 26 of The SuDS Manual) and follows a three step approach:

Step 1 – Allocate suitable pollution hazard indices for the proposed land use categories

Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index

Step 3 – Where the discharge is to protected[1] surface waters or groundwater, consider the need for a more precautionary approach.

Note:

1 Designated as those protected for the supply of drinking water (see SuDS Manual Table 4.3).

Step 1: Define pollution hazard indices

Pollution hazad indices are presented in Table 26.2 of The SuDS Manual and reproduced here for simplicity. The indices range from 0 (no pollution of this type) to 1 (high pollution hazard for this contaminant type).

Table 1: Pollution hazard indices for different land use classes (Source: Reproduced from The SuDS Manual Table 26.2)

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Liquid Hydrocarbons (free floating oils)
Residential Roofs	Very low	0.2	0.2	0.05
Other Roofs (typically commercial / industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) **and non-residential car parks with infrequent change** (e.g. schools, offices) – i.e. <300 traffic movements / day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential parking with frequent change (e.g. hospitals, retail); **all roads except low traffic roads and trunk roads / motorways**[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites); **sites where chemicals and fuels** (other than domestic fuel oil) **are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways**[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes:

1. Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009)
2. These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (see also The SuDS Manual Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help to determine the most appropriate treatment approach to the development of a design solution. **Also consider spill protection – contact Hydro International to find out more about our specialist treatment and containment options for high pollultion hazard sites.**

Where a site land use falls outside of these categories, the indices should be adapted (and agreed with the drainage approving / adopting body) or else a more detailed risk assessment should be carried out.
Equivalent indices should be developed for other contaminants of interest of any given site. **For assistance with development of indices or detailed site analysis, contact Hydro International.**

Step 2: Determine SuDS Pollution Mitigation Indices

To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for that contaminant type):

Total SuDS Mitigation Index (for each contaminant) ≥ Pollution hazard index (for each contaminant)

If the mitigation index of an individual component is insufficient, two components (or more) in series will be required, with a factor of 0.5 used to account for the reduced performance of secondary or tertiary components, in line with the following equation:

$$\text{Total SuDS Mitigation Index} = \text{Mitigation Index}_1 + 0.5\,(\text{Mitigation Index}_2)$$

Where *Mitigation Index$_n$ = Mitigation Index for Component n.*

If the only runoff destination is to surface water (i.e. there is no infiltration from the SuDS to groundwater), the surface water mitigation indices should be used.

Where the principal destination of the runoff is to groundwater, then the groundwater indices should be used. This will be the case, even for infiltration systems that are designed to discharge to surface waters once the infiltration capacity is exceeded – In this scenario, the overflow will often not need to be treated prior to discharge to surface waters as the risk will be low (highly contaminated flows will have been treated prior to infiltration) and dilution will be high.

In England and Wales, if the principal runoff destination is intended to be to surface water, but some infiltration (even in small amounts) may occur through unlined components, then the groundwater indices should be used for the proportion of runoff that discharges to groundwater and the surface water indices used for the proportion of runoff that discharges to surface waters. In Scotland & Northern Ireland, groundwater risk management is not a requirement for this scenario.

Table 2: SuDS mitigation indices for discharges to surface waters (Source: Extended and reproduced from The SuDS Manual Table 26.3)

Type of SuDS Component	Mitigation Indices[1]		
	TSS	Metals	Liquid Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond[3]	0.7[2]	0.7	0.5
Wetland[3]	0.8[2]	0.8	0.8
First Defense® Vortex Separator	0.5[a]	0.33[c]	0.4[d]
Downstream Defender® Advanced Vortex Separator	0.5[a]	0.4[c]	0.8[a]
Up-Flo™ Filter	0.8[a]	0.69[c, e]	0.4[d]
Hydro-BioCell™ Bioretention System	0.8[b]	0.8[b]	0.8[d]

Notes:

1) SuDS components only deliver these indices if they are designed and constructed in accordance with the relevant technical chapters of the SuDS Manual. Designers and installers of SuDS components should be able to demonstrate competence in their respective areas.
2) Filter drains, ponds and wetlands are not recommended for removal of coarse sediments as their use for this purpose will have significant maintenance implications. Sediment (TSS) should be removed upstream where possible.
3) Where a wetland is not specifically designed to provide significantly enhanced treatment performance, it should be considered as having the same mitigation indices as a pond.

a) Derived from 3rd party testing and / or verification programmes. Test reports available on request.
b) Derived from testing and / or monitoring. Test reports available on request.
c) Derived from partitioning of sediment bound and dissolved contaminants and associated testing. Evidence available on request.
d) Based on typical values for components of this type.
e) Dependant on filter media used.

Table 3: SuDS mitigation indices for discharges to groundwater (Source: Extended and reproduced from The SuDS Manual Table 26.4)

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	Mitigation Indices TSS	Metals	Liquid Hydrocarbons
A layer of dense vegetation underlain by soil with good contaminant attenuation potential[2] of at least 300mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment) underlain by soil with good contaminant attenuation potential[2] of at least 300mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment and including a geotextile at the base separating the foundation from the subgrade) underlain by soil with good contaminant attenuation potential[2] of at least 300mm in depth[3]	0.7[4]	0.6	0.7
Bioretention underlain by soil with good contaminant attenuation potential[2] of at least 300mm in depth[3]	0.8[4]	0.8	0.8
Flow through Proprietary Treatment System prior to infiltration SuDS	**TSS**	**Metals**	**Liquid Hydrocarbons**
First Defense® Vortex Separator	0.5[a]	0.33[c]	0.4[d]
Downstream Defender® Advanced Vortex Separator	0.5[a]	0.4[c]	0.8[a]
Up-Flo™ Filter	0.8[a]	0.69[c,e]	0.4[d]
Hydro-BioCell™ Bioretention System	0.8[b]	0.8[b]	0.8[d]

Notes:

SuDS components only deliver these indices if they are designed and constructed in accordance with the relevant technical chapters of the SuDS Manual. Designers and installers of SuDS components should be able to demonstrate competence in their respective areas.

1) All designs must include a minimum of 1m unsaturated depth of aquifer material between the infiltration surface and the maximum likely groundwater level (as required by infiltration design – see The SuDS Manual Chapter 25).
2) For example as recommended in Sniffer (2008a and 2008b), Scott Wilson (2010) or other appropriate guidance.
3) Alternative depths may be considered where it can be demonstrated that the combination of the proposed depth and soil characteristics will provide equivalent protection to the underlying groundwater – see note 1.
4) If significant amounts of sediment are allowed to enter an infiltration system, there will be a high risk of rapid clogging and subsequent system failure. It is recommended to remove sediment prior to the infiltration system as far as reasonably practical.

a) Derived from 3rd party testing and / or verification programmes. Test reports available on request.
b) Derived from testing and / or monitoring. Test reports available on request.
c) Derived from partitioning of sediment bound and dissolved contaminants and associated testing. Evidence available on request.
d) Based on typical values for components of this type.
e) Dependant on filter media used.

IMPORTANT NOTES:

- Where the indices are not considered representative by the designer, a more detailed risk assessment can be undertaken.
- Components should always be designed for treatment, as described in the relevant technical guidance set out in the individual component chapters of The SuDS Manual. **If they are incorrectly designed, constructed or inadequately maintained, their treatment performance could be significanty adversely affected.**
- Where the infiltration component itself does not provide sufficient pollution mitigation, the design should include upstream SuDS components that are lined to prevent infiltration from occurring until sufficient treatment has taken place.

Step 3: Consider the need for a precautionary approach where discharges are to protected waters

Reference should be made to local standards, planning requirements and guidance, particularly with reference to discharges to protected waters where more detailed risk assessments or enhanced treatment may be required.

Case Studies:

Small is Beautiful

A First Defense® provided a much-needed small footprint solution to meeting regulatory requirements on a confined site for a new commercial office development in Perkins Township, Ohio.
TSS was the main pollutant of concern and although the Simple Index Approach was not in use in Ohio at the time of installation, retrospectively considering this approach would give:

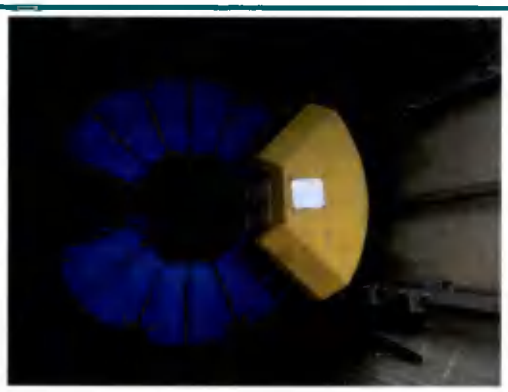
TSS Hazard Index (Office Development) = 0.5
First Defense® TSS Mitigation Index = 0.5

Mitigation Index ≥ Hazard Index

Pollution Protection in Whisky Country

Poor drainage, flooding and freezing weather led to a landslip and extreme surface degradation along a section of the narrow A95 near Elgin. Although it pre-dated the new SuDS Manual risk based approach, treatment was vital as the surface water runoff destination was to an area world-renowned for the production of single malt whiskey and an important salmon fishery.
A Downstream Defender® advanced hydrodynamic vortex separator minimises the risk of sediment and hydrocarbon pollution reaching the sensitive watercourse.

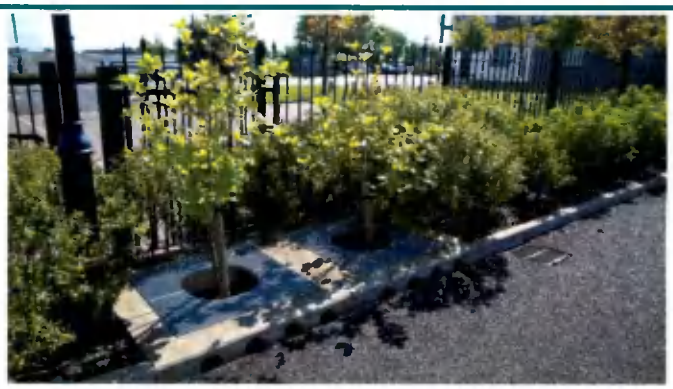
Downstream Defender® Mitigation Indices:
TSS = 0.5
Heavy Metals = 0.4
Liquid Hydrocarbons = 0.8



Fine Filtration enables Mixed-Use Development

Environment Agency planning conditions for a new commercial access road to retail and light commercial units as part of a mixed-use development in Faversham, Kent, required treatment prior to infiltration.
A bypass separator provides important spill protection for liquid hydrocarbons, prior to an Up-Flo™ Filter that ensures fine filtration of sediments and associated contaminants, such as Polycyclic Aromatic Hydrocarbons (PAHs). Although the installation pre-dates the Simple Index Approach, retrospective consideration of the approach gives:

Contaminant	TSS	Metals	PAHs
Hazard Indices (Commercial Access)	0.7	0.6	0.7
Up-Flo™ Filter Mitigation Indices	0.8	0.69	0.72



Stringent Quality Control, Naturally

Hydro BioCell™ have brought attractive landscaping and stringent surface water quality control to a sensitive location in Barry, South Wales.
3 units were retrofitted to the Business Support Centre car park as part of a wide urban regeneration scheme, effectively removing pollutants prior to discharge into the adjacent, rejuvenated harbourside.

Contaminant	TSS	Metals	Hydro-carbons
Hazard Indices (Commercial / Retail Parking)	0.7	0.6	0.7
Hydro BioCell™ Mitigation Indices	0.8	0.8	0.8

Simple Index Approach (SIA) Tool

A SIA spreadsheet tool has been developed by HR Wallingford on behalf of the Scottish Environment Protection Agency (SEPA) to support the implementation of the Simple Index Approach. The tool is freely available to download at www.susdrain.org/resources/SuDS_Manual.html.
The spreadsheet tool works through the Simple Index Approach Design Steps:

Step 1: Define pollution hazard indices

	Runoff Area Land Use Description	*Hazard Level*	*Pollution Hazard Indices* Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Residential parking	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

Step 2: Determine SuDS Pollution Mitigation Indices

	SuDS Component Description		*Pollution Mitigation Indices* Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Proprietary treatment system	Enter User Defined Indices in row below			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None				
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None				
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:	Hydro BioCell	SuDS Component 1	0.8	0.8	0.8

Calculation of Total SuDS Mitigation Indices and Results

	Combined Pollution Mitigation Indices Suspended Solids	Metals	Hydrocarbons
Total Pollution Mitigation Indices for the Runoff Area	**0.8**	**0.8**	**0.8**

Sufficiency of Pollution Mitigation Indices Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

The Hydro StormTrain® Series of Surface Water Treatment Devices

Each Hydro StormTrain® device delivers proven, measurable and repeatable surface water treatment performance. Each can be used independently to meet the specific treatment needs of a site; or can combined with one another or in conjunction with other SuDS components to form a mangament train; or can be used to protect and enhance SuDS features less suited to providing the first stage of treatment or more prone to failure due to sedimentation or shock loads associated with spills.

First Defense®
Vortex Separator

Downstream Defender®
Advanced Hydrodyanmic Vortex Separator

Up-Flo™ Filter
Fluidised Bed Up Flow Filtration System

Hydro BioCell™
Bioretention System

Learn more…

Enquire about our SuDS Treatment Devices and Support Services

Hydro International's design, advisory, inspection & maintenance services can reduce the costs and risks associated with selecting, installing and maintaining SuDS.

Contact the team today:
Call: 01275 337977
Email: sudsservices@hydro-int.com
Visit: www.hydro-int.com/sudsservices

Hydro International is a global leader in sustainable technologies for the control and treatment of stormwater and wastewater. For more than 30 years, Hydro has been at the forefront of water industry innovation and product development. From housing developments and municipal sewage works to paper mills and public highways, thousands of Hydro products are operating in countries all over the world. With strong bases in both the United States and the United Kinbgdom, and a network of partners and agents, Hydro is strategically placed to deliver winning technological solutions to customers wherever they are in the world.

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Appendix D

Irish Water Pre-connection Enquiry Form

Pre-connection enquiry form

Business developments, mixed use developments, housing developments

This form is to be filled out by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure. If completing this form by hand, please use BLOCK CAPITALS and black ink.

Please refer to the **Guide to completing the pre-connection enquiry form** on page 13 of this document when completing the form.

