


Surface Water Management Plan

Cherry Orchard Point – Proposed Development at Sites 4 and 5, Park West Avenue, Dublin 10

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This document has been prepared and checked in accordance with
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Comments

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1. Introduction

1.1 Context

This report has been prepared by Waterman Moylan Consulting Engineers, on behalf of the LDA for a proposed development at Sites 4 and 5, Park West Avenue, Dublin 10.

The report sets out to demonstrate how pollution of watercourses both during the construction stage and after the construction period, during the operational stage will be prevented and/or mitigated. This is in accordance with SI25 of the DCC Development Plan 2022-28, which requires "*the preparation of a Surface Water management Plan as part of all new developments in accordance with the requirements of Appendix 13 – The Council's Surface Water Management Guidance.*". This is required for 2 or more residential units or commercial space of 100m^2 or greater, both of which are appliable to the proposed development. Appendix 13 advises that the following items are to be included in a Surface Water Management Plan, and in brackets which section of this report they are discussed:

- Site location map with proposed planning boundary indicated in red. (Figure 1)
- Overall surface water drainage layout indicating:
    - Existing public surface water infrastructure. (Section 4.2)
    - Proposed connection points to existing public sewers. (Section 4.2)
    - Spine sewers, if any. (Sections 1.6 & 4.2)
    - Detail of any surface water sewer extension, diversions, surface water sewer upgrades etc. to be clearly indicated. (None proposed)
- Report detailing existing site conditions including:
    - Topography. (Section 1.3)
    - Ground conditions. (Section 1.4)
    - Land drain features. (None proposed)
    - Overland flow paths. (Section 4.4.3)
    - Floodplains. (Section 4.4.3)
    - Utilities. (Section 4.5)
- Detail of proposed surface water management strategy shall include:
    - Longitudinal section details of proposed surface water pipe runs if required indicating route, levels, pipe size, gradient etc. A well-designed SuDS scheme will reduce or even eliminate the need for significant piped drainage. Surface Water Management Guidance | Appendix 13 358. (Section 4.5)
    - Identify proposed location to discharge to stream or public drainage system. (Section 4.2)
    - Identification of appropriate SuDS features to meet the key criteria of the GDSDS and reference in Section 16.3 of the Greater Dublin Regional Code of Practice for Drainage Works - source control and interception storage provided and volumes defined – no run-

off from site for events up to 5mm. See also the Council's Sustainable Drainage Design & Evaluation Guide (2021) and Appendix 12. (Sections 4.4 to 4.4.4)

- Provide a clear explanation of the SuDS proposals proposed for each hardstanding area including defined control structures and sizes of same. (Sections 4.4 to 4.4.4)
- Discharge rate applied. (Section 4.2)
- Attenuation storage provided and volumes defined – storage for 1% and 3.3% annual probability with factor in accordance with the SFRA for climate change shall be applied. A figure of 20% will be applicable in most cases. (Section 4.4)
- Exceedance and overland flow routes. (Section 4.4.3)
- Phased development – where development under a planning application/permission is phased, coordination of the overall surface water management strategy shall be implemented at the first phase in order to ensure the overall integrated design is implemented. This would allow different parts of a site to be developed at different times, while ensuring that the final developed site shall meet the overall design criteria as set out in this Appendix. (Sections 1.5 & 1.6)
- Identify green space and public space locations including any that are designed to be multifunctional – integrating SuDS (see also Section 15.6 – Green Infrastructure and Landscaping). (Section 1.5)
- Details of any proposed wayleaves or land transfers in relation to surface water drainage. (Not applicable)
- An undertaking that SuDS will be completed to taking in charge standards (in accordance with Policy SI26). (Section 4.5)

1.2 Site Location and Description

The subject masterplan development is comprised of 2 No. sites. Site 4 & Site 5 are bisected by Park West Avenue and lie to the west and east of this roadway respectively, as per the blue boundary lines indicated on *Figure 1* overleaf.

The Site Investigation Report undertaken by Ground Investigations Ireland (GII) is included as an appendix to the Preliminary Construction Environmental Management Plan, submitted under a separate cover, determined that Site 4 is combination of Greenfield and Brownfield, with evidence of fill material in the area of the site previously used as a construction compound. Site 5 is predominantly a brownfield site, with fill material found for the same reason.

Site 4 is bound to the west by the M50, to the south by the Dublin-Kildare rail line and the Park West & Cherry Orchard station, and to the east and north by Park West Avenue. Site 5 is bound to the west by Park West Avenue, the northwest by Cedar Brook Way, the northeast and east by Barnville Park, and to the south by the Dublin-Kildare rail line and the residential unit of 62 Barnville Park.

Site 4 is currently access via a secured gate from Park West Avenue. Site 5 is accessed via a similar arrangement from Cedar Brook Way.

The area of the subject application is indicated by the red boundary line, also on *Figure 1* overleaf. A letter of consent has been obtained for the area of public works required.

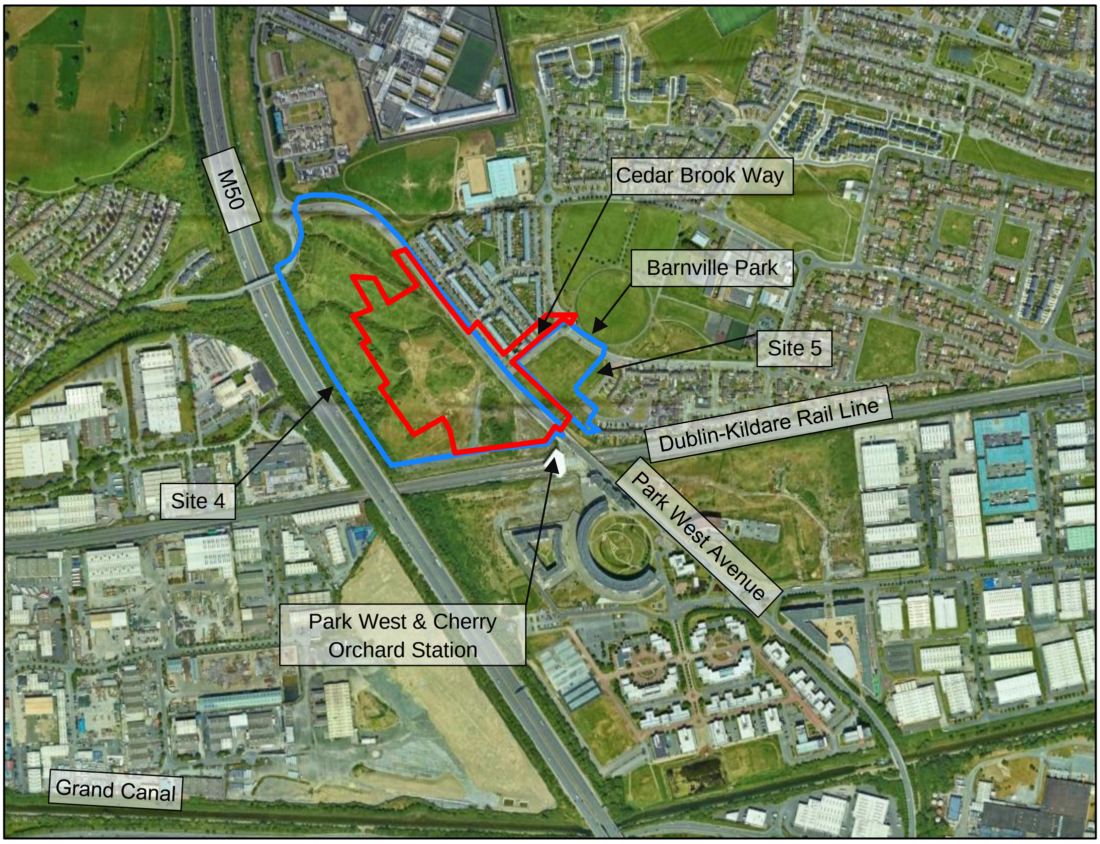


Figure 1 | *Site Location (Source: Google Earth)*

The overall masterplan development area as per the blue line boundaries is c. 13.02ha, with Site 4 being c. 11.41 ha and Site 5 being c. 1.61ha. The area of the subject application indicated by the redline boundary, including for works in the public domain, is 6.16ha (61,648m²).

The project archaeologist, Archer Heritage Planning Ltd., have identified the ploughed out remains of a Fulacht Fia located centrally on site 4, adjacent to the convergence of 2 No. static ditches on their southern side. The archaeologist has recommended that the remains of the Fulacht Fia be preserved by record prior to further works being undertaken on site.

1.3 Topographic details

For Site 4, the topographic survey of the area indicates that the low point of the site has a level of 55.72m OD. This is located on the eastern site boundary approximately 140m north of the junction of Park West Avenue and Cedar Brook Way. The remainder of the site generally slopes to this location owing to the embankments and subsequent site grading from the Dublin-Kildare Rail line to the south, M50 to the west, and approach road to the overpass on the M50 to the north.

Site 5 has a central high point with a level of 58.05m OD, and slopes outwards to all boundaries. The boundaries of Site 5 typically have levels between 54.80m and 56.00m, with the higher of these levels being located to the south of the site, adjacent to the retaining wall of the Park West Avenue Bridge over the rail lines.

Ordnance survey and topographic survey mapping indicates that Site 4 contains static ditches with no outfall. These ditches previously had hydrological connectivity and flow, which has been cut-off by the construction of the M50 to the east and the Cedar Brook housing development to the west, as discussed in Chapter 11 of the EIAR report. These ditches normally remain dry except in heavy rainfall events where water that is not percolated via the site's naturally grassed landscaping, would collect locally in these static ditches for infiltration to the groundwater table. Site 5 does not have any form of surface drainage network and conveys rainfall directly to the soils via its grassed landscape. There is potential during heavy rainfall events, that the ground may become saturated and unable to further infiltrate rainfall, which would then run from the surface, over the boundary and to the adjacent road networks to outfall to the storm drainage networks serving these roads. The sites are located in the catchment of the Blackditch stream, a tributary of the Camac River which has an ultimate outfall to the River Liffey at Heuston Station.

1.4 Site Investigation Details

Site investigations for both sites were undertaken in 2022 by Ground Investigations Ireland (GII), the technical Ground Investigation report was completed in November 2022, and the Waste Analysis Classification report was completed in October 2022. Both these reports are included as appendices to the Construction Environmental Management Plan, submitted under a separate cover.

The fieldworks comprised a programme of 14 no. trial pits with dynamic probes, and 11 No. soakaway tests. 14 No. Cable percussion and 19 No. rotary boreholes, 3 No. groundwater monitoring and geotechnical and environmental laboratory testing was also undertaken. The locations are indicated in *Figure 2*. The procedures undertaken as part of the site investigation were in accordance with Eurocode 7 Part 2: Ground investigation and testing (ISEN 1997-2:2007) & B.S. 5930:2015.

Trial pits were excavated using an 8.5T tracked excavator at the locations indicated in *Figure 2*. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The Trial Pits were sampled, logged, and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, ground water encountered, and the characteristics of the strata encountered and are presented on the trial pit logs, which are provided in Appendix 2 of the Site Investigation report. The site investigation report is included in full as an appendix to the Preliminary Construction Environmental Management Plan report, submitted under a separate cover.

The soakaway testing was carried out in selected trial pits at the locations indicated in *Figure 2*. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was record over time as required by BRE digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arisings upon completion. The results are included as an appendix to the Site Investigation report.

The dynamic probe tests (DPH) were carried out at the locations shown in *Figure 2*, in accordance with B.S. 1377: Part 9 1990. The test consists of mechanically driving a cone with a 50KG weight in 100mm intervals and monitoring of the number of blows required. An equivalent standard Penetration test (SPT) "n" value may be calculated by dividing the total number of blows over a 300mm drive length by 1.5. The dynamic probe logs are provided as an appendix to the Site Investigation report.