*** Denotes mandatory/ required field. Please note, if mandatory fields are not completed the application will be returned.**

Section A | Applicant details

1 *Applicant details:

Registered company name (if applicable): DIGITAL NETHERLAND

S VIII BV C/O DIGITAL REALTY

Trading name (if applicable):

Company registration number (if applicable): IE906549

If you are not a registered company/business, please provide the applicant's name:

*Contact name:

*Postal address:

*Eircode:

*Telephone:

Mobile:

*Email:

2 Agent details (if applicable):

Contact name: Cid dos Santos Junior

Company name (if applicable): Arup

Postal address: 50 Ringsend Road Dublin 4

Eircode: D04T6X0

Telephone: 0123344555

Email: cid.dos-santos-junior@arup.com

3 ***Please indicate whether it is the applicant or agent who should receive future correspondence in relation to the enquiry:**

Applicant [ ] Agent [X]

Section B | Site details

4 ***Site address:** PROFILE BUSINESS PARK

GRANGECASTLE

DUBLIN 22

5 ***Irish Grid co-ordinates of site:** Eastings (X) 303941 Northings (Y) 230229

Eg. co-ordinates of GPO, O'Connell St., Dublin: E(X) 315,878 N(Y) 234,619

6 ***Local Authority:**

Local Authority that granted planning permission (if applicable):

South Dublin County Council

7 ***Has full planning permission been granted?** Yes [ ] No [X]

If 'Yes', please provide the current or previous planning reference number:

Section C | Development details

8 Please outline the domestic and/or industry/business use proposed:

Property type	Number of units	Property type	Number of units	Property type	Number of units
House		Apartments		Agricultural	
Office	3	School		Retail unit	
Residential care home		Institution		Industrial unit	3
Hotel		Factory		Other	
Other (please specify type)					

9 *Approximate start date of proposed development: [ ][ ] / [0][2] / [2][0][2][3]

10 *Is the development multi-phased? Yes [X] No [ ]

If 'Yes', application must include a master-plan identifying the development phases and the current phase number.

If 'Yes', please provide details of variations in water demand volumes and wastewater discharge loads due to phasing requirements.

11 *Please indicate the type of connection required by ticking the appropriate box below:

Water [ ] Please go to Section D

Wastewater [ ] Please go to Section E

Both [X] Please complete both Sections D and E

Section D | Water connection and demand details

12 ***Is there an existing connection to public water mains at the site?** Yes [X] No [ ]

12.1 If yes, is this enquiry for an additional connection to one already installed? Yes [ ] No [X]

12.2 If yes, is this enquiry to increase the size of an existing connection? Yes [ ] No [X]

13 **Approximate date water connection is required:** [ ][ ] / [0][2] / [2][0][2][3]

14 ***What diameter of water connection is required to service the development?** [1][5][0] mm

15 ***Is more than one connection required to the public infrastructure to service this development?** Yes [ ] No [X]

If 'Yes', how many? [ ][ ]

16 **Please indicate the business water demand (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak hour water demand	0.410	**l/s**
Post-development average hour water demand	0.066	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

17 **Please indicate the industrial water demand (industry-specific water requirements):**

Post-development peak hour water demand	4.00	**l/s**
Post-development average hour water demand	0.80	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

18 **What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?**

[7][7][.][1][0] m

19 **What is the highest finished floor level of the proposed development above Malin Head Ordnance Datum?**

[8][7][.][8][4] m

20 **Is on-site water storage being provided?** Yes [X] No [ ]

Please include calculations on the attached sheet provided.

21 **Are there fire flow requirements?** Yes [X] No [ ]

Additional fire flow requirements over and above those identified in Q16-17	25	**l/s**

Please include calculations on the attached sheet provided, and include confirmation of requirements from the Fire Authority.

22 **Do you propose to supplement your potable water supply from other sources?** Yes [ ] No [X]

If 'Yes', please indicate how you propose to supplement your potable water supply from other sources (see **Guide to completing the application form** on page 12 of this document for further details):

Section E | Wastewater connection and discharge details

23 ***Is there an existing connection to a public sewer at the site?** Yes [X] No [ ]

23.1 If yes, is this enquiry for an additional connection to the one already installed? Yes [ ] No [X]

23.2 If yes, is this enquiry to increase the size of an existing connection? Yes [ ] No [X]

24 ***Approximate date that wastewater connection is required:** [ ][ ] / 0 2 / 2 0 2 3

25 ***What diameter of wastewater connection is required to service the development?** 2 2 5 mm

26 ***Is more than one connection required to the public infrastructure to service this development?** Yes [ ] No [X]

If 'Yes', how many? [ ][ ]

27 **Please indicate the commercial wastewater hydraulic load (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak discharge	0.328	**l/s**
Post-development average discharge	0.073	**l/s**

Please include calculations on the attached sheet provided.

28 **Please indicate the industrial wastewater hydraulic load (industry-specific discharge requirements):**

Post-development peak discharge	14.14	**l/s**
Post-development average discharge		**l/s**

Please include calculations on the attached sheet provided.

29 Wastewater organic load:

Characteristic	Max concentration (mg/l)	Average concentration (mg/l)	Maximum daily load (kg/day)
Biochemical oxygen demand (BOD)	295	168	1.9
Chemical oxygen demand (COD)	699	389	4.4
Suspended solids (SS)	299	163	1.9
Total nitrogen (N)	59.6	40.6	0.4
Total phosphorus (P)	11.3	7.1	0.1
Other	0	0	0

Temperature range	10-15 degrees C
pH range	6.73 - 9.0

30 *Storm water run-off will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer. In the case of such brownfield sites, please indicate if the development intends discharging surface water to the combined wastewater collection system:

Yes [ ] No [X]

If 'Yes', please give reason for discharge and comment on adequacy of SUDS/attenuation measures proposed.

31 *Do you propose to pump the wastewater? Yes [ ] No [X]

If 'Yes', please include justification for your pumped solution with this application.

32 What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?

77.10 m

33 What is the lowest finished floor level on site above Malin Head Ordnance Datum? 76.85 m

34 What is the proposed invert level of the pipe exiting the property to the public road?

73.08 m

Section F | Supporting documentation

Please provide the following additional information (all mandatory):

> Site location map: A site location map to a scale of 1:1000, which clearly identifies the land or structure to which the enquiry relates. The map shall include the following details: [X]

i. The scale shall be clearly indicated on the map.

ii. The boundaries shall be delineated in red.

iii. The site co-ordinates shall be marked on the site location map.

> Details of planning and development exemptions (if applicable). [ ]

> Calculations (calculation sheets provided below). [X]

> Site layout map to a scale of 1:500 showing layout of proposed development, water network and wastewater network layouts, additional water/wastewater infrastructure if proposed, connection points to Irish Water infrastructure. [ ]

> Conceptual design of the connection asset from the proposed development to the existing Irish Water infrastructure, including service conflicts, gradients, pipe sizes and invert levels. [ ]

> Any other information that might help Irish Water assess this pre-connection enquiry. [X]

Development Phasing Information
IW Record drawings and possible connection points

Section G | Declaration

I/We hereby make this application to Irish Water for a water and/or wastewater connection as detailed on this form.

I/We understand that any alterations made to this application must be declared to Irish Water.

The details that I/we have given with this application are accurate.

I/We have enclosed all the necessary supporting documentation.

Any personal data you provide will be stored and processed by Irish Water and may be transferred to third parties for the purposes of the water and/or wastewater connection process. I hereby give consent to Irish Water to store and process my personal data and to transfer my personal data to third parties, if required, for the purposes of the connection process.

If you wish to revoke consent at any time or wish to see Irish Water's full Data Protection Notice, please see **https://www.water.ie/privacy-notice/**

Signature: Cid Dos Santos Junior Digitally signed by Cid Dos Santos Junior DN: CN=Cid Dos Santos Junior, OU=Users, OU=Cork, OU=Ireland, OU=Europe, DC=global, DC=arup, DC=com Date: 2021.06.30 12:38:01+01'00'

Date: 30 / 06 / 2021

Your full name (in BLOCK CAPITALS):

C	I	D		D	O	S		S	A	N	T	O	S		J	U	N	I	O	R											

Irish Water will carry out a formal assessment based on the information provided on this form.
Any future connection offer made by Irish Water will be based on the information that has been provided here.

Please submit the completed form to **newconnections@water.ie** or alternatively, post to:

Irish Water
PO Box 860
South City Delivery Office
Cork City

Please note that if you are sending us your application form and any associated documentation by email, the maximum file size that we can receive in any one email is 35MB.

Please note, if mandatory fields are not completed the application will be returned.

Irish Water is subject to the provisions of the Freedom of Information Act 2014 ("FOIA") and the codes of practice issued under FOIA as may be amended, updated or replaced from time to time. The FOIA enables members of the public to obtain access to records held by public bodies subject to certain exemptions such as where the requested records may not be released, for example to protect another individual's privacy rights or to protect commercially sensitive information. Please clearly label any document or part thereof which contains commercially sensitive information. Irish Water accepts no responsibility for any loss or damage arising as a result of its processing of freedom of information requests.

Calculations

Water demand

TOTAL INDUSTRIAL COOLING WATER:

Process Humidification = 11,600 L (5,800 each Data Centre Building)
Storage Replenishment Criteria = 4 hours at peak demand
Storage Replenishment Rate = 0.80 litres / sec
Storage Replenishment Rate * Pf Ind = 0.80 x 5 = 4.00 litres / sec (Section 3.7.2 of IW-CDS-5020-03)

TOTAL STAFF ACCOMMODATION:

Number of Staff:
DUB15 Data Centre Building: 59
DUB16 Data Centre Building: 59
Energy Centre Buildings: 8
Total Staff: 126

Daily consumption (G) = 45 litre per head per day (Irish Water Code of Practice for Water Infrastructure Doc. No. IW-CDS-5020-03 Section 3.28)

Dry Weather Flow (DWF) = 126 x 45 / (24 x 60 x 60) = 0.066 litres / sec

Pf Ind = 1.25 x 5 = 6.25 (Section 3.7.2 of IW-CDS-5020-03)

Design Flow = DWF x Pf Ind = 0.066 x 6.25 = 0.41 litres / sec

CAMPUS PHASING ACCORDING TO WATER DEMAND:

PHASE 1&2:
Process Humidification = 5,800 L
Storage Replenishment Rate = 0.40 litres / sec
Storage Replenishment Rate x Pf Ind = 0.40 x 5 = 2.00 litres / sec
Number of Staff:
DUB15 Data Centre Building: 59
Energy Centre Buildings: 8
Total Staff: 67
Design Flow = 0.218 litres / sec

PHASE 3&4:
Process Humidification = 5,800 L
Storage Replenishment Rate = 0.40 litres / sec
Storage Replenishment Rate x Pf Ind = 0.40 x 5 = 2.00 litres / sec
Number of Staff:
DUB16 Data Centre Building: 59
Design Flow = 0.192 litres / sec

On-site storage

Fire flow requirements

Sprinkler Tank Provision = 600,000 L
Tank Replenishment Criteria = 8 hours at peak demand
Tank Replenishment Rate = 20.83 l/s

Hydrant Fire Flow rate = 25 litres / sec

Hose Reel System = 22,500 L
Flow rate = 1.56 litres / sec

Number of Staff:
DUB15 Data Centre Building: 59
DUB16 Data Centre Building: 59
Energy Centre Buildings: 8
Total Staff: 126

Daily Consumption (Ge) = 50 litres per head per day (Irish Water Code of Practice for Wastewater Infrastructure, Document No. IW-CDS-5030-03, Appendix C)

Peak Water Mist Valve Room Discharge: 10.4 litres / sec (5.2 litres / sec for each Data Centre Building)
Peak Data Hall Area Discharge: 3.74 litres / sec (1.87 litres / sec for each Data Centre Building)

Dry Weather Flow (DWF) = P * G + E
DWF = 126 * 50 / (24 * 60 * 60) + 10.4 + 3.74 = 14.213 litres / sec

Pf Dom,Ind = 4.5 (Irish Water Code of Practice for Wastewater Infrastructure, Document No. IW-CDS-5030-03, Appendix B)

Design Foul Flow (DFF) = Pf Dom,Ind * Pe * Ge + E
DFF = 4.5 * 126 * 50 / (24 * 60 * 60) + 10.4 + 3.74 = 14.47 litres / sec

CAMPUS PHASING ACCORDING TO FOUL WASTEWATER DISCHARGE:

PHASE 1&2:
Peak Water Mist Valve Room Discharge: 5.2 litres / sec
Peak Data Hall Area Discharge: 1.87 litres / sec
Number of Staff:
DUB15 Data Centre Building: 59
Energy Centre Buildings: 8
Total Staff: 67
Dry Weather Flow (DWF) = 7.109 litres / sec
Design Foul Flow = 7.245 litres / sec

PHASE 3&4:
Peak Water Mist Valve Room Discharge: 5.2 litres / sec
Peak Data Hall Area Discharge: 1.87 litres / sec
Number of Staff:
DUB16 Data Centre Building: 59
Dry Weather Flow (DWF) = 7.104 litres / sec
Design Foul Flow = 7.224 litres / sec

Flow balancing and pumping

N/A

Guide to completing the pre-connection enquiry form

This form should be completed by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure.

The Irish Water Codes of Practice are available at **www.water.ie** for reference.

Section A | Applicant Details

Question 1: This question requires the applicant or company enquiring about the feasibility of a connection to identify themselves, their postal address, and to provide their contact details.

Question 2: If the applicant has employed a consulting engineer or an agent to manage the enquiry on their behalf, the agent's address and contact details should be recorded here.

Question 3: Please indicate whether it is the applicant or the agent who should receive future correspondence in relation to the enquiry.

Section B | Site details

Question 4: This is the address of the site requiring the water/wastewater service connection and for which this enquiry is being made.

Question 5: Please provide the Irish Grid co-ordinates of the proposed site. Irish grid positions on maps are expressed in two dimensions as Eastings (E or X) and Northings (N or Y) relative to an origin. You will find these coordinates on your Ordnance Survey map which is required to be submitted with an application.

Question 6: Please identify the Local Authority that is or will be dealing with your planning application, for example Cork City Council.

Question 7: Please indicate if planning permission has been granted for this application, and if so, please provide the planning permission reference number.

Section C | Development details

Question 8: Please specify the number of different property/premises types by filling in the tables provided.

Question 9: Please indicate the approximate commencement date of works on the development.

Question 10: Please indicate if a phased building approach is to be adopted when developing the site. If so, please provide details of the phase master-plan and the proposed variation in water demand/wastewater discharge as a result of the phasing of the development.

Question 11: Please indicate the type of connection required by ticking the appropriate box and proceed to complete the appropriate section or sections.

Section D | Water connection and demand details

Question 12: Please indicate if a water connection already exists for this site.

Question 12.1: Please indicate if this enquiry concerns an additional connection to one already installed on the site.

Question 12.2: Please indicate if you are proposing to upgrade the water connection to facilitate an increase in water demand. Irish Water will determine what impact this will have on our infrastructure.

Question 13: Please indicate the approximate date that the proposed connection to the water infrastructure will be required.

Question 14: Please indicate what diameter of water connection is required to service this development.

Question 15: Please indicate if more than one connection is required to service this development. Please note that the connection size provided may be used to determine the connection charge.

Question 16: If this connection enquiry concerns a business premises, please provide calculations for the water demand and include your calculations on the calculation sheet provided. Business premises include shops, offices, hotels, schools, etc. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 17: If this connection enquiry is for an industrial premises, please calculate the water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak demand for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 18: Please specify the ground level at the location where connection to the public water mains will be made. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 19: Please specify the highest finished floor level on site. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 20: If storage is required, water storage capacity of 24-hour water demand must usually be provided at the proposed site. In some cases, 24-hour storage capacity may not be required, for example 24-hour storage for a domestic house would be provided in an attic storage tank. Please calculate the 24-hour water storage requirements and include your calculations on the attached sheet provided. Please also confirm that on-site storage is being provided by ticking the appropriate box.

Question 21: The water supply system shall be designed and constructed to reliably convey the water flows that are required of the development including fire flow requirements by the Fire Authority. The Fire Authority will provide the requirement for fire flow rates that the water supply system will have to carry. Please note that while flows in excess of your required demand may be achieved in the Irish Water network and could be utilised in the event of a fire, Irish Water cannot guarantee a flow rate to meet your fire flow requirement. To guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development. Please include your calculations on the attached sheet provided, and further provide confirmation of the Fire Authority requirements.

Question 22: Please identify proposed additional water supply sources, that is, do you intend to connect to the public water mains or the public mains and supplement from other sources? If supplementing public water supply with a supply from another source, please provide details as to how the potable water supply is to be protected from cross contamination at the premises.

Section E | Wastewater connection and discharge details

Question 23: Please indicate if a wastewater connection to a public sewer already exists for this site.

Question 23.1: Please indicate if this enquiry relates to an additional wastewater connection to one already installed.

Question 23.2: Please indicate if you are proposing to upgrade the wastewater connection to facilitate an increased discharge. Irish Water will determine what impact this will have on our infrastructure.

Question 24: Please specify the approximate date that the proposed connection to the wastewater infrastructure will be required.

Question 25: Please indicate what diameter of wastewater connection is required to service this development.

Question 26: Please indicate if more than one connection is required to service this development. Please indicate number required.

Question 27: If this enquiry relates to a business premises, please provide calculations for the wastewater discharge and include your calculations on the attached sheet provided. Business premises include shops, offices, hotels, schools, etc. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 28: If this enquiry relates to an industrial premises, please provide calculations for the wastewater discharge and include your calculations on the calculation sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak discharge for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 29: Please specify the maximum and average concentrations and the maximum daily load of each of the wastewater characteristics listed in the wastewater organic load table (if not domestic effluent), and also specify if any other significant concentrations are expected in the effluent. Please complete the table and provide additional supporting documentation if relevant. Note that the concentration shall be in mg/l and the load shall be in kg/day. Note that for business premises (shops, offices, schools, hotels, etc.) for which only domestic effluent will be discharged (excluding discharge from canteens/ restaurants which would require a Trade Effluent Discharge licence), there is no need to complete this question.

Question 30: In exceptional circumstances, such as brownfield sites, where the only practical outlet for storm/ surface water is to a combined sewer, Irish Water will consider permitting a restricted attenuated flow to the combined sewer. Storm/surface water will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer and the applicant must demonstrate how the storm/surface water flow from the proposed site is minimised using sustainable urban drainage system (SUDS). This type of connection will only be considered on a case by case basis. Please advise if the proposed development intends discharging surface water to the combined wastewater collection system.

Question 31: Please specify if the development needs to pump its wastewater discharge to gain access to Irish Water infrastructure.

Question 32: Please specify the ground level at the location where connection to the public sewer will be made. This is required to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 33: Please specify the lowest floor level of the proposed development. This is required in order to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 34: Please specify the proposed invert level of the pipe exiting the property to the public road.

Section F | Supporting documentation

Please provide additional information as listed.

Section G | Declaration

Please review the declaration, sign, and return the completed application form to Irish Water by email or by post using the contact details provided in Section G.

Notes

Notes

Appendix B

Storm Water Attenuation Calculations

Technical Note

ARUP

50 Ringsend Road
Dublin 4
Ireland
www.arup.com

t +353 1 233 4455
f +353 1 668 3169

Project title	INXN DUB15/16	Job number	280503-00
cc		File reference	PL1
Prepared by	Cid dos Santos Junior	Date	28 July 2021
Subject	Proposed Surface Water Drainage Design		

1 Introduction

Microdrainage design software is based on the Wallingford procedure. It has the ability to model and analyse fully integrated drainage systems. The INXN DUB 15 & DUB 16 Data Centres storm water attenuation systems and drainage network are designed using Microdrainage simulation.

2 Microdrainage Simulation Summary

The proposed surface water drainage system is designed for a 5 year storm return period. The system is simulated and indicates no surface flooding at any part of the site for storms up to and including the 1:100 year return period plus 20% for climate change. Refer to Arup drawing C-0104 for the surface water drainage layout.

3 Design Criteria and Loading

The proposed surface water drainage system is designed in accordance with Part H of the Building Regulations, BS EN 752 Drain and Sewer System, the Greater Dublin Regional Code of Practice for Drainage Works.

The Flood Studies Report (FSR) rainfall methodology is used in the programme. Rainfall is calculated using Region, Return Period, M5-60, and Ratio R as explained further below.

The programme uses the M5-60 (60 minutes storm duration of 5 year return period) and ratio R (M5-60/M5-2 day) to calculate the intensity/duration/ frequency characteristics for any location in Ireland.

A rainfall depth of 16.900mm on 60 minutes storm duration of 5 year return period and a ratio of 0.272 was applied as design criteria on Microdrainage 2020.1.3. Refer to Appendix B for a copy of the Met Eireann Rainfall Statistics for the location.

Based on Irish Water Guidelines, a recommended value of 3 minutes global time of entry (Te) was applied.

4 Building Storm Network Details

The storm network is designed on Microdrainage 2015.1.1 using a 5 year return period. The pipe network and gradient are assigned using the Modified Rational Method where:

Q (l/s) = Cv*Cr*(2.78*I(mm/hr)*A (ha))

Cv= 0.75 and Cr= 1.3 (as recommended by the Wallingford Procedure)

The programme uses the M5-60 (16.900mm) and ratio (0.272) to calculate the intensity/duration/ frequency characteristics for any location in Ireland.

The storm network has four online flow control devices (Hydro-brakes), located immediately after each Attenuation Tank. The Hydro-brakes design head and flows are as following:

DUB 15 Attenuation Tank No 1: design head of 0.950m and design flow of 1.512 l/s

DUB 15 Attenuation Tank No 2: design head of 0.950m and design flow of 1.638 l/s

DUB 16 Attenuation Tank: design head of 1.615 m and design flow of 2.992 l/s

Energy Centre Attenuation Tank: design head of 0.950m and design flow of 1.310 l/s

This is in line with extract from Table 6.3 of the Greater Dublin Regional Code of Practice for Drainage Works and South Dublin County Council requirements for a maximum discharge of 2l/s/ha. The proposed overall site area to be incorporated into the proposed surface water system is 3.726 ha. The remaining area will be part of the watercourse catchment and the existing surface water system along The Fairways road. See Arup Drawing C-0105.

	4.3	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.

Table 6.3 Criteria for New Development Drainage

The storm water network has four online attenuation facilities. The facilities will intercept surface water runoff in the network and limit the discharge according to the allowable 2 l/s/ha through use of Hydro-brakes.

The storm water attenuation facilities have storage volume as following:

DUB 15 Attenuation Tank No 1: 586.1 m3

DUB 15 Attenuation Tank No 2: 640.2 m3

DUB 16 Attenuation Tank: 1167.3 m3

Energy Centre Attenuation Tank: 396.3 m3

These are designed to cater for storms up to and including the 1 in 100 year return period plus 20% for climate change. Please refer to attached copy of storm attenuation simulation calculation for further details. Refer to Arup drawings C-0104 and C-0105 for further details.

5 Storm Network Simulation

The level of service includes no surface flooding for return periods up to 1:100 year plus 20% for climate change. Detailed summary of critical results of the 5 year+20%, 30 year+20% and 100 year + 20% is included in this report in Appendix B, Microdrainage Simulation.

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 303941, Northing: 230229,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.4,	4.1,	5.0,	5.7,	6.2,	8.0,	10.1,	11.5,	13.5,	15.4,	16.8,	19.1,	20.8,	22.3,	N/A ,
10 mins	3.2,	4.8,	5.7,	7.0,	8.0,	8.7,	11.2,	14.1,	16.0,	18.9,	21.4,	23.4,	26.6,	29.0,	31.1,	N/A ,
15 mins	3.8,	5.6,	6.7,	8.3,	9.4,	10.2,	13.2,	16.6,	18.9,	22.2,	25.2,	27.5,	31.2,	34.2,	36.6,	N/A ,
30 mins	5.0,	7.4,	8.7,	10.7,	12.1,	13.2,	16.8,	21.0,	23.9,	28.0,	31.7,	34.6,	39.1,	42.7,	45.7,	N/A ,
1 hours	6.6,	9.6,	11.2,	13.8,	15.5,	16.9,	21.5,	26.7,	30.3,	35.3,	39.9,	43.5,	49.0,	53.4,	57.0,	N/A ,
2 hours	8.6,	12.5,	14.6,	17.8,	20.0,	21.7,	27.4,	34.0,	38.4,	44.6,	50.2,	54.6,	61.4,	66.7,	71.2,	N/A ,
3 hours	10.1,	14.5,	17.0,	20.6,	23.2,	25.1,	31.6,	39.1,	44.1,	51.1,	57.5,	62.4,	70.1,	76.1,	81.0,	N/A ,
4 hours	11.3,	16.2,	18.9,	23.0,	25.7,	27.9,	35			56.3,	63.2,	68.6,	76.9,	83.4,	88.9,	N/A ,
6 hours	13.3,	18.9,	22.0,	26.6,	29.8,	32.3,	40			64.5,	72.3,	78.4,	87.8,	95.1,	101.2,	N/A ,
9 hours	15.5,	22.1,	25.6,	30.9,	34.5,	37.4,	46			74.0,	82.7,	89.6,	100.1,	108.3,	115.2,	N/A ,
12 hours	17.4,	24.6,	28.5,	34.4,	38.4,	41.5,	51.			81.5,	91.0,	98.5,	109.9,	118.9,	126.3,	N/A ,
18 hours	20.4,	28.7,	33.2,	39.9,	44.5,	48.0,	59.5,	72.6,	81.2,	93.3,	104.1,	112.5,	125.4,	135.4,	143.7,	N/A ,
24 hours	22.9,	32.1,	37.0,	44.4,	49.4,	53.2,	65.9,	80.2,	89.6,	102.8,	114.6,	123.7,	137.7,	148.6,	157.6,	189.2,
2 days	28.7,	39.1,	44.6,	52.7,	58.1,	62.2,	75.6,	90.5,	100.2,	113.7,	125.6,	134.7,	148.6,	159.3,	168.1,	198.7,
3 days	33.4,	44.8,	50.7,	59.4,	65.1,	69.5,	83.6,	99.1,	109.1,	123.0,	135.1,	144.3,	158.4,	169.2,	178.0,	208.5,
4 days	37.6,	49.8,	56.1,	65.2,	71.3,	75.9,	90.6,	106.7,	117.0,	131.2,	143.5,	152.9,	167.2,	178.1,	187.0,	217.7,
6 days	44.9,	58.5,	65.4,	75.4,	81.9,	86.9,	102.7,	119.7,	130.6,	145.4,	158.3,	168.0,	182.7,	193.9,	203.0,	234.2,
8 days	51.4,	66.1,	73.6,	84.3,	91.3,	96.6,	113.2,	131.1,	142.4,	157.8,	171.1,	181.2,	196.3,	207.8,	217.1,	248.8,
10 days	57.3,	73.1,	81.0,	92.3,	99.7,	105.3,	122.7,	141.3,	153.1,	169.0,	182.7,	193.1,	208.6,	220.3,	229.8,	262.1,
12 days	62.9,	79.6,	87.9,	99.8,	107.5,	113.3,	131.5,	150.8,	162.9,	179.4,	193.4,	204.0,	219.9,	231.9,	241.6,	274.4,
16 days	73.2,	91.6,	100.7,	113.6,	121.9,	128.1,	147.5,	168.0,	180.8,	198.1,	212.9,	223.9,	240.4,	252.8,	262.9,	296.7,
20 days	82.8,	102.6,	112.4,	126.1,	135.0,	141.6,	162.1,	183.7,	197.1,	215.1,	230.4,	241.9,	259.0,	271.8,	282.1,	316.8,
25 days	94.0,	115.5,	126.0,	140.7,	150.1,	157.2,	178.9,	201.6,	215.7,	234.6,	250.5,	262.4,	280.1,	293.4,	304.1,	339.8,

M5-60: 16.9
Ratio-r: 0.272

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

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 3514 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.191	0.191	0.0	1.4	1.4	118.1	O K
30 min Summer	0.264	0.264	0.0	1.4	1.4	163.0	O K
60 min Summer	0.341	0.341	0.0	1.4	1.4	210.5	O K
120 min Summer	0.427	0.427	0.0	1.4	1.4	263.5	O K
180 min Summer	0.481	0.481	0.0	1.4	1.4	297.2	O K
240 min Summer	0.522	0.522	0.0	1.4	1.4	322.4	O K
360 min Summer	0.582	0.582	0.0	1.4	1.4	359.5	O K
480 min Summer	0.625	0.625	0.0	1.4	1.4	386.1	O K
600 min Summer	0.658	0.658	0.0	1.4	1.4	406.6	O K
720 min Summer	0.685	0.685	0.0	1.4	1.4	423.1	O K
960 min Summer	0.725	0.725	0.0	1.4	1.4	448.0	O K
1440 min Summer	0.776	0.776	0.0	1.4	1.4	478.9	O K
2160 min Summer	0.810	0.810	0.0	1.4	1.4	500.1	O K
2880 min Summer	0.819	0.819	0.0	1.4	1.4	505.8	O K
4320 min Summer	0.820	0.820	0.0	1.4	1.4	506.6	O K
5760 min Summer	0.812	0.812	0.0	1.4	1.4	501.4	O K
7200 min Summer	0.800	0.800	0.0	1.4	1.4	493.8	O K
8640 min Summer	0.785	0.785	0.0	1.4	1.4	484.7	O K
10080 min Summer	0.769	0.769	0.0	1.4	1.4	474.8	O K
15 min Winter	0.214	0.214	0.0	1.4	1.4	132.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	88.392	0.0	95.7	19
30 min Summer	61.225	0.0	115.4	34
60 min Summer	39.777	0.0	197.5	64
120 min Summer	25.154	0.0	230.6	124
180 min Summer	19.082	0.0	233.5	184
240 min Summer	15.649	0.0	229.5	244
360 min Summer	11.804	0.0	219.7	364
480 min Summer	9.651	0.0	213.5	482
600 min Summer	8.250	0.0	209.5	602
720 min Summer	7.256	0.0	206.9	722
960 min Summer	5.924	0.0	205.4	962
1440 min Summer	4.450	0.0	208.6	1442
2160 min Summer	3.340	0.0	426.2	2160
2880 min Summer	2.721	0.0	418.7	2736
4320 min Summer	2.036	0.0	410.7	3416
5760 min Summer	1.657	0.0	830.7	4208
7200 min Summer	1.411	0.0	819.0	5040
8640 min Summer	1.238	0.0	783.2	5880
10080 min Summer	1.108	0.0	744.9	6752
15 min Winter	88.392	0.0	104.2	19