The cable percussion boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing. The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a shell in non-cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders, and other hard obstructions are broken up by chiselling and the fragments removed with the shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the cable percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tool at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata. Standard penetration tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken, are shown on the accompanying borehole records in the Site Investigation report. The test consists of a thick wall sampler tube, 50mm external dia., being driven into the soil by a Hammer/Weight weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone. The standard penetration test number referred to as the "n" value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 5 of the Site Investigation report.

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown in *Figure 2*. The rotary boreholes were complete from the ground surface or alternatively, where noted on the individual borehole log, from the case of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring. The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage of the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small dia. wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring, The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 5 of the Site Investigation report.

Groundwater monitoring installations were installed upon the completion of selected boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consist of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the engineer's specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of the Site Investigation report.

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design. Environmental and chemical testing as required by the specification, including the Rilta Suite, pH, and Sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta Suite testing includes both solid waste and Leachate Waste Acceptance Criteria. Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), and hydrometer tests were carried out in Prosoils Geotechnical Laboratory in the UK. The results of the laboratory testing are included in the suite.

Figure 2 | *Site Investigation Test Locations*

1.5 Proposed Subject Development

The subject application is for Phase 1 of a 4-phase masterplan development as per *Figure 3* overleaf.

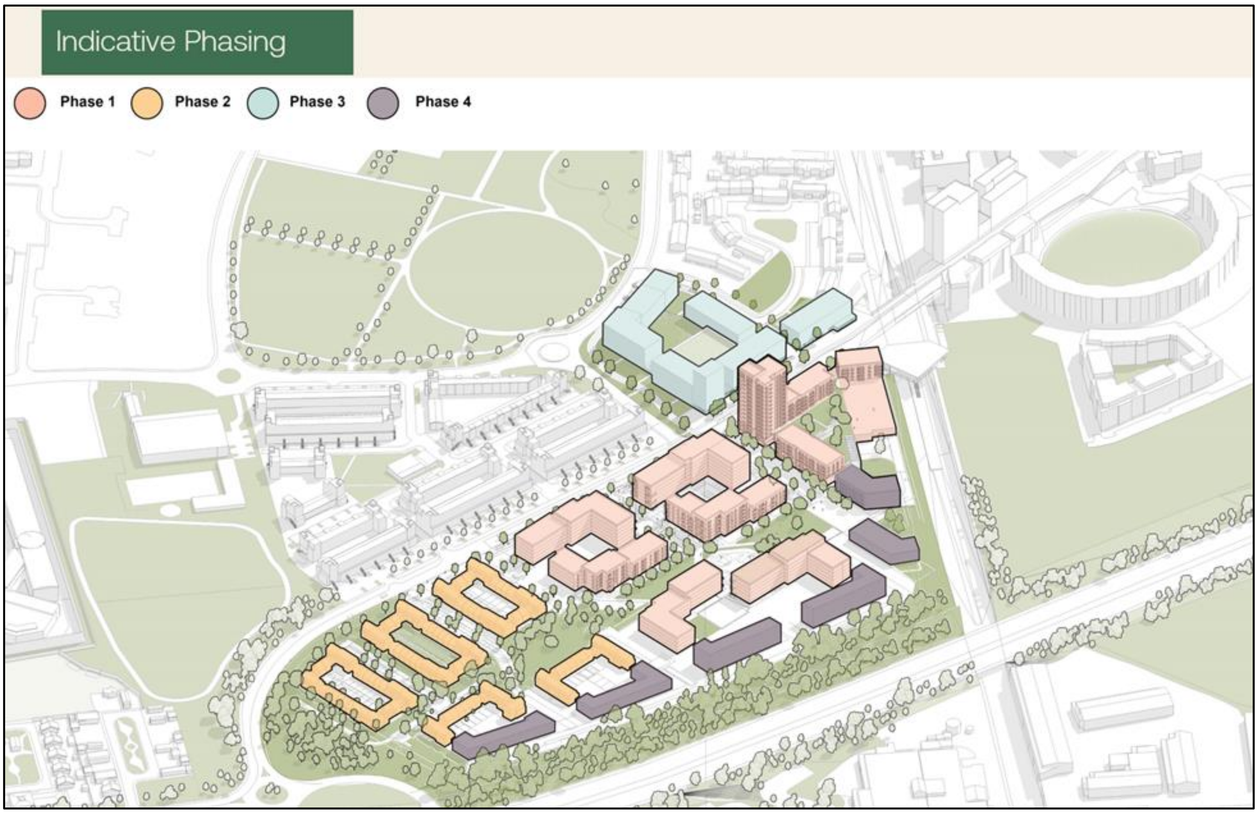


Figure 3 **|** *Phasing Layout*

Phase 1 is the medium and high-density area and the subject application area, which will provide a total of 708 residential units ranging in size from studio to 3-bed apartments, a 2,523m² supermarket, a combined area of 373m² for retail over 7 units, a 672m² creche and 1,222m² of community spaces over 13 buildings. A breakdown of the schedule of accommodation for the subject application is provided in *Table 1* overleaf.

Block	Studio	1-bed Apt	2-bed Apt	3-bed Apt	Total	Total Area
1	-	13	-	11	24	-
2A	-	8	14	5	27	-
2B	1	43	66	-	110	-
3	-	12	23	-	35	-
5A	10	16	28	-	54	-
5B	-	10	14	5	29	-
6A	-	20	32	6	58	-
6B	-	8	12	4	24	-
7A	6	35	40	-	81	-
7B	-	5	25	-	30	-
8A	6	17	34	6	63	-
8B	5	13	10	5	33	-
9A	-	29	13	5	47	-
9B	-	8	10	4	22	-
10A	-	16	22	4	42	-
10B	-	10	14	5	29	-
Supermarket					1	2,523m²
Retail					7	373m²
Community					13	1,222m²
Creche					1	672m²

Table 1 **|** *Phase 1 Schedule of Accommodation*

The development includes all associated site works, undergrounding of overhead lines, boundary treatments, drainage, and service connections.

1.6 Proposed Masterplan Development

The remainder of phases as per *Figure 3* will be subject to their own planning permission applications, however their preliminary details are outlined below so that the subject development may be assessed as part of the full masterplan development in its full context. It should be noted that the trunk foul and surface water drainage, including attenuation storage, to serve phases 2, 3, & 4 are part-provided under the subject application for Phase 1.

Phase 2: This is the low-density housing area located to the north of Site 4 and contains 153 residential units comprising 100 apartment/ duplex units and 53 houses.

Phase 3: This will be the development of Site 5, and comprises 254 residential units, 1,200m² of retail space, with community facilities to be confirmed.

Phase 4: This will be the construction of commercial office space over 6 blocks with a total area of c. 16,310m².

1.7 Surface Water Impacts

Surface water run-off from surface construction activities has the potential to become contaminated. The main contaminants arising from construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of onsite toilet and washing facilities; and
- Concrete/cementitious products: arising from construction materials.

These pollutants pose a temporary risk to surface water quality for the duration of the project if not properly contained and managed.

1.8 Proposed Construction Works

It is currently estimated that Phase 1 which is the subject application will commence end of 2024 with a 4-year construction programme for completion by the end of 2028. The remainder of the masterplan lands, Phases 2, 3, & 4 as per *Figure 3*, are estimated to be completed by 2032.

Working hours for the site will be set out in the conditions of planning approval and would typically be 08.00 to 19.00 from Monday to Friday and 08.00 to 14.00 on Saturday. No Sunday or Bank Holiday work will generally be permitted. The above working hours are typical; however, special construction operations may need to be carried out outside these hours in order to minimise disruption to the surrounding area.

The proposed work will consist of the following:

- Site preparation;
- Erection of security fencing/perimeter fencing;
- Setting up a secure site compound including wash down area;
- Site clearance including topsoil stripping;

- Construction of infrastructure including roads, drainage, and services;
- Provision of road upgrades and pedestrian links;
- Construction of residential and commercial units.
- Reinstatement landscaping.

2. Mitigation Measures

The sites have no direct hydrological connectivity to natural watercourses or surface water networks. There may be an indirect link from surface water runoff which may have the potential to run off the site boundary to the surface water gullies on the adjacent road networks. These networks outfall to the Blackditch Stream.

The following Mitigation Measures are to address potential impacts to water quality and are required to protect the Blackditch Stream, and the Camac River which has an ultimate outfall to the River Liffey at Heuston. All works will be undertaken with reference to the following guidelines:

- CIRIA C532: Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (Masters-Williams et al., 2001);
- CIRIA C692: Environmental Good Practice on Site, (Audus et al., 2010)
- BPGCS005: Oil Storage Guidelines;
- CIRIA C648: Control of Water Pollution from Linear Construction Projects: Technical Guidance (Murnane et al., 2006a)
- CIRIA C648: Control of Water Pollution from Linear Construction Projects: Site Guide (Murnane et al., 2006a)
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI 2016)
- Guidelines for Planning Authorities – Architectural Heritage Protection – Guidance on Part IV of the Planning and Development Act 2000. (Part 2, Chapter 7) and ICOMOS Principles.

The schedule of mitigation presented within *Table 2* summarises measures that will be undertaken in order to reduce impacts on ecological receptors within the zone of influence of the proposed development.

No.	Risk	Possible Impact	Mitigation	Result of Mitigation
1	Hydrocarbons from carparking area entering the drainage network.	Water quality impacts.	Petrol interceptor to be installed on drainage network prior to outfall to public surface water network.	Prevents hydrocarbons from entering the public surface water network.
2	Pollutants from site compound areas entering the drainage network or contaminating soils.	Water quality impacts. Soil quality impacts. Groundwater impacts.	Materials to be stored appropriately in designated areas (discussed below). Temporary foul water connection to be obtained from Uisce Eireann to serve site compound welfare facilities.	Prevents contamination of public surface water network, soil, and groundwater.

No.	Risk	Possible Impact	Mitigation	Result of Mitigation
3	Pollutants from material storage areas entering the watercourse or contaminating soils.	Water quality impacts. Soil quality impacts. Groundwater impacts.	Fuels, oils, greases, and other potentially polluting chemicals will be stored in roofed and bunded compounds at the Contractor's compound. Storage area to be located over 50m away to ensure no direct pathway to the surface water network. Bunds are to be provided with 110% capacity of storage container. Spill kits will be kept on site at all times and all staff trained in their appropriate use. Method statements for dealing with accidental spillages will be provided the Contractor for review by the Employer's Representative.	Prevents contamination of public surface water network, soil, and groundwater.
4	Concrete/ cementitious materials entering the drainage network.	Water quality impacts	A designated wash down area within the Contractor's compound will be used for cleaning of any equipment or plant, with the safe disposal of any contaminated water.	Prevents contamination of public surface water network. Ensures invasive species material is not transported off site as muck.
5	Leaching of contaminated soil into groundwater.	Groundwater quality impacts	Spill kits will contain 10 hr terrestrial oil booms (80mm diameter x 1000mm) and a plastic sheet, upon which contaminated soil can be placed to prevent leaching to ground water.	Prevents contamination of groundwater.
6	Pollutants from equipment storage/ refuelling area entering the drainage network.	Water quality impacts	Any refuelling and maintenance of equipment will be done at designated bunded areas with full attendance of plant operative(s) within contained areas. Discharge licence (where required) pollutant limits to be monitored and adhered to. The site is located at least 50m from any direct pathway to the surface water drainage network.	Prevents contamination of public surface water network.
7	Runoff from exposed work areas and excavated material storage areas entering the drainage network.	Water quality impacts due to silt entering the network.	Provision of silt entrapment facilities such as; straw bales, silt fencing, silt barriers, diversion drains, settlement tank(s), & settlement pond(s), as appropriate and as outlined below.	Prevents contamination of public surface water network.

***Table 2** | Schedule of Surface Water Mitigation Measures*

3. Construction Stage

The proposed potential pollution mitigation measures outlined below will be implemented in accordance with 'CIRIA C532 – Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors' – CIRIA-2001.

3.1 Roles and Responsibilities

3.1.1 Main Contractor

The Main Contractor will have overall responsibility for the implementation of the project Construction Surface Water Management Plan (CSWMP) during the construction phase. The appointed person from the Main Contractors team will be appropriately trained and assigned the authority to instruct all site personnel to comply with the specific provisions of the CSWMP. At the operational level, a designated person from each sub-contractor on the site shall be assigned the direct responsibility to ensure that the operations stated in the CSWMP are performed on an on-going basis.