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.296	0.296	0.0	1.4	1.4	182.7	O K
60 min Winter	0.382	0.382	0.0	1.4	1.4	236.1	O K
120 min Winter	0.479	0.479	0.0	1.4	1.4	295.9	O K
180 min Winter	0.541	0.541	0.0	1.4	1.4	334.3	O K
240 min Winter	0.588	0.588	0.0	1.4	1.4	362.8	O K
360 min Winter	0.655	0.655	0.0	1.4	1.4	404.6	O K
480 min Winter	0.704	0.704	0.0	1.4	1.4	435.0	O K
600 min Winter	0.743	0.743	0.0	1.4	1.4	458.7	O K
720 min Winter	0.774	0.774	0.0	1.4	1.4	477.9	O K
960 min Winter	0.822	0.822	0.0	1.4	1.4	507.4	O K
1440 min Winter	0.883	0.883	0.0	1.5	1.5	545.4	O K
2160 min Winter	0.930	0.930	0.0	1.5	1.5	574.5	O K
2880 min Winter	0.949	0.949	0.0	1.5	1.5	586.1	O K
4320 min Winter	0.947	0.947	0.0	1.5	1.5	584.7	O K
5760 min Winter	0.936	0.936	0.0	1.5	1.5	578.1	O K
7200 min Winter	0.917	0.917	0.0	1.5	1.5	566.3	O K
8640 min Winter	0.893	0.893	0.0	1.5	1.5	551.6	O K
10080 min Winter	0.867	0.867	0.0	1.5	1.5	535.5	O K

Storage volume required

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.225	0.0	118.3	34
60 min Winter	39.777	0.0	216.5	64
120 min Winter	25.154	0.0	234.5	122
180 min Winter	19.082	0.0	228.7	182
240 min Winter	15.649	0.0	222.3	240
360 min Winter	11.804	0.0	214.7	360
480 min Winter	9.651	0.0	211.1	478
600 min Winter	8.250	0.0	210.2	596
720 min Winter	7.256	0.0	211.3	714
960 min Winter	5.924	0.0	216.0	944
1440 min Winter	4.450	0.0	219.7	1412
2160 min Winter	3.340	0.0	437.5	2092
2880 min Winter	2.721	0.0	440.6	2740
4320 min Winter	2.036	0.0	434.6	3888
5760 min Winter	1.657	0.0	874.2	4448
7200 min Winter	1.411	0.0	848.5	5400
8640 min Winter	1.238	0.0	819.2	6320
10080 min Winter	1.108	0.0	793.9	7264

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Shortest Storm (mins)	15
Ratio R	0.272	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.718

AT Catchment Impermeable Area

Time (mins) From:	To:	Area (ha)
0	4	0.718

Model Details

Storage is Offline Dividing Weir Level (m) 0.000
Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	650.0	0.0	1.001	0.0	0.0
1.000	650.0	0.0	2.000	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0059-1512-0950-1512
Design Head (m)	0.950
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	59
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	1.5
Flush-Flo™	0.259	1.4
Kick-Flo®	0.524	1.2
Mean Flow over Head Range	-	1.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	1.7	3.000	2.6	7.000	3.8
0.200	1.4	1.400	1.8	3.500	2.7	7.500	3.9
0.300	1.4	1.600	1.9	4.000	2.9	8.000	4.0
0.400	1.4	1.800	2.0	4.500	3.1	8.500	4.1
0.500	1.2	2.000	2.1	5.000	3.2	9.000	4.3
0.600	1.2	2.200	2.2	5.500	3.4	9.500	4.4
0.800	1.4	2.400	2.3	6.000	3.5		
1.000	1.5	2.600	2.4	6.500	3.7		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 3588 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.190	0.190	0.0	1.5	1.5	127.9	O K
30 min Summer	0.262	0.262	0.0	1.5	1.5	176.7	O K
60 min Summer	0.338	0.338	0.0	1.5	1.5	228.2	O K
120 min Summer	0.423	0.423	0.0	1.5	1.5	285.6	O K
180 min Summer	0.478	0.478	0.0	1.5	1.5	322.1	O K
240 min Summer	0.518	0.518	0.0	1.5	1.5	349.5	O K
360 min Summer	0.578	0.578	0.0	1.5	1.5	389.9	O K
480 min Summer	0.621	0.621	0.0	1.5	1.5	419.0	O K
600 min Summer	0.655	0.655	0.0	1.5	1.5	441.5	O K
720 min Summer	0.681	0.681	0.0	1.5	1.5	459.6	O K
960 min Summer	0.722	0.722	0.0	1.5	1.5	487.1	O K
1440 min Summer	0.773	0.773	0.0	1.5	1.5	521.5	O K
2160 min Summer	0.809	0.809	0.0	1.5	1.5	545.7	O K
2880 min Summer	0.820	0.820	0.0	1.5	1.5	552.9	O K
4320 min Summer	0.822	0.822	0.0	1.5	1.5	554.2	O K
5760 min Summer	0.814	0.814	0.0	1.5	1.5	549.1	O K
7200 min Summer	0.802	0.802	0.0	1.5	1.5	541.1	O K
8640 min Summer	0.788	0.788	0.0	1.5	1.5	531.5	O K
10080 min Summer	0.773	0.773	0.0	1.5	1.5	521.1	O K
15 min Winter	0.213	0.213	0.0	1.5	1.5	143.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	88.392	0.0	102.2	19
30 min Summer	61.225	0.0	122.9	34
60 min Summer	39.777	0.0	212.5	64
120 min Summer	25.154	0.0	247.0	124
180 min Summer	19.082	0.0	250.5	184
240 min Summer	15.649	0.0	247.4	244
360 min Summer	11.804	0.0	236.6	364
480 min Summer	9.651	0.0	229.0	482
600 min Summer	8.250	0.0	224.0	602
720 min Summer	7.256	0.0	220.7	722
960 min Summer	5.924	0.0	217.8	962
1440 min Summer	4.450	0.0	220.4	1442
2160 min Summer	3.340	0.0	452.7	2160
2880 min Summer	2.721	0.0	444.1	2792
4320 min Summer	2.036	0.0	435.1	3460
5760 min Summer	1.657	0.0	891.4	4264
7200 min Summer	1.411	0.0	871.9	5048
8640 min Summer	1.238	0.0	833.5	5888
10080 min Summer	1.108	0.0	793.0	6760
15 min Winter	88.392	0.0	111.1	19

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.294	0.294	0.0	1.5	1.5	198.0	O K
60 min Winter	0.379	0.379	0.0	1.5	1.5	255.9	O K
120 min Winter	0.476	0.476	0.0	1.5	1.5	320.8	O K
180 min Winter	0.537	0.537	0.0	1.5	1.5	362.3	O K
240 min Winter	0.583	0.583	0.0	1.5	1.5	393.4	O K
360 min Winter	0.651	0.651	0.0	1.5	1.5	438.9	O K
480 min Winter	0.700	0.700	0.0	1.5	1.5	472.1	O K
600 min Winter	0.738	0.738	0.0	1.5	1.5	498.0	O K
720 min Winter	0.769	0.769	0.0	1.5	1.5	519.0	O K
960 min Winter	0.818	0.818	0.0	1.5	1.5	551.4	O K
1440 min Winter	0.880	0.880	0.0	1.5	1.5	593.5	O K
2160 min Winter	0.929	0.929	0.0	1.6	1.6	626.3	O K
2880 min Winter	0.949	0.949	0.0	1.6	1.6	639.9	O K
4320 min Winter	0.949	0.949	0.0	1.6	1.6	640.2	O K
5760 min Winter	0.938	0.938	0.0	1.6	1.6	633.0	O K
7200 min Winter	0.921	0.921	0.0	1.6	1.6	621.0	O K
8640 min Winter	0.898	0.898	0.0	1.6	1.6	605.7	O K
10080 min Winter	0.873	0.873	0.0	1.5	1.5	588.6	O K

Storage volume required

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.225	0.0	126.2	34
60 min Winter	39.777	0.0	232.4	64
120 min Winter	25.154	0.0	251.5	122
180 min Winter	19.082	0.0	246.8	182
240 min Winter	15.649	0.0	239.3	240
360 min Winter	11.804	0.0	230.0	360
480 min Winter	9.651	0.0	225.2	478
600 min Winter	8.250	0.0	223.4	596
720 min Winter	7.256	0.0	223.7	714
960 min Winter	5.924	0.0	228.2	944
1440 min Winter	4.450	0.0	232.2	1412
2160 min Winter	3.340	0.0	463.9	2096
2880 min Winter	2.721	0.0	466.6	2764
4320 min Winter	2.036	0.0	460.4	3936
5760 min Winter	1.657	0.0	930.0	4496
7200 min Winter	1.411	0.0	902.0	5408
8640 min Winter	1.238	0.0	871.2	6392
10080 min Winter	1.108	0.0	845.0	7264

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Shortest Storm (mins)	15
Ratio R	0.272	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.778

Time (mins) From:	To:	Area (ha)
0	4	0.778

AT Catchment Impermeable Area

Model Details

Storage is Offline Dividing Weir Level (m) 0.000
Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	710.0	0.0	1.001	0.0	0.0
1.000	710.0	0.0	2.000	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0060-1600-0950-1600
Design Head (m)	0.950
Design Flow (l/s)	1.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	60
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	1.6
Flush-Flo™	0.268	1.5
Kick-Flo®	0.539	1.2
Mean Flow over Head Range	-	1.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.1
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.3	2.000	2.2	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.3	5.500	3.6	9.500	4.6
0.800	1.5	2.400	2.4	6.000	3.7		
1.000	1.6	2.600	2.5	6.500	3.9		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 3743 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.330	0.330	0.0	2.5	2.5	233.7	O K
30 min Summer	0.456	0.456	0.0	2.5	2.5	322.8	O K
60 min Summer	0.590	0.590	0.0	2.5	2.5	417.3	O K
120 min Summer	0.739	0.739	0.0	2.5	2.5	523.3	O K
180 min Summer	0.834	0.834	0.0	2.5	2.5	590.3	O K
240 min Summer	0.904	0.904	0.0	2.5	2.5	640.0	O K
360 min Summer	1.007	1.007	0.0	2.5	2.5	712.6	O K
480 min Summer	1.081	1.081	0.0	2.5	2.5	765.1	O K
600 min Summer	1.139	1.139	0.0	2.6	2.6	805.8	O K
720 min Summer	1.185	1.185	0.0	2.6	2.6	838.5	O K
960 min Summer	1.255	1.255	0.0	2.7	2.7	888.0	O K
1440 min Summer	1.342	1.342	0.0	2.8	2.8	949.8	O K
2160 min Summer	1.402	1.402	0.0	2.8	2.8	992.5	O K
2880 min Summer	1.420	1.420	0.0	2.8	2.8	1004.9	O K
4320 min Summer	1.425	1.425	0.0	2.8	2.8	1008.8	O K
5760 min Summer	1.414	1.414	0.0	2.8	2.8	1000.5	O K
7200 min Summer	1.395	1.395	0.0	2.8	2.8	987.3	O K
8640 min Summer	1.373	1.373	0.0	2.8	2.8	971.7	O K
10080 min Summer	1.349	1.349	0.0	2.8	2.8	954.5	O K
15 min Winter	0.370	0.370	0.0	2.5	2.5	261.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	88.392	0.0	190.5	19
30 min Summer	61.225	0.0	208.3	34
60 min Summer	39.777	0.0	386.8	64
120 min Summer	25.154	0.0	393.8	124
180 min Summer	19.082	0.0	383.3	184
240 min Summer	15.649	0.0	377.3	244
360 min Summer	11.804	0.0	374.1	364
480 min Summer	9.651	0.0	378.4	482
600 min Summer	8.250	0.0	387.4	602
720 min Summer	7.256	0.0	394.9	722
960 min Summer	5.924	0.0	404.7	962
1440 min Summer	4.450	0.0	412.3	1442
2160 min Summer	3.340	0.0	809.1	2160
2880 min Summer	2.721	0.0	821.2	2684
4320 min Summer	2.036	0.0	810.0	3416
5760 min Summer	1.657	0.0	1580.9	4208
7200 min Summer	1.411	0.0	1538.4	5040
8640 min Summer	1.238	0.0	1489.6	5880
10080 min Summer	1.108	0.0	1450.7	6664
15 min Winter	88.392	0.0	200.8	19

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.511	0.511	0.0	2.5	2.5	361.9	O K
60 min Winter	0.662	0.662	0.0	2.5	2.5	468.2	O K
120 min Winter	0.830	0.830	0.0	2.5	2.5	587.2	O K
180 min Winter	0.937	0.937	0.0	2.5	2.5	662.9	O K
240 min Winter	1.016	1.016	0.0	2.5	2.5	719.3	O K
360 min Winter	1.133	1.133	0.0	2.5	2.5	802.1	O K
480 min Winter	1.219	1.219	0.0	2.6	2.6	862.4	O K
600 min Winter	1.285	1.285	0.0	2.7	2.7	909.6	O K
720 min Winter	1.339	1.339	0.0	2.7	2.7	947.8	O K
960 min Winter	1.422	1.422	0.0	2.8	2.8	1006.8	O K
1440 min Winter	1.530	1.530	0.0	2.9	2.9	1083.1	O K
2160 min Winter	1.614	1.614	0.0	3.0	3.0	1142.3	O K
2880 min Winter	1.648	1.648	0.0	3.0	3.0	1166.6	O K
4320 min Winter	1.649	1.649	0.0	3.0	3.0	1167.3	O K
5760 min Winter	1.636	1.636	0.0	3.0	3.0	1157.7	O K
7200 min Winter	1.607	1.607	0.0	3.0	3.0	1137.4	O K
8640 min Winter	1.571	1.571	0.0	3.0	3.0	1111.7	O K
10080 min Winter	1.531	1.531	0.0	2.9	2.9	1083.4	O K

Storage volume required

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.225	0.0	209.0	34
60 min Winter	39.777	0.0	400.5	64
120 min Winter	25.154	0.0	386.1	122
180 min Winter	19.082	0.0	378.5	182
240 min Winter	15.649	0.0	377.1	240
360 min Winter	11.804	0.0	385.8	360
480 min Winter	9.651	0.0	399.9	478
600 min Winter	8.250	0.0	410.0	596
720 min Winter	7.256	0.0	417.5	712
960 min Winter	5.924	0.0	427.0	944
1440 min Winter	4.450	0.0	433.2	1412
2160 min Winter	3.340	0.0	859.1	2092
2880 min Winter	2.721	0.0	869.5	2740
4320 min Winter	2.036	0.0	854.1	3588
5760 min Winter	1.657	0.0	1645.1	4440
7200 min Winter	1.411	0.0	1615.7	5400
8640 min Winter	1.238	0.0	1595.0	6312
10080 min Winter	1.108	0.0	1558.3	7256

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Shortest Storm (mins)	15
Ratio R	0.272	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 1.421

Time (mins) From:	To:	Area (ha)
0	4	1.421

AT Catchment Impermeable Area

Model Details

Storage is Offline Dividing Weir Level (m) 0.000
Cover Level (m) 2.700

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	745.0	0.0	1.701	0.0	0.0
1.700	745.0	0.0	2.700	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0074-3000-1615-3000
Design Head (m)	1.615
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	74
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.615	3.0
Flush-Flo™	0.325	2.5
Kick-Flo®	0.659	2.0
Mean Flow over Head Range	-	2.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	2.6	3.000	4.0	7.000	5.9
0.200	2.4	1.400	2.8	3.500	4.3	7.500	6.1
0.300	2.5	1.600	3.0	4.000	4.6	8.000	6.3
0.400	2.4	1.800	3.2	4.500	4.8	8.500	6.5
0.500	2.4	2.000	3.3	5.000	5.1	9.000	6.7
0.600	2.2	2.200	3.5	5.500	5.3	9.500	6.9
0.800	2.2	2.400	3.6	6.000	5.5		
1.000	2.4	2.600	3.7	6.500	5.7		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 2897 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.203	0.203	0.0	1.2	1.2	84.9	O K
30 min Summer	0.280	0.280	0.0	1.2	1.2	117.1	O K
60 min Summer	0.362	0.362	0.0	1.2	1.2	151.1	O K
120 min Summer	0.452	0.452	0.0	1.2	1.2	188.9	O K
180 min Summer	0.509	0.509	0.0	1.2	1.2	212.9	O K
240 min Summer	0.551	0.551	0.0	1.2	1.2	230.5	O K
360 min Summer	0.612	0.612	0.0	1.2	1.2	255.8	O K
480 min Summer	0.655	0.655	0.0	1.2	1.2	273.7	O K
600 min Summer	0.687	0.687	0.0	1.2	1.2	287.3	O K
720 min Summer	0.713	0.713	0.0	1.2	1.2	298.0	O K
960 min Summer	0.750	0.750	0.0	1.2	1.2	313.6	O K
1440 min Summer	0.792	0.792	0.0	1.2	1.2	331.2	O K
2160 min Summer	0.813	0.813	0.0	1.2	1.2	339.9	O K
2880 min Summer	0.818	0.818	0.0	1.2	1.2	341.8	O K
4320 min Summer	0.812	0.812	0.0	1.2	1.2	339.3	O K
5760 min Summer	0.797	0.797	0.0	1.2	1.2	333.2	O K
7200 min Summer	0.779	0.779	0.0	1.2	1.2	325.6	O K
8640 min Summer	0.759	0.759	0.0	1.2	1.2	317.3	O K
10080 min Summer	0.738	0.738	0.0	1.2	1.2	308.6	O K
15 min Winter	0.228	0.228	0.0	1.2	1.2	95.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	88.392	0.0	74.5	19
30 min Summer	61.225	0.0	94.1	34
60 min Summer	39.777	0.0	147.4	64
120 min Summer	25.154	0.0	180.3	124
180 min Summer	19.082	0.0	187.8	184
240 min Summer	15.649	0.0	186.2	244
360 min Summer	11.804	0.0	181.9	362
480 min Summer	9.651	0.0	178.9	482
600 min Summer	8.250	0.0	177.0	602
720 min Summer	7.256	0.0	175.9	722
960 min Summer	5.924	0.0	175.9	962
1440 min Summer	4.450	0.0	179.0	1440
2160 min Summer	3.340	0.0	363.2	2096
2880 min Summer	2.721	0.0	355.7	2420
4320 min Summer	2.036	0.0	344.5	3200
5760 min Summer	1.657	0.0	612.6	4032
7200 min Summer	1.411	0.0	647.7	4832
8640 min Summer	1.238	0.0	649.2	5704
10080 min Summer	1.108	0.0	615.1	6552
15 min Winter	88.392	0.0	82.2	19

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.314	0.314	0.0	1.2	1.2	131.3	O K
60 min Winter	0.406	0.406	0.0	1.2	1.2	169.6	O K
120 min Winter	0.508	0.508	0.0	1.2	1.2	212.4	O K
180 min Winter	0.573	0.573	0.0	1.2	1.2	239.4	O K
240 min Winter	0.620	0.620	0.0	1.2	1.2	259.3	O K
360 min Winter	0.689	0.689	0.0	1.2	1.2	288.2	O K
480 min Winter	0.739	0.739	0.0	1.2	1.2	308.9	O K
600 min Winter	0.777	0.777	0.0	1.2	1.2	324.7	O K
720 min Winter	0.807	0.807	0.0	1.2	1.2	337.4	O K
960 min Winter	0.852	0.852	0.0	1.2	1.2	356.3	O K
1440 min Winter	0.907	0.907	0.0	1.3	1.3	379.1	O K
2160 min Winter	0.942	0.942	0.0	1.3	1.3	393.6	O K
2880 min Winter	0.948	0.948	0.0	1.3	1.3	396.3	O K
4320 min Winter	0.937	0.937	0.0	1.3	1.3	391.7	O K
5760 min Winter	0.915	0.915	0.0	1.3	1.3	382.5	O K
7200 min Winter	0.885	0.885	0.0	1.3	1.3	370.1	O K
8640 min Winter	0.852	0.852	0.0	1.2	1.2	356.3	O K
10080 min Winter	0.818	0.818	0.0	1.2	1.2	341.9	O K

Storage volume required

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.225	0.0	97.5	34
60 min Winter	39.777	0.0	163.7	64
120 min Winter	25.154	0.0	188.3	122
180 min Winter	19.082	0.0	186.6	182
240 min Winter	15.649	0.0	183.9	240
360 min Winter	11.804	0.0	180.6	358
480 min Winter	9.651	0.0	179.4	476
600 min Winter	8.250	0.0	179.6	594
720 min Winter	7.256	0.0	181.2	710
960 min Winter	5.924	0.0	185.5	942
1440 min Winter	4.450	0.0	188.7	1398
2160 min Winter	3.340	0.0	372.4	2072
2880 min Winter	2.721	0.0	370.8	2684
4320 min Winter	2.036	0.0	365.9	3372
5760 min Winter	1.657	0.0	683.7	4320
7200 min Winter	1.411	0.0	705.9	5256
8640 min Winter	1.238	0.0	681.7	6144
10080 min Winter	1.108	0.0	651.0	7064

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Shortest Storm (mins)	15
Ratio R	0.272	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.517

Time (mins) From:	To:	Area (ha)
0	4	0.517

AT Catchment Impermeable Area

Model Details

Storage is Offline Dividing Weir Level (m) 0.000
Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	440.0	0.0	1.001	0.0	0.0
1.000	440.0	0.0	2.000	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0054-1300-0950-1300
Design Head (m)	0.950
Design Flow (l/s)	1.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	1.3
Flush-Flo™	0.239	1.2
Kick-Flo®	0.484	1.0
Mean Flow over Head Range	-	1.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	1.4	3.000	2.2	7.000	3.2
0.200	1.2	1.400	1.5	3.500	2.4	7.500	3.4
0.300	1.2	1.600	1.6	4.000	2.5	8.000	3.5
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.6
0.500	1.0	2.000	1.8	5.000	2.8	9.000	3.6
0.600	1.1	2.200	1.9	5.500	2.9	9.500	3.7
0.800	1.2	2.400	2.0	6.000	3.0		
1.000	1.3	2.600	2.0	6.500	3.1		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for DUB15 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	16.900	Add Flow / Climate Change (%)	0
Ratio R	0.272	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for DUB15 1

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	79.071	0.395	200.2	0.250	3.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	10.587	0.053	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	4.181	0.021	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	8.187	0.020	400.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	27.626	0.138	200.2	0.350	3.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	74.766	0.007	9999.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S3.000	17.941	0.090	199.3	0.119	3.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	8.010	0.040	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	2.982	0.018	165.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.19	75.005	0.250	0.0	0.0	0.0	1.11	78.3	33.9
S1.001	50.00	4.35	74.610	0.250	0.0	0.0	0.0	1.11	78.3	33.9
S1.002	50.00	4.41	74.557	0.250	0.0	0.0	0.0	1.11	78.3	33.9
S1.003	50.00	4.52	74.536	0.250	0.0	0.0	0.0	1.21	342.5	33.9
S2.000	50.00	3.42	75.200	0.350	0.0	0.0	0.0	1.11	78.3	47.4
S2.001	50.00	8.75	75.062	0.350	0.0	0.0	0.0	0.23	66.1	47.4
S3.000	50.00	3.32	75.500	0.119	0.0	0.0	0.0	0.92	36.7	16.1
S3.001	50.00	3.47	75.410	0.119	0.0	0.0	0.0	0.92	36.6	16.1
S3.002	50.00	3.50	75.370	0.119	0.0	0.0	0.0	1.89	534.2	16.1

Network Design Table for DUB15 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.004	2.250	0.008	299.9	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
S1.005	3.924	0.013	301.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	47.556	0.159	299.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	3.799	0.013	292.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	47.747	0.159	300.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	76.323	0.382	200.0	0.122	3.00	0.0	0.600	o	300	Pipe/Conduit	
S4.001	16.851	0.084	200.0	0.048	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.002	11.765	0.076	155.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	23.920	0.598	40.0	0.030	3.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	4.620	0.018	250.0	0.102	3.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	12.566	0.050	250.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	49.172	0.197	250.0	0.244	0.00	0.0	0.600	o	375	Pipe/Conduit	
S5.003	49.172	0.197	249.6	0.219	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.003	7.584	0.030	250.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.004	4.346	0.004	999.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S4.005	2.787	0.007	400.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	50.00	8.78	74.473	0.719	0.0	0.0	0.0	1.08	136.3	97.4
S1.005	49.79	8.87	74.466	0.719	0.0	0.0	0.0	0.75	29.7«	97.4
S1.006	47.28	9.92	74.453	0.719	0.0	0.0	0.0	0.75	29.9«	97.4
S1.007	47.10	10.01	74.294	0.719	0.0	0.0	0.0	0.76	30.2«	97.4
S1.008	44.89	11.07	74.281	0.719	0.0	0.0	0.0	0.75	29.8«	97.4
S4.000	50.00	4.15	74.930	0.122	0.0	0.0	0.0	1.11	78.3	16.5
S4.001	50.00	4.40	74.548	0.170	0.0	0.0	0.0	1.11	78.3	23.0
S4.002	50.00	4.56	74.464	0.170	0.0	0.0	0.0	1.26	89.0	23.0
S5.000	50.00	3.19	75.550	0.030	0.0	0.0	0.0	2.07	82.5	4.1
S6.000	50.00	3.09	74.925	0.102	0.0	0.0	0.0	0.82	32.7	13.8
S5.001	50.00	3.45	74.907	0.144	0.0	0.0	0.0	0.82	32.7	19.5
S5.002	50.00	4.16	74.706	0.388	0.0	0.0	0.0	1.14	126.1	52.5
S5.003	50.00	4.88	74.510	0.607	0.0	0.0	0.0	1.14	126.2	82.2
S4.003	50.00	4.99	74.313	0.777	0.0	0.0	0.0	1.14	126.1	105.2
S4.004	50.00	5.09	74.283	0.777	0.0	0.0	0.0	0.76	215.5	105.2
S4.005	50.00	5.16	74.279	0.777	0.0	0.0	0.0	0.65	25.8«	105.2

Network Design Table for DUB15 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.006	4.044	0.010	400.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.007	107.605	0.269	400.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	12.974	0.043	301.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	10.581	0.035	302.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	5.690	0.019	299.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	31.781	0.424	75.0	0.147	3.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	12.514	0.313	40.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	8.596	0.043	199.9	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	31.160	1.154	27.0	0.016	3.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	92.190	0.230	400.8	0.349	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.004	13.630	0.034	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.005	6.841	0.017	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.006	27.260	0.068	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.007	6.173	0.015	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.008	37.504	0.008	5000.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.000	41.742	0.209	199.7	0.175	3.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.006	50.00	5.26	74.272	0.777	0.0	0.0	0.0	0.65	25.8«	105.2
S4.007	50.00	8.03	74.262	0.777	0.0	0.0	0.0	0.65	25.8«	105.2
S1.009	44.33	11.36	73.993	1.496	0.0	0.0	0.0	0.75	29.7«	179.6
S1.010	43.89	11.59	73.950	1.496	0.0	0.0	0.0	0.75	29.7«	179.6
S1.011	43.66	11.72	73.915	1.496	0.0	0.0	0.0	0.75	29.8«	179.6
S7.000	50.00	3.35	76.100	0.147	0.0	0.0	0.0	1.51	60.1	19.9
S7.001	50.00	3.45	75.676	0.147	0.0	0.0	0.0	2.07	82.5	19.9
S7.002	50.00	3.61	75.363	0.180	0.0	0.0	0.0	0.92	36.6	24.4
S8.000	50.00	3.21	76.500	0.016	0.0	0.0	0.0	2.53	100.5	2.2
S7.003	50.00	5.32	75.170	0.545	0.0	0.0	0.0	0.90	99.3	73.8
S7.004	50.00	5.57	74.940	0.545	0.0	0.0	0.0	0.90	99.4	73.8
S7.005	50.00	5.70	74.906	0.545	0.0	0.0	0.0	0.90	99.4	73.8
S7.006	50.00	6.20	74.889	0.545	0.0	0.0	0.0	0.90	99.4	73.8
S7.007	50.00	6.31	74.821	0.545	0.0	0.0	0.0	0.90	99.4	73.8
S7.008	49.85	8.85	74.805	0.545	0.0	0.0	0.0	0.25	27.3«	73.8
S9.000	50.00	3.75	75.875	0.175	0.0	0.0	0.0	0.92	36.6	23.7