Copies of the Construction Surface Water Management Plan will be made available to all relevant personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the CSWMP and informed of the responsibilities which fall upon them because of its provisions.

The responsibilities of the appointed person will be as follows;

- Updating the CSWMP as necessary to reflect activities on site.
- Advise site management (including, but not limited to, the site Construction Manager) on environmental matters.
- Ensure pre-construction checks for protected species, if any, are undertaken.
- Review method statement of the sub-contractors to ensure that it incorporates all aspects of CSWMP.
- Provide toolbox talks and other training, and ensure understanding by all involved of all mitigation measures.
- Assess effectiveness of mitigation, check weather forecast and site conditions where trigger levels are required.
- Ensure adherence to the specific measures listed in the Planning Conditions.
- Advise upon the production of written method statements and site environmental rules and on the arrangements to bring these to the attention of the workforce.
- Investigate incidents of significant, potential, or actual environmental damage, ensure corrective actions are carried out and recommend means to prevent recurrence; and,
- Be responsible for maintaining all environmental related documentation.
- Ensure plant suggested is environmentally suited to the task in hand.
- Co-ordinate environmental planning of the construction activities to comply with environmental authorities' requirements and with minimal risk to the environment. Give contractors precise

instructions as to their responsibility to ensure correct working methods where risk of environmental damage exists.

3.2 Pre-Construction Plan

3.2.1 Designated Storage Area & Site Compound

A site compound(s) including offices and welfare facilities will be set up by the main contractor in locations to be decided within the subject site.

The main contractor will be required to schedule delivery of materials daily. The main contractor will be required to provide a site compound on the site for the secure storage of materials.

Measures will be implemented throughout the construction stage to prevent contamination of the soil and surrounding watercourses from oil and petrol leakages and significant siltation. Suitable bunded areas will be installed for oil and petrol storage tanks. Designated fuel filling points will be put in place with appropriate oil and petrol interceptors to provide protection from accidental spills. Spill kits will be provided by the Contractor to cater for any other spills.

3.3 Construction Plan

3.3.1 Vehicle Washdown

Where possible, and subject to licence, the permanent connection to the public foul sewer will be used temporarily for construction phase. Vehicle wash down water will discharge directly, via suitable pollution control and attenuation, to the foul sewer system. If this connection is not permitted, then wastewater generated will be required to be stored for collection and treatment off-site at a suitable waste disposal facility.

3.3.2 Surface Water Run-off

On-site treatment measures will be installed to treat surface water run-off from the site prior to discharge to the receiving surface water sewer on Park West Avenue. This treatment will be achieved by the construction of settlement tanks/ponds, in conjunction with the installation of proprietary surface water treatment systems including class 1 full retention petrol interceptors, and spill protection control measures. Settlement tanks/ponds will be sized to deal with surface run-off and any groundwater encountered.

A sampling chamber with shut down valve will be installed downstream of the settlement pond/tank and water quality monitoring will be carried out here prior to discharge to the surface water sewer.

It is likely that the surface water run-off from the site will be discharged to the existing public surface water network, post treatment. This will need to be confirmed between the Contractor and Local Authority, as well as any further conditions such as the permitted levels of contamination as well as frequency for testing, as part of the Contractor's application for a discharge licence.

3.3.3 Surface Water Monitoring Parameters

In addition to daily visual inspections, a surface water monitoring programme, as outlined in *Table 3* must be followed during construction in order to ensure maintenance of water quality protection. This is in line with Transport Infrastructure Ireland (TII)'s 'Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan'. It is considered that the parameter limit values (Guide/Mandatory) defined in the Fresh Water Quality Regulations (EU Directive 2006/44/EEC) should act as a trigger value for the monitoring of Surface Water.

Parameter	**Limit**		**Frequency and Manner of Samplings**
	Limit Value	**Guide/Mandatory**	
Temperature	1.5°C	Mandatory Limit	Weekly, and at appropriate intervals where the works activities associated with the scheme have the potential to alter the temperature of the waters.
Dissolved oxygen	50% of Samples ≥ 9 (mg/l O2) 100% of Samples ≥ 7 (mg/l O2)	Guide Limit	Weekly, minimum one sample representative of flow oxygen conditions of the day of sampling
pH	6 to 9	Mandatory Limit	Weekly
Nitrites	≤0.01 (mg/l N02)	Guide Limit	Monthly
Suspended Solids	≤25 (mg/l)	Guide Limit	Monthly
BOD5	≤3 (mg/l)	Guide Limit	Monthly
Phenolic Compounds	-	-	Monthly where the presence of phenolic compounds is presumed (An examination by test)
Petroleum Hydrocarbons	5 (mg/l)	Guide Limit	Monthly (visual)
Non-Ionized Ammonia	≤ 0.005 (mg/l NH3)	Guide Limit	Monthly
Total Ammonium	≤ 0.004 (mg/l NH4)	Guide Limit	Monthly
Total Residual Chlorine	≤ 0.005 (mg/l HOCl)	Mandatory Limit	At appropriate intervals where works activities associated with the scheme have the potential to alter the Total residual Chlorine of the waters
Electrical Conductivity	-	-	Weekly

***Table 3 |** Monitoring Guidelines (Fresh Water Quality Regulations)*

4. Operational Stage

The design of the surface water network is discussed in full in the Engineering Assessment Report, submitted under a separate cover. This report, however, discusses the surface water management plan as a whole, with an emphasis on describing the rational for the selection of proposed SuDS, and calculations for attenuation volumes, discharged water quality enhancement, and the further enhancement of amenity and biodiversity values. The following sections may be considered as the *"SuDS Design statement"* as required under Section 9.11 of the Council's SuDS Design & Evaluation Guide.

4.1 SuDS

The Council's SuDS Design & Evaluation Guide advises that: *"Sustainable Drainage or SuDS is a way of managing rainfall that minimises the negative impacts on the quantity and quality or runoff while maximising the benefits of amenity and biodiversity for people and the environments.".* These Sustainable Drainage System (SuDS) are considered a collection of water management practices that aim to align modern drainage systems with natural water processes.

Sustainable Drainage System (SuDS) are a collection of water management practices that aim to align modern drainage systems with natural water processes.

SuDS facilities are designed to prevent pollution of streams and rivers and to slow down runoff from sites, therefore helping to prevent downstream flooding and improve water quality. This closely mimics natural catchment behaviour where rainfall either infiltrates through the soil or runs off slowly over the ground surface to the nearest watercourse. This is known as the "treatment train" approach. SuDS devices should be placed at source, site, and regional levels. SuDS can also provide amenity benefits to local communities and benefits for biodiversity simultaneously.

Dublin City Council's Development Plan (2022-2028) has identified SuDS as the preferred method of managing rainfall from new developments. The proposed SuDS for the subject application have been incorporated and designed in accordance with Dublin City Council's SuDS Design and Evaluation Guide and also in accordance with their Green and Blue Roof Guide.

In the following sections of the it will be outlined in detail how SuDS devices have been utilised and incorporated as an integral part of the overall plan for the proposed development, and how their inclusion will mitigate the risk of localised and downstream flooding, while also promoting residential amenity and biodiversity.

The proposed SuDS measures have been assessed for suitability, designed, and incorporated in accordance with CIRIA Report C753 The SuDS Manual, and Dublin City Council's SuDS Design and Evaluation Guide, and Green & Blue Roof Guide, in order to develop a nature-based approach to surface water management for the proposed development.

4.2 Proposed Surface Water Network and SuDS Strategy

It is proposed to construct a stormwater drainage network that will service and attenuate the development internally before discharging at the current greenfield (or allowable) rates to the local Surface Water network. It is proposed that Site 4 will connect to the existing 1,050mm Ø network in Cedar Brook Way, while Site 5 will outfall to the 900mm Ø Network in Barnville Park.

Based on the details presented by the Site Investigation Report, the sites have properties equivalent of a Type 5 soil, which has a runoff rate of 8.66 l/s/ha. However, in line with DCC requirements, the attenuation calculations undertaken, have limited the outflow rate to a maximum of 2.0 l/s/ha, by using a soil type 2 for progression of the calculations. The reason for this limitation, is that the Flood Risk Assessment submitted under a separate cover, has identified a downstream area of the Camac River of being at risk of flooding. The Council, already aware of this issue, confirmed in the preliminary surface water strategy meeting, that our early-stage modelling of the attenuation volume requirements was correct in applying the max outfall rate of 2 l/s/ha to our calculations. An extract of the Control Discharge Limits Table from the Council's SuDS Design & Evaluation guide is shown in *Figure 4* below.

	1-in-1 year rainfall (maximum outflow rate)l	1-in-100 year rainfall (maximum outflow rate)	Long term storage-volume control
Discharge to a combined sewer or location where there is a known downstream capacity issues / flood risk	2 l/s/ha	2 l/s/ha	No
Discharge to a surface water sewer or watercourse (no known flood risk or capacity issues) Criterion 2.1, 2.2, 4.1, 4.2	1-in-1 year greenfield rate	1-in-100 year greenfield rate	Yes
Discharge to a surface water sewer or watercourse (no known flood risk or capacity issues) Criterion 4.3	Qbar/ Qmed	Qbar/ Qmed	No

Figure 4 | *Permitted Outflow Rates as per SuDS Design & Evaluation Guide Document*

For storm water management purposes, it is proposed to divide the sites into four separate sub-catchments, as shown in *Figure 5* below.

Figure 5 **|** *Sketch of Catchments Template*

Storm water from each catchment will be attenuated and discharge at a controlled rate, limited to a maximum of 2 l/s/ha (as per Dublin City Council requirements), to ultimately outfall to the existing surface water networks at Cedar Brook Way and Barnville Walk. The proposed development has been designed to incorporate best drainage practice.

It is proposed to incorporate a Storm Water Management Plan through the use of various SuDS techniques to treat and minimise surface water runoff from the site. The methodology involved in developing a Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS), Dublin City Council's SuDS Design and Evaluation Guide, and in the CIRIA Report C753 The SuDS Manual. Based on three key elements – Water Quantity, Water Quality and Amenity – the targets of the CIRIA Report C SuDS train concept have been implemented in the design, providing SuDS devices for each of the following:

- Source Control
- Site Control
- Regional Control

4.2.1 Source Control

Permeable Paving:

It is proposed to introduce permeable paving at all private driveways and parking courts throughout the development. Downpipes from the front of the houses and apartments will drain to filter drains beneath the permeable paving to facilitate maximum infiltration of surface water from driveways and roof areas.

The goal of permeable paving is to control stormwater at the source to reduce runoff. In addition to reducing surface runoff, permeable paving has the dual benefit of improving water quality by trapping suspended solids and filtering pollutants in the substrata layers.

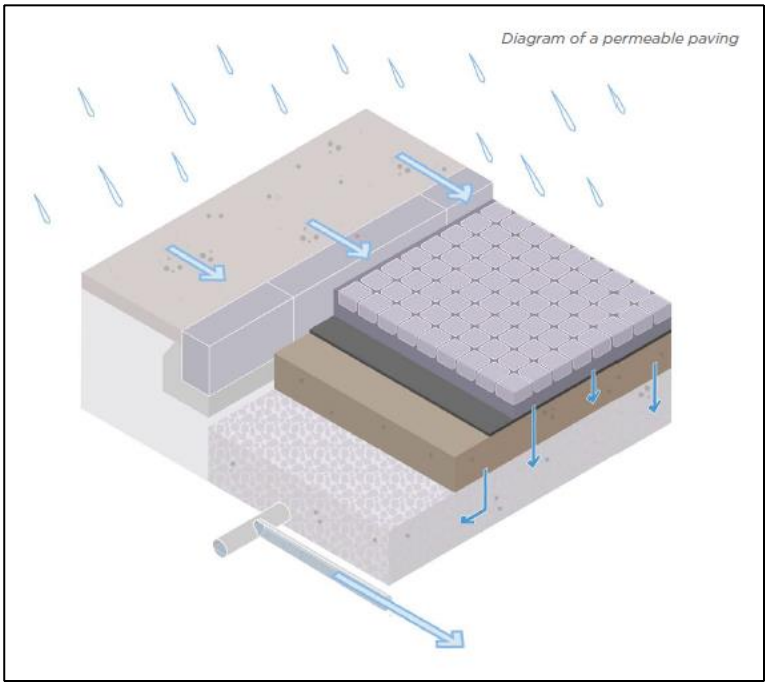


Figure 6 | *Illustration of Permeable Paving Extracted from the SuDS Design & Evaluation Guide*

Filter Drains:

It is proposed to install filter drains, consisting of perforated pipes surrounded in filter stone around the perimeter of each apartment block. The filter drains will provide infiltration, optimise the retention time, and provide quality improvement to the storm water runoff, in particular to the first flush from hardstanding areas. The proposed perforated pipes connect to the proposed surface water sewer network.