Network Design Table for DUB15 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	36.173	0.181	199.9	0.165	3.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	7.994	0.040	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.002	35.724	2.077	17.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	22.870	0.152	150.5	0.054	3.00	0.0	0.600	o	225	Pipe/Conduit	
S11.001	7.707	0.051	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.002	57.273	0.382	149.9	0.247	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.003	57.273	0.382	150.0	0.235	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.004	5.147	0.034	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.005	4.000	0.027	148.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.009	6.545	0.013	503.5	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
S7.010	63.973	0.213	300.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.011	56.893	0.190	300.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.012	14.672	0.049	300.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.013	10.254	0.034	300.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.000	2.974	0.030	100.0	0.079	3.00	0.0	0.600	o	225	Pipe/Conduit	
S12.001	26.650	0.267	99.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	40.678	0.407	99.9	0.167	3.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	3.65	75.875	0.165	0.0	0.0	0.0	0.92	36.6	22.3
S9.001	50.00	3.88	75.591	0.340	0.0	0.0	0.0	1.11	78.3	46.0
S9.002	50.00	4.03	75.551	0.340	0.0	0.0	0.0	3.81	269.3	46.0
S11.000	50.00	3.36	76.340	0.054	0.0	0.0	0.0	1.06	42.3	7.3
S11.001	50.00	3.48	76.188	0.054	0.0	0.0	0.0	1.07	42.4	7.3
S11.002	50.00	4.22	76.062	0.301	0.0	0.0	0.0	1.28	90.6	40.8
S11.003	50.00	4.97	75.680	0.536	0.0	0.0	0.0	1.28	90.6	72.6
S11.004	50.00	5.04	75.298	0.536	0.0	0.0	0.0	1.28	90.6	72.6
S11.005	50.00	5.09	75.263	0.536	0.0	0.0	0.0	1.29	91.2	72.6
S7.009	49.52	8.98	74.696	1.421	0.0	0.0	0.0	0.83	104.8«	190.6
S7.010	46.25	10.40	74.683	1.421	0.0	0.0	0.0	0.75	29.8«	190.6
S7.011	43.76	11.67	74.470	1.421	0.0	0.0	0.0	0.75	29.8«	190.6
S7.012	43.17	11.99	74.280	1.421	0.0	0.0	0.0	0.75	29.8«	190.6
S7.013	42.77	12.22	74.231	1.421	0.0	0.0	0.0	0.75	29.8«	190.6
S12.000	50.00	3.04	75.000	0.079	0.0	0.0	0.0	1.31	52.0	10.7
S12.001	50.00	3.38	74.970	0.079	0.0	0.0	0.0	1.31	52.0	10.7
S13.000	50.00	3.52	75.300	0.167	0.0	0.0	0.0	1.31	52.0	22.6

Network Design Table for DUB15 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S13.001	7.329	0.073	100.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.002	5.500	0.055	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.000	28.908	0.289	100.0	0.128	3.00	0.0	0.600	o	225	Pipe/Conduit	
S15.000	26.272	0.414	63.5	0.142	3.00	0.0	0.600	o	225	Pipe/Conduit	
S14.001	6.760	0.034	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.002	19.629	0.098	200.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	2.641	0.007	377.3	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
S12.003	57.895	0.193	300.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.014	48.237	0.161	300.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	11.865	0.040	296.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S13.001	50.00	3.61	74.893	0.167	0.0	0.0	0.0	1.30	51.9	22.6
S13.002	50.00	3.68	74.820	0.167	0.0	0.0	0.0	1.31	52.0	22.6
S14.000	50.00	3.37	74.850	0.128	0.0	0.0	0.0	1.31	52.0	17.3
S15.000	50.00	3.27	74.850	0.142	0.0	0.0	0.0	1.64	65.4	19.3
S14.001	50.00	3.49	74.436	0.270	0.0	0.0	0.0	0.92	36.6	36.6
S14.002	50.00	3.85	74.402	0.270	0.0	0.0	0.0	0.92	36.6	36.6
S12.002	50.00	3.89	74.290	0.516	0.0	0.0	0.0	0.97	121.4	69.9
S12.003	50.00	5.18	74.283	0.516	0.0	0.0	0.0	0.75	29.8«	69.9
S7.014	41.01	13.29	74.090	1.937	0.0	0.0	0.0	0.75	29.8«	215.1
S1.012	40.60	13.55	73.896	3.433	0.0	0.0	0.0	0.75	30.0«	377.5

Free Flowing Outfall Details for DUB15 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.012	S	77.530	73.856	0.000	0	0

Simulation Criteria for DUB15 1

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

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	30
Ratio R	0.272		

Online Controls for DUB15 1

Hydro-Brake® Optimum Manhole: S7A, DS/PN: S1.004, Volume (m³): 28.4

DUB15 Attenuation Tank No 1

Unit Reference	MD-SHE-0058-1500-0950-1500
Design Head (m)	0.950
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	58
Invert Level (m)	74.473
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	1.5
Flush-Flo™	0.255	1.4
Kick-Flo®	0.520	1.1
Mean Flow over Head Range	-	1.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	1.7	3.000	2.5	7.000	3.7
0.200	1.4	1.400	1.8	3.500	2.7	7.500	3.9
0.300	1.4	1.600	1.9	4.000	2.9	8.000	4.0
0.400	1.3	1.800	2.0	4.500	3.1	8.500	4.1
0.500	1.2	2.000	2.1	5.000	3.2	9.000	4.2
0.600	1.2	2.200	2.2	5.500	3.3	9.500	4.3
0.800	1.4	2.400	2.3	6.000	3.5		
1.000	1.5	2.600	2.4	6.500	3.6		

Hydro-Brake® Optimum Manhole: S19B, DS/PN: S4.005, Volume (m³): 5.1

DUB15 Attenuation Tank No 2

Unit Reference	MD-SHE-0060-1600-0950-1600
Design Head (m)	0.950
Design Flow (l/s)	1.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	60
Invert Level (m)	74.279
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: S19B, DS/PN: S4.005, Volume (m³): 5.1

DUB15 Attenuation Tank No 2

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	1.6
Flush-Flo™	0.268	1.5
Kick-Flo®	0.539	1.2
Mean Flow over Head Range	-	1.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.1
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.3	2.000	2.2	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.3	5.500	3.6	9.500	4.6
0.800	1.5	2.400	2.4	6.000	3.7		
1.000	1.6	2.600	2.5	6.500	3.9		

Hydro-Brake® Optimum Manhole: S41B, DS/PN: S7.009, Volume (m³): 10.5

DUB16 Attenuation Tank

Unit Reference	MD-SHE-0075-3100-1615-3100
Design Head (m)	1.615
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	74.696
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.615	3.1
Flush-Flo™	0.329	2.6
Kick-Flo®	0.672	2.1
Mean Flow over Head Range	-	2.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.300	2.6	0.500	2.5	0.800	2.2
0.200	2.5	0.400	2.6	0.600	2.3	1.000	2.5

Hydro-Brake® Optimum Manhole: S41B, DS/PN: S7.009, Volume (m³): 10.5

DUB16 Attenuation Tank

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	2.7	2.400	3.7	5.000	5.2	8.000	6.5
1.400	2.9	2.600	3.9	5.500	5.5	8.500	6.7
1.600	3.1	3.000	4.1	6.000	5.7	9.000	6.9
1.800	3.3	3.500	4.4	6.500	5.9	9.500	7.1
2.000	3.4	4.000	4.7	7.000	6.1		
2.200	3.6	4.500	5.0	7.500	6.3		

Hydro-Brake® Optimum Manhole: S51B, DS/PN: S12.002, Volume (m³): 5.1

Energy Centre Attenuation Tank

Unit Reference	MD-SHE-0052-1200-0950-1200
Design Head (m)	0.950
Design Flow (l/s)	1.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	74.290
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	1.2
Flush-Flo™	0.230	1.1
Kick-Flo®	0.464	0.9
Mean Flow over Head Range	-	1.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	1.3	3.000	2.0	7.000	3.0
0.200	1.1	1.400	1.4	3.500	2.2	7.500	3.1
0.300	1.0	1.600	1.5	4.000	2.3	8.000	3.2
0.400	1.0	1.800	1.6	4.500	2.4	8.500	3.3
0.500	0.9	2.000	1.7	5.000	2.6	9.000	3.4
0.600	1.0	2.200	1.8	5.500	2.7	9.500	3.5
0.800	1.1	2.400	1.8	6.000	2.8		
1.000	1.2	2.600	1.9	6.500	2.9		

Storage Structures for DUB15 1

Cellular Storage Manhole: S7A, DS/PN: S1.004

DUB15 Attenuation Tank No 1

Invert Level (m) 74.473 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	650.0	0.0	1.001	0.0	0.0
1.000	650.0	0.0			

Cellular Storage Manhole: S19B, DS/PN: S4.005

DUB15 Attenuation Tank No 2

Invert Level (m) 74.279 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	710.0	0.0	1.001	0.0	0.0
1.000	710.0	0.0			

Cellular Storage Manhole: S41B, DS/PN: S7.009

DUB16 Attenuation Tank

Invert Level (m) 74.696 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	745.0	0.0	1.701	0.0	0.0
1.700	745.0	0.0			

Cellular Storage Manhole: S51B, DS/PN: S12.002

Energy Centre Attenuation Tank

Invert Level (m) 74.290 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	440.0	0.0	1.001	0.0	0.0
1.000	440.0	0.0			

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.272
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Summer	5	+20%	30/15 Summer			
S1.001	S2	4320 Winter	5	+20%	5/960 Winter			
S1.002	S3	4320 Winter	5	+20%	5/600 Winter			
S1.003	S3A	4320 Winter	5	+20%	30/1440 Winter			
S2.000	S4	15 Summer	5	+20%	5/15 Summer			
S2.001	S4A	15 Summer	5	+20%				
S3.000	S5	15 Summer	5	+20%	30/15 Summer			
S3.001	S6	15 Summer	5	+20%	30/15 Summer			
S3.002	S6A	15 Summer	5	+20%				
S1.004	S7A	4320 Winter	5	+20%	5/720 Winter			
S1.005	S7	2880 Winter	5	+20%				
S1.006	S8	480 Winter	5	+20%				
S1.007	S9	360 Winter	5	+20%				
S1.008	S10	10080 Winter	5	+20%				
S4.000	S11	15 Summer	5	+20%	100/15 Summer			
S4.001	S12	15 Winter	5	+20%	30/15 Summer			
S4.002	S13	4320 Winter	5	+20%	5/15 Winter			
S5.000	S14	15 Summer	5	+20%	100/15 Summer			
S6.000	S15	15 Summer	5	+20%	5/15 Summer			

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	75.220	-0.085	0.000	0.73			55.0	OK
S1.001	S2	75.000	0.090	0.000	0.03			1.8	SURCHARGED
S1.002	S3	75.000	0.143	0.000	0.04			1.8	SURCHARGED
S1.003	S3A	75.000	-0.136	0.000	0.01			1.8	OK
S2.000	S4	75.561	0.061	0.000	1.18			83.5	SURCHARGED
S2.001	S4A	75.333	-0.329	0.000	0.42			82.5	OK
S3.000	S5	75.672	-0.053	0.000	0.87			28.8	OK
S3.001	S6	75.590	-0.045	0.000	0.99			29.1	OK
S3.002	S6A	75.512	-0.458	0.000	0.13			28.6	OK
S1.004	S7A	75.000	0.127	0.000	0.01		2784	1.4	SURCHARGED
S1.005	S7	74.500	-0.191	0.000	0.05			1.4	OK
S1.006	S8	74.485	-0.193	0.000	0.05			1.4	OK
S1.007	S9	74.328	-0.191	0.000	0.05			1.4	OK
S1.008	S10	74.313	-0.193	0.000	0.05			1.4	OK
S4.000	S11	75.065	-0.165	0.000	0.36			27.1	OK
S4.001	S12	74.823	-0.025	0.000	0.46			31.0	OK
S4.002	S13	74.784	0.020	0.000	0.02			1.2	SURCHARGED
S5.000	S14	75.598	-0.177	0.000	0.10			7.6	OK
S6.000	S15	75.187	0.037	0.000	0.95			23.1	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	
S1.003	S3A	
S2.000	S4	
S2.001	S4A	
S3.000	S5	
S3.001	S6	
S3.002	S6A	
S1.004	S7A	
S1.005	S7	
S1.006	S8	
S1.007	S9	
S1.008	S10	
S4.000	S11	
S4.001	S12	
S4.002	S13	
S5.000	S14	
S6.000	S15	

Level of service:
No flood risk or flooding

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S5.001	S16	15 Summer	5	+20%	5/15 Summer		
S5.002	S17	15 Winter	5	+20%	30/15 Summer		
S5.003	S18	15 Winter	5	+20%	30/15 Summer		
S4.003	S19	4320 Winter	5	+20%	5/15 Summer		
S4.004	S19A	4320 Winter	5	+20%	30/960 Winter		
S4.005	S19B	4320 Winter	5	+20%	5/120 Winter		
S4.006	S20	360 Winter	5	+20%			
S4.007	S21	5760 Winter	5	+20%			
S1.009	S22	10080 Winter	5	+20%			
S1.010	S23	10080 Winter	5	+20%			
S1.011	S24	8640 Winter	5	+20%			
S7.000	S25	15 Summer	5	+20%	30/15 Summer		
S7.001	S26	15 Summer	5	+20%	30/15 Summer		
S7.002	S27	15 Summer	5	+20%	5/15 Summer		
S8.000	S28	15 Summer	5	+20%			
S7.003	S29	4320 Winter	5	+20%	5/15 Winter		
S7.004	S30	4320 Winter	5	+20%	5/15 Summer		
S7.005	S31	4320 Winter	5	+20%	5/15 Summer		
S7.006	S32	4320 Winter	5	+20%	5/15 Summer		
S7.007	S33	4320 Winter	5	+20%	5/15 Summer		
S7.008	S33A	4320 Winter	5	+20%	5/15 Summer		
S9.000	S34	15 Summer	5	+20%	5/15 Summer		
S10.000	S35	15 Summer	5	+20%	5/15 Summer		
S9.001	S36	15 Summer	5	+20%	5/15 Summer		
S9.002	S36A	15 Summer	5	+20%	30/2160 Winter		
S11.000	S37	15 Summer	5	+20%	30/15 Summer		
S11.001	S38	15 Summer	5	+20%	30/15 Summer		
S11.002	S39	15 Winter	5	+20%	30/15 Summer	100/15 Winter	
S11.003	S40	15 Winter	5	+20%	5/15 Summer		
S11.004	S41	15 Winter	5	+20%	5/15 Summer		
S11.005	S41A	15 Winter	5	+20%	5/15 Summer		
S7.009	S41B	4320 Winter	5	+20%	5/120 Winter		
S7.010	S42	240 Summer	5	+20%			
S7.011	S43	4320 Summer	5	+20%			
S7.012	S44	240 Summer	5	+20%			
S7.013	S45	1440 Summer	5	+20%			
S12.000	S46	15 Summer	5	+20%	100/15 Summer		
S12.001	S46A	15 Summer	5	+20%	100/1440 Winter		
S13.000	S47	15 Summer	5	+20%	30/15 Summer		
S13.001	S48	15 Summer	5	+20%	5/15 Summer		
S13.002	S48A	15 Summer	5	+20%	5/15 Summer		
S14.000	S49	15 Summer	5	+20%	30/15 Summer		
S15.000	S50	15 Summer	5	+20%	30/15 Summer		
S14.001	S51	15 Summer	5	+20%	5/15 Summer		
S14.002	S51A	4320 Winter	5	+20%	5/15 Summer		
S12.002	S51B	4320 Winter	5	+20%	5/600 Winter		
S12.003	S52	1440 Winter	5	+20%			
S7.014	S53	7200 Summer	5	+20%			

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S5.001	S16		75.139	0.007	0.000	1.15			32.3
S5.002	S17		74.924	-0.157	0.000	0.62			71.8
S5.003	S18		74.867	-0.018	0.000	0.83			96.5
S4.003	S19		74.784	0.096	0.000	0.07			5.7
S4.004	S19A		74.783	-0.100	0.000	0.03			5.7
S4.005	S19B		74.783	0.279	0.000	0.06		2760	1.5
S4.006	S20		74.309	-0.188	0.000	0.06			1.5
S4.007	S21		74.297	-0.190	0.000	0.06			1.5
S1.009	S22		74.044	-0.174	0.000	0.11			2.9
S1.010	S23		74.006	-0.169	0.000	0.12			2.9
S1.011	S24		73.981	-0.159	0.000	0.13			2.9
S7.000	S25		76.236	-0.089	0.000	0.63			35.3
S7.001	S26		75.793	-0.108	0.000	0.51			36.3
S7.002	S27		75.624	0.036	0.000	1.42			42.2
S8.000	S28		76.530	-0.195	0.000	0.04			4.0
S7.003	S29		75.572	0.027	0.000	0.04			4.1
S7.004	S30		75.572	0.257	0.000	0.06			3.8
S7.005	S31		75.572	0.291	0.000	0.06			3.8
S7.006	S32		75.571	0.308	0.000	0.04			3.7
S7.007	S33		75.571	0.375	0.000	0.05			3.7
S7.008	S33A		75.571	0.391	0.000	0.07			3.7
S9.000	S34		76.187	0.087	0.000	1.12			38.9
S10.000	S35		76.153	0.053	0.000	1.09			37.7
S9.001	S36		75.923	0.032	0.000	1.26			73.6
S9.002	S36A		75.661	-0.190	0.000	0.29			72.7
S11.000	S37		76.433	-0.132	0.000	0.34			13.0
S11.001	S38		76.292	-0.121	0.000	0.42			13.4
S11.002	S39		76.239	-0.122	0.000	0.64			54.9
S11.003	S40		76.067	0.087	0.000	0.95			81.3
S11.004	S41		75.728	0.130	0.000	1.33			80.5
S11.005	S41A		75.624	0.061	0.000	1.42			80.5
S7.009	S41B		75.570	0.474	0.000	0.03		3024	2.6
S7.010	S42		74.728	-0.180	0.000	0.09			2.6
S7.011	S43		74.515	-0.180	0.000	0.09			2.6
S7.012	S44		74.327	-0.178	0.000	0.10			2.6
S7.013	S45		74.279	-0.177	0.000	0.10			2.6
S12.000	S46		75.138	-0.087	0.000	0.66			19.6
S12.001	S46A		75.073	-0.122	0.000	0.41			19.8
S13.000	S47		75.464	-0.061	0.000	0.81			40.2
S13.001	S48		75.144	0.026	0.000	0.97			37.1
S13.002	S48A		75.053	0.008	0.000	1.10			36.5
S14.000	S49		75.031	-0.044	0.000	0.63			30.4
S15.000	S50		75.043	-0.032	0.000	0.56			33.9
S14.001	S51		74.940	0.279	0.000	1.90			54.3
S14.002	S51A		74.833	0.206	0.000	0.06			2.0
S12.002	S51B		74.832	0.142	0.000	0.01		2592	1.1
S12.003	S52		74.311	-0.197	0.000	0.04			1.1

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S7.014	S53		74.143	-0.172	0.000	0.13			3.6

PN	US/MH Name	Status	Level Exceeded
S5.001	S16	SURCHARGED	
S5.002	S17	OK	
S5.003	S18	OK	
S4.003	S19	SURCHARGED	
S4.004	S19A	OK	
S4.005	S19B	SURCHARGED	
S4.006	S20	OK	
S4.007	S21	OK	
S1.009	S22	OK	
S1.010	S23	OK	
S1.011	S24	OK	
S7.000	S25	OK	
S7.001	S26	OK	
S7.002	S27	SURCHARGED	
S8.000	S28	OK	
S7.003	S29	SURCHARGED	
S7.004	S30	SURCHARGED	
S7.005	S31	SURCHARGED	
S7.006	S32	SURCHARGED	
S7.007	S33	SURCHARGED	
S7.008	S33A	SURCHARGED	
S9.000	S34	SURCHARGED	
S10.000	S35	SURCHARGED	
S9.001	S36	SURCHARGED	
S9.002	S36A	OK	
S11.000	S37	OK	
S11.001	S38	OK	
S11.002	S39	OK	1
S11.003	S40	SURCHARGED	
S11.004	S41	SURCHARGED	
S11.005	S41A	SURCHARGED	
S7.009	S41B	SURCHARGED	
S7.010	S42	OK	
S7.011	S43	OK	
S7.012	S44	OK	
S7.013	S45	OK	
S12.000	S46	OK	
S12.001	S46A	OK	
S13.000	S47	OK	
S13.001	S48	SURCHARGED	
S13.002	S48A	SURCHARGED	

Level of service:
No flood risk or flooding

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Status	Level Exceeded
S14.000	S49	OK	
S15.000	S50	OK	
S14.001	S51	SURCHARGED	
S14.002	S51A	SURCHARGED	
S12.002	S51B	SURCHARGED	
S12.003	S52	OK	
S7.014	S53	OK	

Level of service:
No flood risk or flooding

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.012	S54	8640 Winter	5	+20%					73.973

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.012	S54	-0.148	0.000	0.25			6.5	OK	

Level of service:
No flood risk or flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.272
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Summer	30	+20%	30/15 Summer			
S1.001	S2	4320 Winter	30	+20%	5/960 Winter			
S1.002	S3	4320 Winter	30	+20%	5/600 Winter			
S1.003	S3A	4320 Winter	30	+20%	30/1440 Winter			
S2.000	S4	15 Summer	30	+20%	5/15 Summer			
S2.001	S4A	15 Summer	30	+20%				
S3.000	S5	15 Summer	30	+20%	30/15 Summer			
S3.001	S6	15 Summer	30	+20%	30/15 Summer			
S3.002	S6A	15 Summer	30	+20%				
S1.004	S7A	4320 Winter	30	+20%	5/720 Winter			
S1.005	S7	7200 Winter	30	+20%				
S1.006	S8	2880 Winter	30	+20%				
S1.007	S9	4320 Winter	30	+20%				
S1.008	S10	2880 Winter	30	+20%				
S4.000	S11	15 Winter	30	+20%	100/15 Summer			
S4.001	S12	15 Winter	30	+20%	30/15 Summer			
S4.002	S13	15 Winter	30	+20%	5/15 Winter			
S5.000	S14	15 Summer	30	+20%	100/15 Summer			
S6.000	S15	15 Winter	30	+20%	5/15 Summer			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	75.440	0.135	0.000	1.01			76.4	SURCHARGED
S1.001	S2	75.224	0.314	0.000	0.04			2.4	SURCHARGED
S1.002	S3	75.224	0.367	0.000	0.05			2.4	SURCHARGED
S1.003	S3A	75.224	0.088	0.000	0.01			2.4	SURCHARGED
S2.000	S4	75.806	0.306	0.000	1.68			118.5	SURCHARGED
S2.001	S4A	75.398	-0.264	0.000	0.60			118.3	OK
S3.000	S5	75.828	0.103	0.000	1.26			41.3	SURCHARGED
S3.001	S6	75.670	0.035	0.000	1.41			41.4	SURCHARGED
S3.002	S6A	75.542	-0.428	0.000	0.18			40.6	OK
S1.004	S7A	75.224	0.351	0.000	0.01		3720	1.4	SURCHARGED
S1.005	S7	74.500	-0.191	0.000	0.05			1.4	OK
S1.006	S8	74.485	-0.193	0.000	0.05			1.4	OK
S1.007	S9	74.328	-0.191	0.000	0.05			1.4	OK
S1.008	S10	74.313	-0.193	0.000	0.05			1.4	OK
S4.000	S11	75.134	-0.096	0.000	0.52			39.1	OK
S4.001	S12	75.099	0.251	0.000	0.48			32.2	SURCHARGED
S4.002	S13	75.019	0.254	0.000	0.47			32.5	SURCHARGED
S5.000	S14	75.608	-0.167	0.000	0.15			11.1	OK
S6.000	S15	75.492	0.342	0.000	1.34			32.5	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	
S1.003	S3A	
S2.000	S4	
S2.001	S4A	
S3.000	S5	
S3.001	S6	
S3.002	S6A	
S1.004	S7A	
S1.005	S7	
S1.006	S8	
S1.007	S9	
S1.008	S10	
S4.000	S11	
S4.001	S12	
S4.002	S13	
S5.000	S14	
S6.000	S15	

Level of service:
No flood risk or flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S5.001	S16	15 Winter	30	+20%	5/15 Summer		
S5.002	S17	15 Winter	30	+20%	30/15 Summer		
S5.003	S18	15 Winter	30	+20%	30/15 Summer		
S4.003	S19	4320 Winter	30	+20%	5/15 Summer		
S4.004	S19A	4320 Winter	30	+20%	30/960 Winter		
S4.005	S19B	4320 Winter	30	+20%	5/120 Winter		
S4.006	S20	10080 Winter	30	+20%			
S4.007	S21	8640 Winter	30	+20%			
S1.009	S22	10080 Winter	30	+20%			
S1.010	S23	10080 Winter	30	+20%			
S1.011	S24	4320 Winter	30	+20%			
S7.000	S25	15 Summer	30	+20%	30/15 Summer		
S7.001	S26	15 Winter	30	+20%	30/15 Summer		
S7.002	S27	15 Winter	30	+20%	5/15 Summer		
S8.000	S28	15 Summer	30	+20%			
S7.003	S29	15 Winter	30	+20%	5/15 Winter		
S7.004	S30	4320 Winter	30	+20%	5/15 Summer		
S7.005	S31	4320 Winter	30	+20%	5/15 Summer		
S7.006	S32	4320 Winter	30	+20%	5/15 Summer		
S7.007	S33	4320 Winter	30	+20%	5/15 Summer		
S7.008	S33A	4320 Winter	30	+20%	5/15 Summer		
S9.000	S34	15 Summer	30	+20%	5/15 Summer		
S10.000	S35	15 Summer	30	+20%	5/15 Summer		
S9.001	S36	15 Summer	30	+20%	5/15 Summer		
S9.002	S36A	4320 Winter	30	+20%	30/2160 Winter		
S11.000	S37	15 Winter	30	+20%	30/15 Summer		
S11.001	S38	15 Winter	30	+20%	30/15 Summer		
S11.002	S39	15 Winter	30	+20%	30/15 Summer	100/15 Winter	
S11.003	S40	15 Winter	30	+20%	5/15 Summer		
S11.004	S41	15 Winter	30	+20%	5/15 Summer		
S11.005	S41A	4320 Winter	30	+20%	5/15 Summer		
S7.009	S41B	4320 Winter	30	+20%	5/120 Winter		
S7.010	S42	4320 Winter	30	+20%			
S7.011	S43	4320 Winter	30	+20%			
S7.012	S44	4320 Winter	30	+20%			
S7.013	S45	4320 Winter	30	+20%			
S12.000	S46	15 Summer	30	+20%	100/15 Summer		
S12.001	S46A	15 Summer	30	+20%	100/1440 Winter		
S13.000	S47	15 Summer	30	+20%	30/15 Summer		
S13.001	S48	15 Summer	30	+20%	5/15 Summer		
S13.002	S48A	15 Summer	30	+20%	5/15 Summer		
S14.000	S49	15 Summer	30	+20%	30/15 Summer		
S15.000	S50	15 Summer	30	+20%	30/15 Summer		
S14.001	S51	15 Summer	30	+20%	5/15 Summer		
S14.002	S51A	4320 Winter	30	+20%	5/15 Summer		
S12.002	S51B	4320 Winter	30	+20%	5/600 Winter		
S12.003	S52	4320 Winter	30	+20%			
S7.014	S53	4320 Winter	30	+20%			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S5.001	S16		75.465	0.333	0.000	1.52			42.8
S5.002	S17		75.403	0.322	0.000	0.83			96.9
S5.003	S18		75.269	0.384	0.000	1.31			152.8
S4.003	S19		75.009	0.321	0.000	0.09			7.5
S4.004	S19A		75.009	0.126	0.000	0.03			7.5
S4.005	S19B		75.009	0.505	0.000	0.06		3768	1.5
S4.006	S20		74.309	-0.188	0.000	0.06			1.5
S4.007	S21		74.297	-0.190	0.000	0.06			1.5
S1.009	S22		74.044	-0.174	0.000	0.11			2.9
S1.010	S23		74.006	-0.169	0.000	0.12			2.9
S1.011	S24		73.981	-0.159	0.000	0.13			2.9
S7.000	S25		76.404	0.079	0.000	0.89			50.1
S7.001	S26		76.177	0.276	0.000	0.55			39.0
S7.002	S27		76.064	0.476	0.000	1.60			47.6
S8.000	S28		76.537	-0.188	0.000	0.06			5.9
S7.003	S29		75.950	0.405	0.000	1.43			135.6
S7.004	S30		75.948	0.633	0.000	0.07			5.0
S7.005	S31		75.947	0.666	0.000	0.07			5.0
S7.006	S32		75.947	0.683	0.000	0.06			5.0
S7.007	S33		75.946	0.750	0.000	0.07			5.0
S7.008	S33A		75.946	0.766	0.000	0.10			5.0
S9.000	S34		76.532	0.432	0.000	1.50			52.4
S10.000	S35		76.426	0.326	0.000	1.49			51.6
S9.001	S36		76.011	0.120	0.000	1.78			104.1
S9.002	S36A		75.946	0.095	0.000	0.01			3.4
S11.000	S37		76.987	0.422	0.000	0.42			16.4
S11.001	S38		76.968	0.555	0.000	0.58			18.5
S11.002	S39		76.960	0.599	0.000	0.77			66.4
S11.003	S40		76.736	0.757	0.000	1.39			119.4
S11.004	S41		75.973	0.375	0.000	1.97			119.2
S11.005	S41A		75.945	0.382	0.000	0.09			5.3
S7.009	S41B		75.945	0.849	0.000	0.03		3888	2.7
S7.010	S42		74.729	-0.179	0.000	0.09			2.7
S7.011	S43		74.516	-0.179	0.000	0.09			2.7
S7.012	S44		74.328	-0.177	0.000	0.10			2.7
S7.013	S45		74.280	-0.176	0.000	0.11			2.7
S12.000	S46		75.191	-0.034	0.000	0.96			28.6
S12.001	S46A		75.098	-0.097	0.000	0.61			29.2
S13.000	S47		75.743	0.218	0.000	1.11			54.7
S13.001	S48		75.256	0.138	0.000	1.38			52.4
S13.002	S48A		75.115	0.070	0.000	1.58			52.3
S14.000	S49		75.429	0.354	0.000	0.73			35.3
S15.000	S50		75.453	0.378	0.000	0.65			39.1
S14.001	S51		75.266	0.605	0.000	2.53			72.1
S14.002	S51A		75.066	0.439	0.000	0.08			2.6
S12.002	S51B		75.065	0.375	0.000	0.01		3456	1.1
S12.003	S52		74.311	-0.197	0.000	0.04			1.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S7.014	S53		74.144	-0.171	0.000	0.13			3.8