Green / Sedum Roof:

As per the Dublin City Council Green & Blue Roof Guide (2021), it is proposed to introduce a green sedum roofing as a source control device on the roofs of all apartment blocks and commercial buildings on Phases 1, 3, & 4. Phase 2 comprises residential house and duplex type units which are not considered suitable for the incorporation of green or blue roofing measures.

Green roofs have been selected over blue roofs for the following reasons:

- There is ample open space onsite to allow for attenuation at surface level.

- The majority of attenuated surface water will be generated by hardstanding areas at surface level, such as parking bays/courts, roads, and footpaths.
- Utilisation of green roofing ties in well to the overall SuDS strategy and central green corridor and adds increased biodiversity and amenity value.
- The project ecologist has noted that while there is no evidence of bat roosts on-site, evidence of bat foraging has been found. A suitable planting scheme on the green roofs will attract aphid and invertebrate species which will provide a food source for urban birds and bats.
- Green roofs were proposed to be utilised on-site as part of our strategy discussions with Dublin City Council.

Section 3.13 of the Council's Green and Blue Roof Guide notes that where a biodiverse green/blue roof is proposed, a seed mix that replicates Irish grassland habitats of Irish Origin is preferred as far as possible. The project's Landscape Architects have ultimate responsibility for the material design of the planting selection for the proposed green roofs and will design this in consultation with the Project Ecologist in order to produce a suitable landscape for aphids and invertebrate species in order to maintain and encourage these areas as suitable bat foraging location. The Council's guide further advises that if required, consultation requests can be directed to the Authority's Parks, Biodiversity, and Landscape Departments and their officers.

The quantum of green roofing proposed has been coordinated with the M&E designers as photovoltaic (PV) cells will also be required to be installed at roof level on these buildings. The M&E designers have specified that 30% of the roof area is required for the installation of the PV cells. A further 10% has been afforded to allow for the circulation/access routes and roof level plant/fittings. As such it is proposed that 60% of the total quantum of roof area will be dedicated to intensive green roofing. This in accordance with the Dublin City Council Green & Blue Rood Guide 2021, Section 2.0, Green blue roof requirements – area coverage, which specifies a minimum of 50% coverage for intensive green roofs.

Type of green roof	Minimum coverage (% of total roof area being developed)
Extensive	70%
Intensive	50%

Figure 7 | *Intensive vs. Extensive Coverage Areas as per the Council's Green and Blue Roof Guide*

Intensive green roofs are defined as having a 200mm minimum substrate depth and are suitable for providing planting with habitat complexity, which is suitable for encouraging biodiversity, as per Section 1.2 of the Council's Green and Blue Roof Guide. While it is also noted in this section that intensive roofs are typically planted with grass and sedum, it is proposed that the planting regime to be designed and employed by the Landscape Architects will maintain, and encourage these areas, as suitable for continued bird and bat foraging locations.

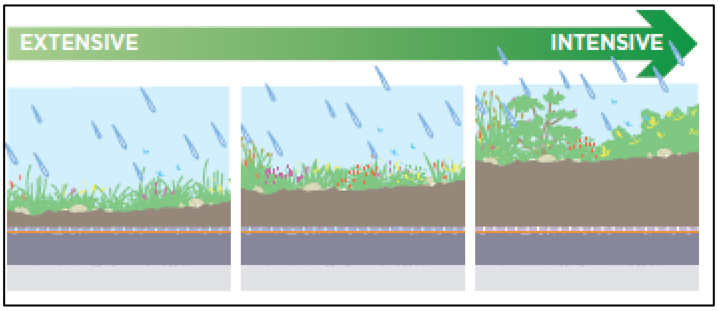


Figure 8 | *Illustrative Cross Section of Green Roof Types as per the Council's Green and Blue Roof Guide*

In summary, it is proposed to cover 60% of the total suitable roof space with an intensive green roof with a substrate depth of 200mm minimum, totalling a cumulative green roof area of 14,909m^2. This measurement is based upon the full masterplan layout. The indicative roof plan for the green roofs and PV cells is shown on Drawing Number: 22-010-P240.

The substrate and the plant layers in a green roof absorb large amounts of rainwater and release it back into the atmosphere by transpiration and evaporation. They also filter water as it passes through the layers, so the run-off, when it is produced, has fewer pollutants. Rainfall not retained by green roofs is detained, effectively increasing the time to peak, and slowing peak flows.

4.2.2 Site Control

Roadside Bio-retention Tree Pits:

It is proposed to provide roadside trees throughout the development. Trees can help control storm water runoff because their leaves, stems, and roots slow rain from reaching the ground and capture and store rainfall to be released later. Trees help to attenuate flows, trap silts and pollutants, promote infiltration, and prevent erosion. Incorporating tree planting offers multiple benefits, including attractive planting features, improved air quality and increased biodiversity whilst helping to ensure adaptation to climate change.

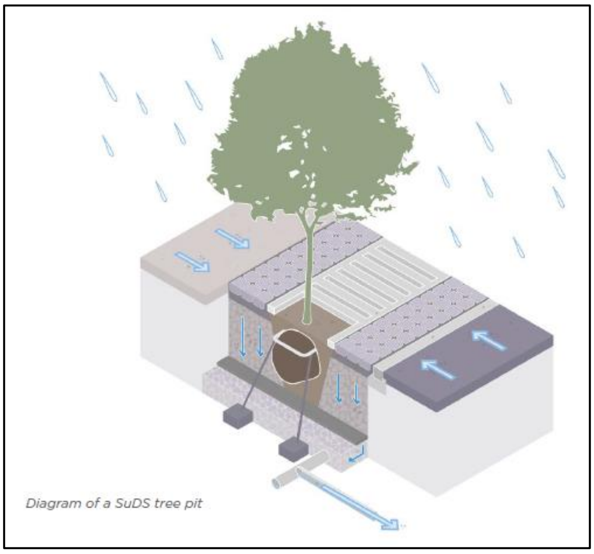


Figure 9 | *Illustration of a Tree Pit Extracted from the SuDS Design & Evaluation Guide*

Swales:

Swales are grassed channels proposed to run parallel and adjacent to selected roads throughout the site. Rainfall from the road surface will be directed to gaps in the road kerbing and will flow to the swales. The swales will be linked back to the drainage network to prevent flooding in extreme weather events, where the volume of rainfall exceeds the percolation capacity of the swales. An extract from Drawing Number: 22-010-P240 shows an illustration of the gapped kerbing construction.

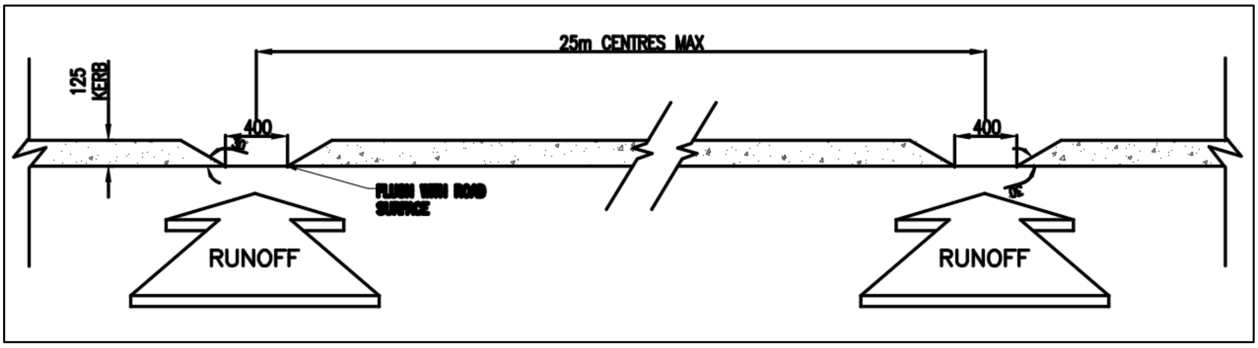


Figure 10 | *Gapped Kerbing Extract from Drawing Number: 22-010-P240*

There is intended to be several pedestrian crossings over the long swale adjacent Road 1. These crossings will not interrupt the swale, which will incorporate short piped connections as per *Figure 11* overleaf, which has been extracted from Section 8.4.5 of the SuDS Design & Evaluation Guide. Check dams are small, gapped, walls which lie across the width of swales at regular intervals, and are proposed to be incorporated to the swales. These check dams allow the surface water flowing through a swale to have a reduced velocity, increasing its retention time in the swale, and the surface water absorption volume to the soil.

Figure 11 | *Examples of Swale Crossings and Check Dams*

Grassed swales enhance surface water runoff quality as they slow down water flow, allowing suspended particles to filter and settle out of suspension.

362 linear metres of swales are proposed as part of the development.

Bio-retention Systems (Raingardens):

Bio-retention planted areas will be provided within the private domain around apartment blocks. Planted boxes will intercept down pipes from the apartment blocks.

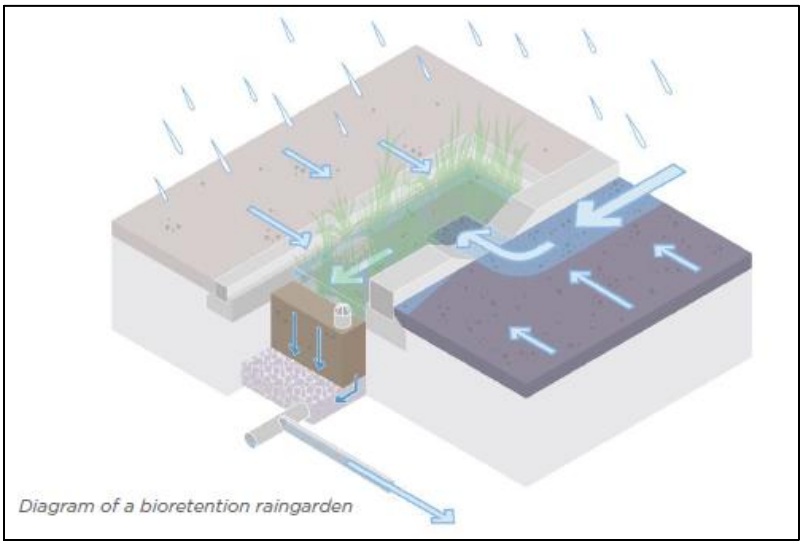


Figure 12 | *Illustration of a Raingarden Extract from the SuDS Design & Evaluation Guide*

4.2.3 Regional Control

<u>Detention Basin</u>

Detention basins are proposed to be utilised for attenuation of surface water. These basins can be utilised during regular weather conditions for other purposes and will only fill with water during heavier rainfall events. Detention basins are engineered depressions in the ground and are typically seeded with grass and may also be suitable for planting. Detention basins may be further utilised as recreational/play areas, an option which has been utilised in the proposals for this project. A prime example of this incorporated to the project is Basin 4, which performs the role of a "*multi-functional SuDS component*" which will act as a sports court during dry weather and an attenuation area during heavier rainfall events, as per the figure included on Page 15 of the Council's SuDS Design & Evaluation guide. The entry invert levels of the pipes to the multipurpose area have been designed in such a way that it will be the last of the attenuation areas to fill and water will only be retained here during the heaviest of rainfall events, ensuring that it can be utilised in its role as a play facility more often. An extract from Drawing Number: 22-010-P240 is included as *Figure 13* showing this multi-purpose court and basin, below.

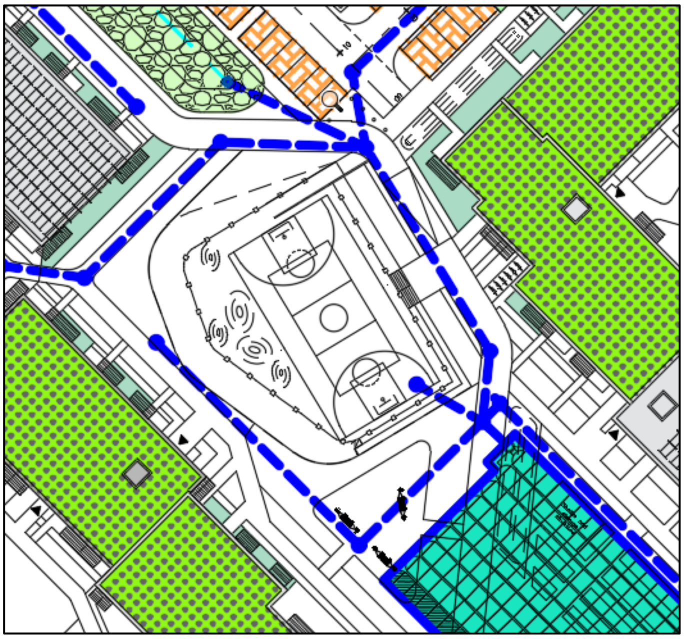


Figure 13 **|** *Extract from 22-010-P240*

Attenuation tanks:

Underground attenuation tanks are also proposed to be utilised for the attenuation of surface water. These will attenuate water volumes underground. Each attenuation tank/system has been sized in conjunction with the basin attenuation volumes to accommodate attenuation from catchments for rainfall events greater than the 1-in-100-year event.

The basement level attenuation tank will remain under private management.

Flow Control:

A flow control device (Hydrobrake or similar approved) is proposed at each sub-catchment attenuation feature, which will limit exiting flows to a maximum rate of 2l/s/ha as permitted by DCC.

Petrol interceptor:

Class 1 petrol interceptors will be provided before the surface water outfalls to the local surface water networks.

Rainwater butts are not considered suitable due to the scale of the development (large residential and commercial blocks). The site investigation report results indicate that the subsoil infiltration rates are not conducive to successful integration of soakaways to the design.

4.3 SuDS Maintenance Regime

A maintenance regime for the SuDS features will be incorporated to the Operation and Maintenance manual for the development. Surface SuDS features can typically be maintained as part of the regular maintenance of the landscape, incorporating litter picking, grass cutting, and inspections. *Figure 14* overleaf, is an extract from Section 12.3 of the SuDS Design & Evaluation Guide, and generally describes the regular maintenance aspect for the SuDS.

Type	Activity	Normal site care (Site) or SuDS-specific maintenance (SuDS)	Suggested frequency
Regular Maintenance			
Litter	Pick up all litter in SUDS Landscape areas along with remainder of the site – remove from site	Site	1 visit monthly
Grass	Mow all grass verges, paths and amenity grass at 35-50mm with 75mm max. Leaving cuttings in situ	Site	As required or 1 visit monthly
Grass	Mow all dry swales, dry SUDS basins and margins to low flow channels and other SUDS features at 100mm with 150mm max. Cut wet swales or basins annually as wildflower areas – 1st and last cuts to be collected	Site	4-8 visits per year or as required
Grass	Wildflower areas strimmed to 100mm in Sept or at end of school holidays – all cuttings removed Or Wildflower areas strimmed to 100mm on 3 year rotation – 30% each year – all cuttings removed	Site	1 visit annually 1 visit annually
Inlets & outlets	Inspect monthly, remove silt from slab aprons and debris. Strim 1m round for access	SuDS	1 visit monthly
Permeable paving	Sweep all paving regularly to keep surface tidy	Site	1 visit annually or as required

Figure 14 | *Regular Maintenance Requirements for SuDS*

There will still be a remaining requirement for more intensive maintenance tasks to be undertaken however, the severity of these tasks can be reduced by regular inspections and proactive responses being incorporated as a part of the regular maintenance regime discussed above. A table showing the typical requirements for the occasional maintenance tasks and remedial works is extracted from the SuDS Design & Evaluation Guide to the figure overleaf.

Occasional Tasks			
Permeable paving	Sweep and suction brush permeable paving when ponding occurs	SuDS	As required - estimate 10-15 year intervals
Flow controls	Annual inspection of control chambers - remove silt and check free flow	SuDS	1 visit annually
Wetland & pond	Wetland vegetation to be cut at 100mm on 3 – 5 year rotation or 30% each year. All cuttings to be removed to wildlife piles or from site.	Site	As required
Silt	Inspect swales, ponds, wetlands annually for silt accumulation	Site & SuDS	1 visit annually
Silt	Excavate silt, stack and dry within 10m of the SUDS feature, but outside the design profile where water flows. Spread, rake and overseed.	Site & SuDS	As required
Native planting	Remove lower branches where necessary to ensure good ground cover to protect soil profile from erosion.	SuDS	1 visit annually
Remedial Work			
General SuDS	Inspect SuDS system to check for damage or failure when carrying out other tasks. Undertake remedial work as required.	SuDS	Monthly As required

Figure 15 | *Further Maintenance Requirements for SuDS*

4.4 Interception of Treatment Storage and Attenuation Storage

As noted above, the methodology involved in developing the Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS). DCC's SuDS Design and Evaluation Guide 2021, and in the CIRIA Report C753 The SuDS Manual. Appendix E of the Greater Dublin Strategic Drainage Study (GDSDS) sets out criteria for determining the provision of interception or treatment storage, attenuation storage and long-term storage at a development site. These calculations are summarised below. Please note that for the following calculations:

- The calculations have been progressed for the full masterplan development comprising Sites 4 & 5, unless specified otherwise.
- The site area measurement is deemed to be the blueline boundary (ownership boundary as per *Figure 1*) and excludes the public domain area. The reason for this exclusion is that the existing roads and footpaths are already served by the existing road gullies and surface water network infrastructure.

- While Section 3.5 of the Council's Green and Blue Roof Guide advises that green roofs provide an element of short-term storage and reduced runoff via evapotranspiration, for the purpose of producing the volumetric attenuation requirement calculations, green roofs for this project have been considered as paved surfaces (hardstanding areas) for the progression of these calculations.

4.4.1 Criterion 1: River Water Quality Protection

Water Quality Standard 1: Interception

The Greater Dublin Strategic Drainage Study (GDSDS) states that approximately 30% to 40% of rainfall events are sufficiently small that there is no measurable runoff from greenfield areas into the receiving waters. These events are generally considered as the first 5mm of rainfall. Assuming 80% runoff from paved surfaces and 0% from pervious surfaces for the first 5mm of rainfall yields the following:

Paved surfaces connected to drainage system	*138,311m² x 0.62 x 0.75 =* 64,315m²	*138,311m² site area* *62% of the site is paved* *75% of the paved area*
Volume of Interception Storage	*64,315m² x 5mm x 0.8 =* **257.26m³**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

Table 4 | *Interception Calculation*

This is further in line with Section 4.2.2 of the CIRIA Report C753 The SuDS Manual, which identifies Water Quality Criterion 1 as required to "*Support the management of water quality in receiving waters and groundwaters*". The section further lists methods whereby this can be achieved: Pollution Prevention, Interception, Treatment, & Maintenance and remedial work. Section 4.3.1 of the same document discusses the requirements for provided sufficient interception methods via the introduction of Green Roofs, Pervious Surfaces, & Vegetated SuDS.

It has been calculated that the interception volume as noted above will be provided through the introduction of nature-based SuDS to the design as follows:

Permeable paving is proposed in private driveways and parking courts and accounts for a total cumulative area of C. 6,684m^2. Assuming a subbase depth of 0.4m with 33% voids, this yields a treatment volume of 882m^3. The permeable paving locations can be seen on drawing number 22-010-P010 Surfacing Layout. These figures are based on the masterplan layout for Site 4 but does not include any permeable paving which may be later proposed as part of the detailed design of Site 5, which will be the subject of a later planning application.

As noted above, the green roofing amounts to a cumulative area of approximately 14,909m^2 and shall consist of 200mm substrate minimum. Assuming a 30% water volume retention, this amounts to approximately 894m^3 of treatment storage volume.

Filter drains, swales, raingardens, and roadside trees around the site provide further treatment volume.

These SuDS features provide ample treatment volume to meet the volumetric interception requirements.

SuDS features are identified on the SuDS Layout Drawing, refer to 22-010-P240, submitted as part of the planning package.

4.4.2 Criterion 2: River Regime Protection

Attenuation storage is provided to limit the discharge rate from the site into receiving waters. As per the GDSDS, the required attenuation volume is calculated assuming 80% runoff from paved areas (20% assumed as permeable paved parking bays, excludes calculations for apartment blocks which have been calculated as 100%), and has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each – refer to calculations included in Appendix A.

The calculations included in Appendix A have been based on the usage of an outflow rate of 1.991 l/s/ha, in line with DCC's requirement for a max permitted value of 2 l/s/ha.

As noted above, Site 4 has been divided in to 3 sub-catchments, with Site 5 its own catchment. However, 2 of the sub-catchments for Site 4, catchments 1 & 2, will run in a chain-like system to outfall to the public SW water network. This means that Catchment 1 will flow through Catchment 2 before outfalling to the public surface water network. Subsequently, the hydrobrake limit for Catchment 2 will be the sum of the permitted outflow rate for Catchments 1 & 2.

Based on the calculations, included as Appendix A, the required attenuation storage volume for each sub-catchment is set out in *Table 5* below, as well as the permitted outflow rate per catchment, and the actual outflow rate of the catchments running in the chain system.

Catchment	**Area**	**Allowable Discharge Rate (Per Catchment)**	**Allowable Discharge Rate (accounting for Chain System)**	**Required Attenuation Volume**
	m^2	*l/s*	*l/s*	*m^3*
Catchment 1: Site 4 North	60,290	11.82	11.82	1,800
Catchment 2: Site 4 Central	33,711	7.54	19.36	800
Catchment 3: Site 4 South	16,868	3.36	3.36	1,100
Catchment 4: Site 5	18,166	3.20	3.20	1,00
Total	**129,035**	**25.92**	**-**	**4,700**

Table 5 **|** *Attenuation Volume for Each Sub-Catchment*

It should be noted that the figures provided in the table above, and the calculations in Appendix A for Site 5 are indicative only, for the purpose of this masterplan submission and that Site 5 will be subject to a future detailed planning permission application.

In order to cater for the full attenuation requirement, detention basins and tanks have been incorporated to the design. There is an attenuation tank located in the basement of the southern blocks complex, with detention basins and further attenuation tanks located in the central green corridor. The attenuation areas have been designed to ensure the required attenuation volume is catered for and that there will be no surcharging of the tanks or basins for up to the 1-in-100 year storm incorporating an additional 20% for climate change. The attenuation volumes provided in the detention basins and tanks are recorded to *Table 6*, overleaf.

Location	Attenuation volume provided
	m^3
Catchment 1	1,918
Catchment 2	813
Catchment 3	1,122
Catchment 4	1,000
Total	**4,853**

Table 6 | *Attenuation Volume Provision*

As per *Table 5 & 6*, the required attenuation volume is 4,700m^3, with 4,853m^3 of attenuation volume actually provided.

Please note that given the masterplan development in mainly comprised of apartment, duplex, and commercial blocks with their associated private green spaces to be controlled by a management company, there is limited to no scope for urban creep, and as such these have not been factors to the attenuation calculations previously discussed.