PN	US/MH Name	Status	Level Exceeded
S5.001	S16	SURCHARGED	
S5.002	S17	SURCHARGED	
S5.003	S18	SURCHARGED	
S4.003	S19	SURCHARGED	
S4.004	S19A	SURCHARGED	
S4.005	S19B	SURCHARGED	
S4.006	S20	OK	
S4.007	S21	OK	
S1.009	S22	OK	
S1.010	S23	OK	
S1.011	S24	OK	
S7.000	S25	SURCHARGED	
S7.001	S26	SURCHARGED	
S7.002	S27	SURCHARGED	
S8.000	S28	OK	
S7.003	S29	SURCHARGED	
S7.004	S30	SURCHARGED	
S7.005	S31	SURCHARGED	
S7.006	S32	SURCHARGED	
S7.007	S33	SURCHARGED	
S7.008	S33A	SURCHARGED	
S9.000	S34	SURCHARGED	
S10.000	S35	SURCHARGED	
S9.001	S36	SURCHARGED	
S9.002	S36A	SURCHARGED	
S11.000	S37	SURCHARGED	
S11.001	S38	SURCHARGED	
S11.002	S39	SURCHARGED	1
S11.003	S40	SURCHARGED	
S11.004	S41	SURCHARGED	
S11.005	S41A	SURCHARGED	
S7.009	S41B	SURCHARGED	
S7.010	S42	OK	
S7.011	S43	OK	
S7.012	S44	OK	
S7.013	S45	OK	
S12.000	S46	OK	
S12.001	S46A	OK	
S13.000	S47	SURCHARGED	
S13.001	S48	SURCHARGED	
S13.002	S48A	SURCHARGED	

Level of service:
No flood risk or flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Status	Level Exceeded
S14.000	S49	SURCHARGED	
S15.000	S50	SURCHARGED	
S14.001	S51	SURCHARGED	
S14.002	S51A	SURCHARGED	
S12.002	S51B	SURCHARGED	
S12.003	S52	OK	
S7.014	S53	OK	

Level of service:
No flood risk or flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.012	S54	4320 Winter	30	+20%					73.974

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.012	S54	-0.147	0.000	0.26			6.7	OK	

Level of service:
No flood risk or flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.272
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Summer	100	+20%	30/15 Summer			
S1.001	S2	4320 Winter	100	+20%	5/960 Winter			
S1.002	S3	4320 Winter	100	+20%	5/600 Winter			
S1.003	S3A	4320 Winter	100	+20%	30/1440 Winter			
S2.000	S4	15 Summer	100	+20%	5/15 Summer			
S2.001	S4A	15 Summer	100	+20%				
S3.000	S5	15 Summer	100	+20%	30/15 Summer			
S3.001	S6	15 Summer	100	+20%	30/15 Summer			
S3.002	S6A	15 Summer	100	+20%				
S1.004	S7A	4320 Winter	100	+20%	5/720 Winter			
S1.005	S7	4320 Winter	100	+20%				
S1.006	S8	4320 Winter	100	+20%				
S1.007	S9	4320 Winter	100	+20%				
S1.008	S10	4320 Winter	100	+20%				
S4.000	S11	15 Winter	100	+20%	100/15 Summer			
S4.001	S12	15 Winter	100	+20%	30/15 Summer			
S4.002	S13	15 Winter	100	+20%	5/15 Winter			
S5.000	S14	15 Winter	100	+20%	100/15 Summer			
S6.000	S15	15 Winter	100	+20%	5/15 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	75.768	0.463	0.000	1.27			95.8	SURCHARGED
S1.001	S2	75.412	0.502	0.000	0.05			2.8	SURCHARGED
S1.002	S3	75.412	0.555	0.000	0.06			2.8	SURCHARGED
S1.003	S3A	75.412	0.276	0.000	0.02			2.8	SURCHARGED
S2.000	S4	76.098	0.598	0.000	2.12			149.6	SURCHARGED
S2.001	S4A	75.457	-0.205	0.000	0.76			150.0	OK
S3.000	S5	75.973	0.248	0.000	1.61			52.9	SURCHARGED
S3.001	S6	75.723	0.088	0.000	1.79			52.6	SURCHARGED
S3.002	S6A	75.565	-0.405	0.000	0.23			51.6	OK
S1.004	S7A	75.412	0.539	0.000	0.01		4008	1.5	SURCHARGED
S1.005	S7	74.501	-0.190	0.000	0.06			1.5	OK
S1.006	S8	74.486	-0.192	0.000	0.05			1.5	OK
S1.007	S9	74.329	-0.190	0.000	0.06			1.5	OK
S1.008	S10	74.314	-0.192	0.000	0.05			1.5	OK
S4.000	S11	75.490	0.260	0.000	0.63			47.6	SURCHARGED
S4.001	S12	75.417	0.569	0.000	0.76			50.5	SURCHARGED
S4.002	S13	75.332	0.568	0.000	0.70			48.0	SURCHARGED
S5.000	S14	75.982	0.207	0.000	0.18			13.5	SURCHARGED
S6.000	S15	75.992	0.842	0.000	1.41			34.3	FLOOD RISK

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	
S1.003	S3A	
S2.000	S4	
S2.001	S4A	
S3.000	S5	
S3.001	S6	
S3.002	S6A	
S1.004	S7A	
S1.005	S7	
S1.006	S8	
S1.007	S9	
S1.008	S10	
S4.000	S11	
S4.001	S12	
S4.002	S13	
S5.000	S14	
S6.000	S15	

Level of service:
No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S5.001	S16	15 Winter	100	+20%	5/15 Summer			
S5.002	S17	15 Winter	100	+20%	30/15 Summer			
S5.003	S18	15 Winter	100	+20%	30/15 Summer			
S4.003	S19	15 Winter	100	+20%	5/15 Summer			
S4.004	S19A	4320 Winter	100	+20%	30/960 Winter			
S4.005	S19B	4320 Winter	100	+20%	5/120 Winter			
S4.006	S20	4320 Winter	100	+20%				
S4.007	S21	4320 Winter	100	+20%				
S1.009	S22	4320 Winter	100	+20%				
S1.010	S23	4320 Winter	100	+20%				
S1.011	S24	4320 Winter	100	+20%				
S7.000	S25	15 Winter	100	+20%	30/15 Summer			
S7.001	S26	15 Winter	100	+20%	30/15 Summer			
S7.002	S27	15 Winter	100	+20%	5/15 Summer			
S8.000	S28	15 Summer	100	+20%				
S7.003	S29	15 Winter	100	+20%	5/15 Winter			
S7.004	S30	4320 Winter	100	+20%	5/15 Summer			
S7.005	S31	4320 Winter	100	+20%	5/15 Summer			
S7.006	S32	4320 Winter	100	+20%	5/15 Summer			
S7.007	S33	4320 Winter	100	+20%	5/15 Summer			
S7.008	S33A	4320 Winter	100	+20%	5/15 Summer			
S9.000	S34	15 Summer	100	+20%	5/15 Summer			
S10.000	S35	15 Summer	100	+20%	5/15 Summer			
S9.001	S36	4320 Winter	100	+20%	5/15 Summer			
S9.002	S36A	4320 Winter	100	+20%	30/2160 Winter			
S11.000	S37	15 Winter	100	+20%	30/15 Summer			
S11.001	S38	15 Winter	100	+20%	30/15 Summer			
S11.002	S39	15 Winter	100	+20%	30/15 Summer	100/15 Winter		
S11.003	S40	15 Winter	100	+20%	5/15 Summer			
S11.004	S41	4320 Winter	100	+20%	5/15 Summer			
S11.005	S41A	4320 Winter	100	+20%	5/15 Summer			
S7.009	S41B	4320 Winter	100	+20%	5/120 Winter			
S7.010	S42	4320 Winter	100	+20%				
S7.011	S43	4320 Winter	100	+20%				
S7.012	S44	4320 Winter	100	+20%				
S7.013	S45	4320 Winter	100	+20%				
S12.000	S46	15 Summer	100	+20%	100/15 Summer			
S12.001	S46A	4320 Winter	100	+20%	100/1440 Winter			
S13.000	S47	15 Summer	100	+20%	30/15 Summer			
S13.001	S48	15 Winter	100	+20%	5/15 Summer			
S13.002	S48A	4320 Winter	100	+20%	5/15 Summer			
S14.000	S49	15 Winter	100	+20%	30/15 Summer			
S15.000	S50	15 Winter	100	+20%	30/15 Summer			
S14.001	S51	15 Winter	100	+20%	5/15 Summer			
S14.002	S51A	4320 Winter	100	+20%	5/15 Summer			
S12.002	S51B	4320 Winter	100	+20%	5/600 Winter			
S12.003	S52	4320 Winter	100	+20%				
S7.014	S53	4320 Winter	100	+20%				

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S5.001	S16	75.971	0.839	0.000	1.54			43.3	FLOOD RISK
S5.002	S17	75.903	0.822	0.000	0.97			113.3	FLOOD RISK
S5.003	S18	75.737	0.852	0.000	1.58			184.8	SURCHARGED
S4.003	S19	75.238	0.550	0.000	2.66			230.4	SURCHARGED
S4.004	S19A	75.205	0.322	0.000	0.04			8.8	SURCHARGED
S4.005	S19B	75.205	0.701	0.000	0.06		4080	1.6	SURCHARGED
S4.006	S20	74.310	-0.187	0.000	0.06			1.6	OK
S4.007	S21	74.298	-0.189	0.000	0.06			1.6	OK
S1.009	S22	74.046	-0.172	0.000	0.12			3.0	OK
S1.010	S23	74.008	-0.167	0.000	0.12			3.0	OK
S1.011	S24	73.985	-0.155	0.000	0.13			3.0	OK
S7.000	S25	76.917	0.592	0.000	0.89			50.3	SURCHARGED
S7.001	S26	76.672	0.771	0.000	0.63			44.7	FLOOD RISK
S7.002	S27	76.543	0.955	0.000	1.81			53.9	FLOOD RISK
S8.000	S28	76.544	-0.181	0.000	0.08			7.7	OK
S7.003	S29	76.438	0.893	0.000	1.67			158.5	FLOOD RISK
S7.004	S30	76.265	0.950	0.000	0.09			6.3	SURCHARGED
S7.005	S31	76.265	0.984	0.000	0.09			6.3	SURCHARGED
S7.006	S32	76.265	1.001	0.000	0.07			6.3	SURCHARGED
S7.007	S33	76.264	1.068	0.000	0.09			6.2	SURCHARGED
S7.008	S33A	76.263	1.083	0.000	0.13			6.2	SURCHARGED
S9.000	S34	76.940	0.840	0.000	1.89			65.8	SURCHARGED
S10.000	S35	76.776	0.676	0.000	1.82			63.0	SURCHARGED
S9.001	S36	76.264	0.373	0.000	0.07			4.1	SURCHARGED
S9.002	S36A	76.263	0.412	0.000	0.02			4.1	SURCHARGED
S11.000	S37	77.624	1.059	0.000	0.47			18.3	FLOOD RISK
S11.001	S38	77.587	1.174	0.000	0.63			20.3	FLOOD RISK
S11.002	S39	77.571	1.209	1.054	0.96			82.4	FLOOD
S11.003	S40	77.334	1.355	0.000	1.69			145.1	FLOOD RISK
S11.004	S41	76.263	0.666	0.000	0.10			6.2	SURCHARGED
S11.005	S41A	76.263	0.700	0.000	0.11			6.2	SURCHARGED
S7.009	S41B	76.263	1.167	0.000	0.04		4320	3.0	SURCHARGED
S7.010	S42	74.731	-0.177	0.000	0.10			3.0	OK
S7.011	S43	74.518	-0.177	0.000	0.11			3.0	OK
S7.012	S44	74.331	-0.174	0.000	0.12			3.0	OK
S7.013	S45	74.283	-0.173	0.000	0.12			3.0	OK
S12.000	S46	75.263	0.038	0.000	1.28			38.3	SURCHARGED
S12.001	S46A	75.262	0.067	0.000	0.02			1.0	SURCHARGED
S13.000	S47	76.152	0.627	0.000	1.36			67.2	SURCHARGED
S13.001	S48	75.386	0.268	0.000	1.67			63.5	SURCHARGED
S13.002	S48A	75.262	0.217	0.000	0.06			2.0	SURCHARGED
S14.000	S49	75.873	0.798	0.000	0.88			42.8	SURCHARGED
S15.000	S50	75.909	0.834	0.000	0.80			48.2	SURCHARGED
S14.001	S51	75.632	0.971	0.000	3.16			90.1	SURCHARGED
S14.002	S51A	75.263	0.636	0.000	0.09			3.1	SURCHARGED
S12.002	S51B	75.262	0.572	0.000	0.01		4008	1.2	SURCHARGED
S12.003	S52	74.312	-0.196	0.000	0.04			1.2	OK

Small flooded volume to be accommodated within Permeable paving, swales, side drains and gullies

Level of service: No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.014	S53	74.147	-0.168	0.000	0.15			4.2	OK

PN	US/MH Name	Level Exceeded
S5.001	S16	
S5.002	S17	
S5.003	S18	
S4.003	S19	
S4.004	S19A	
S4.005	S19B	
S4.006	S20	
S4.007	S21	
S1.009	S22	
S1.010	S23	
S1.011	S24	
S7.000	S25	
S7.001	S26	
S7.002	S27	
S8.000	S28	
S7.003	S29	
S7.004	S30	
S7.005	S31	
S7.006	S32	
S7.007	S33	
S7.008	S33A	
S9.000	S34	
S10.000	S35	
S9.001	S36	
S9.002	S36A	
S11.000	S37	
S11.001	S38	
S11.002	S39	1
S11.003	S40	
S11.004	S41	
S11.005	S41A	
S7.009	S41B	
S7.010	S42	
S7.011	S43	
S7.012	S44	
S7.013	S45	
S12.000	S46	
S12.001	S46A	
S13.000	S47	
S13.001	S48	
S13.002	S48A	

Small flooded volume to be accommodated within Permeable paving, swales, side drains and gullies

Level of service: No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Level Exceeded
S14.000	S49	
S15.000	S50	
S14.001	S51	
S14.002	S51A	
S12.002	S51B	
S12.003	S52	
S7.014	S53	

Level of service:
No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for DUB15 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.012	S54	4320 Winter	100	+20%					73.977

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.012	S54	-0.144	0.000	0.28			7.2	OK	

Level of service:
No flooding

Appendix C

South Dublin County Council
Drainage Record Drawings and
Watermain Record Drawings