The finished floor levels of surrounding building have been designed to be at least 0.5m above the Top of Water levels of the nearby detention basins as applicable. The Top of Water levels for the basins for the 1 in 100-year storm event have been calculated to be:

Catchment 1: 55.65mOD

Catchment 2: 56.25mOD

Catchment 3: 55.65mOD

4.4.3 Criterion 3: Levels of Service

There are four criteria for levels of service. These are:

Criterion 3.1: No external flooding except where specifically planned (30-year high intensity rainfall event).

Criterion 3.2: No internal flooding (100-year high intensity rainfall event).

Criterion 3.3: No internal flooding (100-year river event and critical duration for site storage).

Criterion 3.4: No flood routing off site except where specifically planned (100-year high intensity rainfall event).

Both internal and external flooding have been assessed in the Flood Risk Assessment report which accompanies this Engineering Assessment Report. The Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

This report has identified that the site lies within Flood Zone C and is separated from sites identified as being in Flood zone A & B both topographically and with sufficient separation distance. The subject site is a suitable location for the proposed development. Thusly, justification tests are not required to be undertaken. There are currently no floodplains identified on-site nor are any proposed as part of the subject development design. Further Flood Risk Assessment details are extracted to Section 4.6 of this report.

The assessment identifies the risk of both internal and external flooding at the site from various sources and sets out mitigation measures against the potential risks of flooding. The sources of possible flooding assessed in the report include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors.

As a result of the flood risk management and mitigation measures proposed, the residual risk of internal or external flooding for the 30-year and 100-year flood events is low, and accordingly all four of the above criteria have been met. Please refer to the accompanying Flood Risk Assessment report for the full analysis of the flood risk at the subject site.

4.4.4 Criterion 4: River Flood Protection

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

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

The Criteria 4.3 approach is for all runoff to be limited to either Q_{BAR} or to 2 l/s/Ha, whichever is the greater. However, DCC policy instructs that a max outflow rate of 2 l/s/ha is permitted. The proposed drainage system includes flow control devices at the outfall for each catchment to ensure that the discharge rate is limited to the permitted outflow rate, and ample attenuation is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change.

The extra runoff volume of the development runoff over greenfield runoff, Vol_{xs}, has been calculated for each of the sub-catchments. Note that as stated in the GDSDS, this volume is not additional to the attenuation storage volume but is effectively an element of it.

4.5 Surface Water - General

The proposed drainage and attenuation strategy drawings are included as part of the planning package and can be seen on drawing numbers:

- 22-010 -P200-P203 and P205.
- Surface water catchments on 22-010-P210.
- The SuDS layout drawing is 22-010-P240.
- A cross section of the central attenuation corridor is provided on 22-010-P250.
- Ancillary details drawings for the Typical Surface Water Details are on 22-010-P230.

- The Typical SuDS Details are provided on 22-010-P241.

Surface water long sections have been prepared in line with the Development Plan requirements for the preparation of a Surface Water Management Plan Report and are submitted as Drawing Numbers: 22-010-P250, & 22-010-P260 & P261.

Surface water sewers will generally consist of PVC (to IS 123) or concrete socket and spigot pipes (to IS 6) and laid strictly in accordance with Dublin City Council requirements for taking in charge. It is intended that all sewers within the public domain will be handed over to Dublin City Council for taking in charge.

All private outfall manholes will be built in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. No private drainage will be located within public areas.

Drains will be laid in accordance with the requirements of the Building Regulations, Technical Guidance Document H.

All SuDS and surface water drainage networks proposed in the public domain will be constructed to the standards required for Taking in Charge.

As is standard, the proposed Surface Water network, including SuDS devices will be constructed in accordance with the requirements of the various utility provides such as in respect to separation distance between utilities etc.

Typically, there are no existing utilities internal to the site (gas/telecommunications etc)., with the exception of overhead electricity lines. It is intended that these overhead lines will be undergrounded as part of the site work, however, ESB will not engage on this matter until a grant of planning permission has been received. The proposal/design for the undergrounding of overhead lines will be undertaken at the appropriate time.

4.6 Flood Risk Assessment

As previously noted, a site-specific Flood Risk Assessment has been carried out for the proposed development and accompanies this submission under separate cover.

This report identifies that the site is located in an area designated as Flood Zone C, which is suitable for the proposed development.

There have been no flood plains identified on site, nor are any proposed as part of the subject development design.

Overland flood routing has been incorporated to the design. Should fluvial flooding occur, surface water can flow overland towards the attenuation areas and ditch networks via open spaces as shown in the figure overleaf. This figure is extracted from Drawing Number: 22-010-P220 which is submitted as part of the planning package.

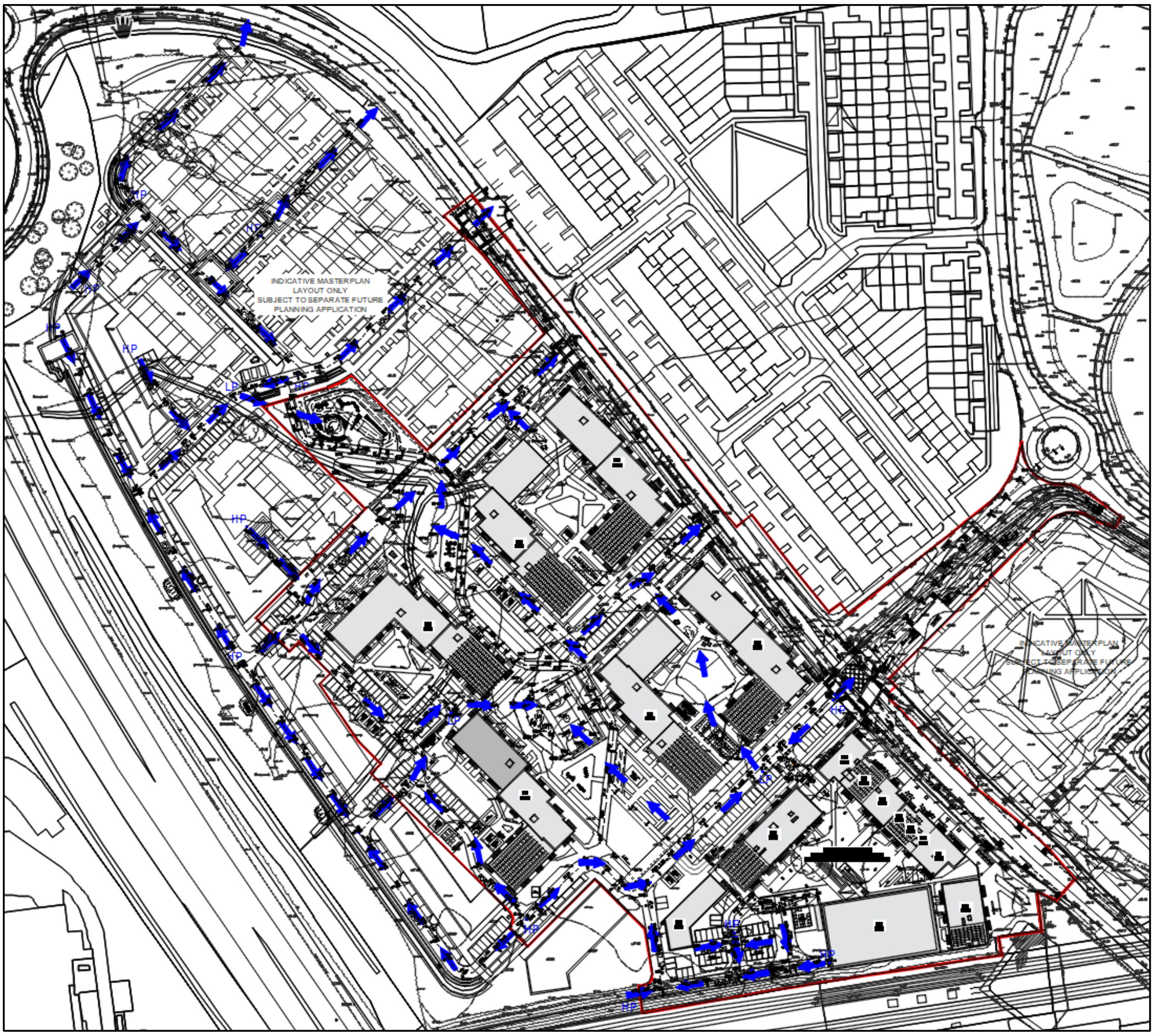


Figure 16 **|** *Overland Flood Route*

The Flood Risk Assessment discusses in detail the various sources, pathways, receptors, likelihood, consequence, and risk of flooding. The identified risks are mitigated and the residual risk assessed. A summary is provided in *Table 7*, overleaf.

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*Irish Sea (River Liffey)*	*Proposed development*	*Extremely low*	*None*	*Negligible*	*None*	Negligible
Fluvial	*Blackditch Stream & River Camac*	*Proposed development*	*Low*	*Low*	*Extremely Low*	*Setting of floor levels, overland flood routing*	Extremely Low
Pluvial	*Private & Public Drainage Network*	*Proposed development, downstream properties, and roads*	*Ranges from high to low*	*Moderate*	*Ranges from high to low*	*Appropriate drainage, SuDS, and attenuation design, setting of floor levels, overland flood routing*	Low
Ground Water	*Ground*	*Underground services, ground and undercroft level of buildings, roads*	*High*	*Moderate*	*High*	*Appropriate setting of floor levels, flood routing, damp proof membranes*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed development*	*High*	*Moderate*	*High*	*Setting of floor levels, overland flood routing, regular inspection of SW network*	Low

Table 7* | *Summary of the Flood Risks from the Various Components

Appendices

A. GDSDS Attenuation Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.090	4.00	57.320	1200	707582.615	733130.913	1.120
2	0.094	4.00	57.300	1200	707631.554	733179.070	1.558
3	0.118	4.00	57.160	1200	707646.088	733103.044	1.230
4	0.143	4.00	56.800	1200	707686.346	733143.264	1.535
5	0.186	4.00	56.680	1200	707678.677	733040.140	1.240
6	0.186	4.00	56.180	1200	707731.036	733092.449	1.253
7	0.060	4.00	56.000	1350	707766.868	733047.149	1.575
8	0.058	4.00	55.830	1200	707795.011	733011.704	1.125
9	0.058	4.00	56.050	1200	707776.870	733035.010	1.493
10	0.060	4.00	55.830	1200	707767.760	733033.825	1.530
11	0.060	4.00	56.020	1200	707753.222	733019.219	1.864
12	0.057	4.00	56.080	1200	707748.849	733007.619	1.790
13	0.098	4.00	56.170	1200	707739.264	733008.337	2.100
14	0.824	4.00	57.220	1200	707552.358	733030.718	1.450
15	0.082	4.00	56.810	1200	707580.419	732974.310	1.535
16			56.900	1200	707583.499	732975.911	1.814
17	0.020	4.00	56.900	1200	707588.629	733018.388	1.500
18	0.085	4.00	56.750	1200	707607.207	732999.605	1.832
19	0.848	4.00	56.550	1200	707623.498	733015.910	1.799
20	0.022	4.00	57.600	1200	707557.536	733073.568	1.425
21	0.080	4.00	57.450	1200	707582.693	733098.703	1.986
22	0.118	4.00	57.240	1200	707639.436	733091.309	1.425
23	0.212	4.00	57.140	1200	707614.894	733066.788	2.279
24	0.215	4.00	56.860	1200	707655.360	733026.683	2.670
25			57.000	1200	707667.633	733023.067	2.853
26			55.150	1200	707672.207	732986.631	1.117
27			55.150	1200	707691.305	732984.076	1.181
28	0.057	4.00	57.000	1200	707712.245	732992.966	1.925
29	0.057	4.00	55.150	1200	707708.670	732977.575	1.243
30	0.083	4.00	56.830	1200	707590.871	732955.923	0.930
31	0.832	4.00	57.450	1200	707627.313	732896.089	2.242
32			57.600	1200	707635.462	732901.380	2.441
33	0.040	4.00	57.050	1200	707651.237	732917.100	2.336
34	0.028	4.00	57.020	1200	707638.572	732948.769	1.370
35	0.028	4.00	56.830	1200	707654.753	732932.519	1.295
36	0.090	4.00	56.860	1200	707662.206	732933.154	2.431
37	0.054	4.00	56.700	1200	707647.642	733001.609	1.491
38	0.061	4.00	56.410	1200	707689.219	732960.032	2.108
39			55.150	1200	707709.094	732954.197	1.335
40	0.058	4.00	55.750	1200	707809.077	732993.635	0.925
41	0.058	4.00	55.750	1200	707830.504	732966.107	1.425

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
42	0.029	4.00	56.050	1200	707830.561	732959.010	1.760
43	0.029	4.00	56.060	1200	707808.187	732936.671	1.928
44	0.046	4.00	56.240	1200	707793.010	732925.360	2.278
45	0.056	4.00	56.630	1200	707773.973	732906.324	2.776
46	0.058	4.00	56.400	1200	707731.229	732948.695	2.787
47	0.058	4.00	56.300	1200	707726.510	732973.051	1.425
48			56.450	1200	707725.039	732949.075	2.862
49			56.570	1500	707719.676	732942.481	2.808
50	0.078	4.00	56.790	1200	707667.288	732838.488	1.425
51	0.078	4.00	57.200	1200	707633.852	732886.667	2.128
52	0.055	4.00	56.690	1200	707690.123	732872.909	1.540
53	0.048	4.00	57.030	1200	707655.169	732907.984	2.234
54	0.085	4.00	56.600	1200	707697.549	732950.364	2.004
55	0.085	4.00	56.700	1200	707747.278	732900.622	1.425
56	0.085	4.00	56.700	1200	707715.184	732932.724	2.262
57			56.720	1200	707722.058	732940.127	2.961
58			55.740	1200	707731.855	732931.029	2.025
59			55.750	1200	707758.967	732903.921	1.065
60			56.900	1350	707765.933	732896.955	2.300
61	0.058	4.00	57.410	1200	707734.942	732764.697	1.425
62	0.093	4.00	57.400	1200	707770.349	732800.111	1.230
63	0.093	4.00	57.610	1200	707754.555	732784.314	1.839
64	0.043	4.00	57.170	1200	707733.946	732804.922	1.863
65	0.043	4.00	57.180	1200	707731.572	732816.684	1.933
66	0.078	4.00	57.110	1200	707713.370	732772.930	1.400
67	0.078	4.00	56.800	1200	707679.556	732820.801	1.556
68	0.081	4.00	56.750	1200	707703.518	732844.753	1.776
69	0.043	4.00	56.800	1200	707715.962	732866.502	1.951
70	0.085	4.00	56.800	1200	707729.757	732880.144	2.091
71	0.043	4.00	57.100	1200	707785.360	732827.871	1.425
72	0.043	4.00	57.100	1200	707775.426	732843.654	1.611
73	0.043	4.00	56.700	1200	707740.545	732878.534	2.027
74			56.700	1350	707749.441	732887.430	2.069
75	0.119	4.00	56.520	1200	707859.264	732852.421	1.430
76	0.046	4.00	57.020	1200	707804.877	732798.070	1.250
77	0.085	4.00	57.620	1350	707829.427	732822.604	2.750
78			57.000	1350	707791.921	732860.029	2.370
79	0.030	4.00	56.000	1350	707779.375	732862.434	1.413
80	0.030	4.00	56.000	1350	707766.010	732884.373	1.574
81	0.073	4.00	57.000	1200	707824.072	732839.343	1.125
82	0.078	4.00	57.000	1200	707793.051	732870.402	2.003
83	0.078	4.00	56.860	1350	707777.022	732896.708	2.595
84			56.580	1800	707777.981	732907.503	2.370
85			56.240	1200	707797.658	732927.180	2.130
86			56.020	1200	707807.268	732934.340	1.950
87			56.900	1200	707834.498	732961.081	2.957
88			55.630	1200	707841.014	732964.358	1.711
89	0.025	4.00	57.380	1200	707813.378	732773.344	1.425
90	0.025	4.00	57.900	1200	707816.530	732753.705	2.044
91	0.029	4.00	58.850	1200	707874.700	732763.043	1.425
92	0.045	4.00	58.240	1200	707849.689	732759.028	2.552
93	0.128	4.00	57.840	1200	707845.749	732783.568	2.330

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
94		4.00	56.000	1200	707885.570	732824.307	0.430
95	0.133	4.00	56.000	1200	707873.258	732811.989	1.530
96	0.053	4.00	56.000	1200	707892.179	732793.068	1.619
97	0.156	4.00	56.000	1200	707922.702	732797.973	1.722
98	0.118	4.00	56.000	1200	707925.756	732801.027	1.736
99			56.000	1200	707890.793	732835.990	1.901
100	0.138	4.00	56.590	1200	707868.297	732858.585	2.597
101	0.188	4.00	59.200	1200	707962.141	732812.736	1.425
102	0.237	4.00	56.820	1200	707892.325	732882.596	3.015
103	0.083	4.00	56.000	1200	707845.472	732946.315	1.125
104	0.083	4.00	56.550	1200	707881.315	732901.600	2.057
105			56.000	1500	707896.317	732886.586	2.214
106			56.740	1200	707899.695	732889.962	2.970
107			56.600	1200	707892.284	732899.924	2.955
107_OUT			56.000	1200	707907.707	732912.208	2.421

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	68.660	0.600	56.200	55.742	0.458	150.0	225	5.07	50.0
1.001	2	4	65.454	0.600	55.742	55.415	0.327	200.0	225	6.26	50.0
2.000	3	4	56.907	0.600	55.930	55.551	0.379	150.0	225	4.89	50.0
1.002	4	6	67.671	0.600	55.265	54.927	0.338	200.0	375	7.14	50.0
3.000	5	6	74.011	0.600	55.440	55.070	0.370	200.0	225	5.34	50.0
1.003	6	7	57.761	0.600	54.927	54.514	0.413	140.0	375	7.77	50.0
1.004	7	10	13.354	0.600	54.425	54.358	0.067	200.0	450	7.93	50.0
4.000	8	9	29.534	0.600	54.705	54.557	0.148	200.0	225	4.53	50.0
4.001	9	10	9.187	0.600	54.557	54.511	0.046	200.0	225	4.70	50.0
1.005	10	11	20.608	0.600	54.300	54.231	0.069	300.0	450	8.22	50.0
1.006	11	13	17.699	0.600	54.156	54.097	0.059	300.0	525	8.45	50.0
5.000	12	13	9.612	0.600	54.290	54.226	0.064	150.0	225	4.15	50.0
1.007	13	29	43.385	0.600	54.070	53.925	0.145	300.0	525	9.01	50.0
6.000	14	15	63.002	0.600	55.770	55.350	0.420	150.0	225	4.99	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.065	42.3	16.3	0.895	1.333	0.090	0.0	96	0.995
1.001	0.921	36.6	33.2	1.333	1.160	0.184	0.0	169	1.040
2.000	1.065	42.3	21.3	1.005	1.024	0.118	0.0	113	1.067
1.002	1.277	141.1	80.4	1.160	0.878	0.445	0.0	203	1.318
3.000	0.921	36.6	33.6	1.015	0.885	0.186	0.0	170	1.040
1.003	1.529	168.9	147.6	0.878	1.111	0.817	0.0	273	1.714
1.004	1.434	228.0	158.5	1.125	1.022	0.877	0.0	277	1.544
4.000	0.921	36.6	10.5	0.900	1.268	0.058	0.0	82	0.796
4.001	0.921	36.6	21.0	1.268	1.094	0.116	0.0	122	0.950
1.005	1.168	185.8	190.3	1.080	1.339	1.053	0.0	383	1.320
1.006	1.288	278.8	201.1	1.339	1.548	1.113	0.0	331	1.397
5.000	1.065	42.3	10.3	1.565	1.719	0.057	0.0	75	0.880
1.007	1.288	278.8	229.1	1.575	0.700	1.268	0.0	364	1.430
6.000	1.065	42.3	148.9	1.225	1.235	0.824	0.0	225	1.085

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
6.001	15	16	3.471	0.600	55.275	55.236	0.039	89.0	300	5.02	50.0
6.002	16	18	33.518	0.600	55.086	54.918	0.168	199.5	450	5.41	50.0
7.000	17	18	26.419	0.600	55.400	55.106	0.294	90.0	225	4.32	50.0
6.003	18	19	23.049	0.600	54.918	54.826	0.092	250.5	375	5.75	50.0
6.004	19	24	33.634	0.600	54.751	54.639	0.112	300.0	450	6.23	50.0
8.000	20	21	35.562	0.600	56.175	55.464	0.711	50.0	225	4.32	50.0
8.001	21	23	45.337	0.600	55.464	55.011	0.453	100.0	225	4.90	50.0
9.000	22	23	34.693	0.600	55.815	55.642	0.173	200.0	300	4.52	50.0
8.002	23	24	56.973	0.600	54.861	54.576	0.285	200.0	375	5.64	50.0
6.005	24	25	12.795	0.600	54.190	54.147	0.043	300.0	450	6.41	50.0
6.006	25	26	36.722	0.600	54.155	54.033	0.122	300.0	450	6.93	50.0
6.007	26	27	19.268	0.600	54.033	53.969	0.064	300.0	375	7.24	50.0
6.008	27	29	18.542	0.600	53.969	53.907	0.062	300.0	450	7.51	50.0
10.000	28	29	15.801	0.600	55.075	54.285	0.790	20.0	225	4.09	50.0
1.008	29	39	23.382	0.600	53.910	53.832	0.078	300.0	375	9.39	50.0
11.000	30	31	70.058	0.600	55.900	55.433	0.467	150.0	225	5.10	50.0
11.001	31	32	9.716	0.600	55.208	55.159	0.049	200.0	450	5.21	50.0
11.002	32	33	22.270	0.600	55.159	54.714	0.445	50.0	450	5.34	50.0
11.003	33	36	19.444	0.600	54.714	54.617	0.097	200.0	450	5.56	50.0
12.000	34	35	22.932	0.600	55.650	55.535	0.115	200.0	225	4.42	50.0
12.001	35	36	7.480	0.600	55.535	55.498	0.037	202.2	225	4.55	50.0
11.004	36	38	38.107	0.600	54.429	54.302	0.127	300.1	525	6.06	50.0
13.000	37	38	58.799	0.600	55.209	54.493	0.716	82.1	225	4.68	50.0
11.005	38	39	20.714	0.600	54.302	54.233	0.069	300.0	450	6.35	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
6.001	1.667	117.8	163.7	1.235	1.364	0.906	0.0	300	1.688
6.002	1.435	228.3	163.7	1.364	1.382	0.906	0.0	283	1.555
7.000	1.379	54.8	3.6	1.275	1.419	0.020	0.0	39	0.787
6.003	1.140	125.9	182.7	1.457	1.349	1.011	0.0	375	1.155
6.004	1.168	185.8	335.9	1.349	1.771	1.859	0.0	450	1.183
8.000	1.854	73.7	4.0	1.200	1.761	0.022	0.0	36	1.002
8.001	1.307	52.0	18.4	1.761	1.904	0.102	0.0	93	1.200
9.000	1.108	78.3	21.3	1.125	1.198	0.118	0.0	106	0.946
8.002	1.277	141.1	78.1	1.904	1.909	0.432	0.0	200	1.309
6.005	1.168	185.8	452.8	2.220	2.403	2.506	0.0	450	1.183
6.006	1.168	185.8	452.8	2.395	0.667	2.506	0.0	450	1.183
6.007	1.041	114.9	452.8	0.742	0.806	2.506	0.0	375	1.054
6.008	1.168	185.8	452.8	0.731	0.793	2.506	0.0	450	1.183
10.000	2.939	116.8	10.3	1.700	0.640	0.057	0.0	45	1.837
1.008	1.041	114.9	702.6	0.865	0.943	3.888	0.0	375	1.054
11.000	1.065	42.3	15.0	0.705	1.792	0.083	0.0	93	0.977
11.001	1.434	228.0	165.3	1.792	1.991	0.915	0.0	285	1.557
11.002	2.880	458.1	165.3	1.991	1.886	0.915	0.0	187	2.658
11.003	1.434	228.0	172.6	1.886	1.793	0.955	0.0	294	1.570
12.000	0.921	36.6	5.1	1.145	1.070	0.028	0.0	57	0.652
12.001	0.916	36.4	10.1	1.070	1.137	0.056	0.0	81	0.788
11.004	1.288	278.7	199.0	1.906	1.583	1.101	0.0	329	1.393
13.000	1.444	57.4	9.8	1.266	1.692	0.054	0.0	63	1.085
11.005	1.168	185.8	219.7	1.658	0.467	1.216	0.0	450	1.183

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.009	39	49	15.787	0.600	53.815	53.762	0.053	300.0	450	9.61	49.8
14.000	40	41	34.884	0.600	54.825	54.651	0.174	200.0	225	4.63	50.0
14.001	41	42	7.097	0.600	54.325	54.290	0.035	200.0	225	4.76	50.0
14.002	42	43	31.617	0.600	54.290	54.132	0.158	200.0	225	5.33	50.0
14.003	43	44	18.928	0.600	54.132	54.037	0.095	200.0	225	5.67	50.0
14.004	44	45	26.922	0.600	53.962	53.854	0.108	250.0	300	6.13	50.0
14.005	45	46	60.186	0.600	53.854	53.613	0.241	250.0	300	7.14	50.0
14.006	46	48	6.202	0.600	53.613	53.588	0.025	250.0	300	7.25	50.0
15.000	47	48	24.021	0.600	54.875	54.395	0.480	50.0	225	4.22	50.0
14.007	48	49	8.500	0.600	53.839	53.805	0.034	250.0	375	7.37	50.0
1.010	49	57	3.349	0.600	53.770	53.759	0.011	300.0	450	9.66	49.6
16.000	50	51	58.645	0.600	55.365	55.072	0.293	200.0	225	5.06	50.0
16.001	51	53	30.147	0.600	55.072	54.871	0.201	150.0	225	5.53	50.0
17.000	52	53	49.518	0.600	55.150	54.902	0.248	200.0	225	4.90	50.0
16.002	53	54	59.934	0.600	54.796	54.596	0.200	300.0	300	6.64	50.0
16.003	54	56	24.943	0.600	54.596	54.513	0.083	300.0	300	7.10	50.0
18.000	55	56	45.393	0.600	55.275	55.048	0.227	200.0	225	4.82	50.0
16.004	56	57	10.102	0.600	54.438	54.387	0.051	200.0	375	7.23	50.0
1.011	57	58	13.370	0.600	53.760	53.715	0.045	300.0	450	9.85	49.2
1.012	58	59	38.339	0.600	54.825	54.697	0.128	300.0	375	10.46	47.8
1.013	59	60	9.851	0.600	54.685	54.652	0.033	300.0	450	10.60	47.4
1.014	60	84	16.013	0.600	54.600	54.210	0.390	41.1	450	10.69	47.3
19.000	61	63	27.740	0.600	55.985	55.846	0.139	200.0	225	4.50	50.0
20.000	62	63	22.338	0.600	56.170	55.771	0.399	56.0	225	4.21	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.009	1.168	185.8	917.8	0.885	2.358	5.104	0.0	450	1.183
14.000	0.921	36.6	10.5	0.700	0.874	0.058	0.0	82	0.796
14.001	0.921	36.6	21.0	1.200	1.535	0.116	0.0	122	0.950
14.002	0.921	36.6	26.2	1.535	1.703	0.145	0.0	141	0.999
14.003	0.921	36.6	31.4	1.703	1.978	0.174	0.0	161	1.032
14.004	0.990	70.0	39.8	1.978	2.476	0.220	0.0	162	1.020
14.005	0.990	70.0	49.9	2.476	2.487	0.276	0.0	188	1.072
14.006	0.990	70.0	60.4	2.487	2.562	0.334	0.0	216	1.109
15.000	1.854	73.7	10.5	1.200	1.830	0.058	0.0	57	1.317
14.007	1.141	126.0	70.8	2.236	2.390	0.392	0.0	201	1.173
1.010	1.168	185.8	986.0	2.350	2.511	5.496	0.0	450	1.183
16.000	0.921	36.6	14.1	1.200	1.903	0.078	0.0	97	0.863
16.001	1.065	42.3	28.2	1.903	1.934	0.156	0.0	134	1.137
17.000	0.921	36.6	9.9	1.315	1.903	0.055	0.0	80	0.783
16.002	0.902	63.8	46.8	1.934	1.704	0.259	0.0	191	0.983
16.003	0.902	63.8	62.2	1.704	1.887	0.344	0.0	241	1.023
18.000	0.921	36.6	15.4	1.200	1.427	0.085	0.0	102	0.881
16.004	1.277	141.1	92.9	1.887	1.958	0.514	0.0	222	1.360
1.011	1.168	185.8	1068.1	2.510	1.575	6.010	0.0	450	1.183
1.012	1.041	114.9	1037.4	0.540	0.678	6.010	0.0	375	1.054
1.013	1.168	185.8	1030.6	0.615	1.798	6.010	0.0	450	1.183
1.014	3.180	505.7	1026.6	1.850	1.920	6.010	0.0	450	3.220
19.000	0.921	36.6	10.5	1.200	1.539	0.058	0.0	82	0.796
20.000	1.751	69.6	16.8	1.005	1.614	0.093	0.0	75	1.449

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
19.001	63	64	29.145	0.600	55.771	55.382	0.389	75.0	225	4.82	50.0
19.002	64	65	11.999	0.600	55.307	55.247	0.060	200.0	300	5.00	50.0
19.003	65	68	39.685	0.600	55.247	55.049	0.198	200.0	300	5.60	50.0
21.000	66	67	58.609	0.600	55.710	55.319	0.391	150.0	225	4.92	50.0
21.001	67	68	33.880	0.600	55.244	55.075	0.169	200.5	300	5.43	50.0
19.004	68	69	25.057	0.600	54.974	54.849	0.125	200.0	375	5.93	50.0
19.005	69	70	19.401	0.600	54.849	54.784	0.065	300.0	375	6.24	50.0
19.006	70	73	10.907	0.600	54.709	54.673	0.036	300.0	450	6.39	50.0
22.000	71	72	18.649	0.600	55.675	55.489	0.186	100.0	225	4.24	50.0
22.001	72	73	49.328	0.600	55.489	54.996	0.493	100.0	225	4.87	50.0
19.007	73	74	12.581	0.600	54.673	54.631	0.042	300.0	450	6.57	50.0
19.008	74	80	16.849	0.600	54.631	54.575	0.056	300.0	450	6.81	50.0
23.000	75	77	42.182	0.600	55.090	54.879	0.211	200.0	300	4.63	50.0
24.000	76	77	34.708	0.600	55.770	55.596	0.174	200.0	225	4.63	50.0
23.001	77	78	52.984	0.600	54.870	54.693	0.177	300.0	375	5.48	50.0
23.002	78	79	12.774	0.600	54.630	54.587	0.043	300.0	375	5.69	50.0
23.003	79	80	25.689	0.600	54.587	54.501	0.086	298.7	375	6.10	50.0
19.009	80	83	16.535	0.600	54.426	54.371	0.055	300.6	450	7.05	50.0
25.000	81	82	43.897	0.600	55.875	54.997	0.878	50.0	225	4.39	50.0
25.001	82	83	30.805	0.600	54.997	54.843	0.154	200.0	225	4.95	50.0
19.010	83	84	10.838	0.600	54.265	54.229	0.036	300.0	450	7.21	50.0
1.015	84	85	27.827	0.600	54.210	54.117	0.093	300.0	300	11.20	46.2
1.016	85	86	11.984	0.600	54.110	54.070	0.040	300.0	300	11.42	45.7
1.017	86	87	38.165	0.600	54.070	53.943	0.127	300.0	300	12.13	44.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
19.001	1.511	60.1	44.1	1.614	1.563	0.244	0.0	144	1.648
19.002	1.108	78.3	51.9	1.563	1.633	0.287	0.0	178	1.181
19.003	1.108	78.3	59.6	1.633	1.401	0.330	0.0	197	1.216
21.000	1.065	42.3	14.1	1.175	1.256	0.078	0.0	89	0.960
21.001	1.106	78.2	28.2	1.256	1.375	0.156	0.0	125	1.020
19.004	1.277	141.1	102.5	1.401	1.576	0.567	0.0	238	1.388
19.005	1.041	114.9	110.2	1.576	1.641	0.610	0.0	296	1.178
19.006	1.168	185.8	125.6	1.641	1.577	0.695	0.0	272	1.251
22.000	1.307	52.0	7.8	1.200	1.386	0.043	0.0	58	0.944
22.001	1.307	52.0	15.5	1.386	1.479	0.086	0.0	84	1.143
19.007	1.168	185.8	148.9	1.577	1.619	0.824	0.0	306	1.293
19.008	1.168	185.8	148.9	1.619	0.975	0.824	0.0	306	1.293
23.000	1.108	78.3	21.5	1.130	2.441	0.119	0.0	107	0.948
24.000	0.921	36.6	8.3	1.025	1.799	0.046	0.0	73	0.747
23.001	1.041	114.9	45.2	2.375	1.932	0.250	0.0	163	0.980
23.002	1.041	114.9	45.2	1.995	1.038	0.250	0.0	163	0.980
23.003	1.043	115.2	50.6	1.038	1.124	0.280	0.0	174	1.011
19.009	1.167	185.6	204.9	1.124	2.039	1.134	0.0	450	1.182
25.000	1.854	73.7	13.2	0.900	1.778	0.073	0.0	65	1.416
25.001	0.921	36.6	27.3	1.778	1.792	0.151	0.0	145	1.008
19.010	1.168	185.8	246.3	2.145	1.901	1.363	0.0	450	1.183
1.015	0.902	63.8	1230.6	2.070	1.823	7.373	0.0	300	0.914
1.016	0.902	63.8	1218.7	1.830	1.650	7.373	0.0	300	0.914
1.017	0.902	63.8	1182.5	1.650	2.657	7.373	0.0	300	0.914

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.018	87	88	7.294	0.600	53.943	53.919	0.024	300.0	300	12.26	44.1
1.019	88	107	82.343	0.600	53.919	53.645	0.274	300.0	300	13.78	41.5
26.000	89	90	19.890	0.600	55.955	55.856	0.099	200.0	225	4.36	50.0
26.001	90	92	33.584	0.600	55.856	55.688	0.168	200.0	225	4.97	50.0
27.000	91	92	25.331	0.600	57.425	56.792	0.633	40.0	225	4.20	50.0
26.002	92	93	24.854	0.600	55.688	55.510	0.178	140.0	225	5.34	50.0
26.003	93	95	39.554	0.600	55.510	55.114	0.396	100.0	225	5.85	50.0
28.000	94	95	17.416	0.600	55.570	55.483	0.087	200.0	225	4.32	50.0
26.004	95	96	26.758	0.600	54.470	54.381	0.089	300.7	450	6.23	50.0
26.005	96	97	30.915	0.600	54.381	54.278	0.103	300.1	450	6.67	50.0
26.006	97	98	4.319	0.600	54.278	54.264	0.014	300.0	450	6.73	50.0
26.007	98	99	49.445	0.600	54.264	54.099	0.165	300.0	450	7.44	50.0
26.008	99	100	31.884	0.600	54.099	53.993	0.106	300.0	450	7.89	50.0
26.009	100	102	33.969	0.600	53.993	53.880	0.113	300.0	450	8.38	50.0
29.000	101	102	98.766	0.600	57.775	54.483	3.292	30.0	225	4.69	50.0
26.010	102	105	5.644	0.600	53.805	53.786	0.019	300.0	525	8.45	50.0
30.000	103	104	57.308	0.600	54.875	54.493	0.382	150.0	225	4.90	50.0
30.001	104	105	21.225	0.600	54.493	54.352	0.141	150.0	225	5.23	50.0
26.011	105	106	4.776	0.600	53.786	53.770	0.016	300.0	525	8.51	50.0
26.012	106	107	12.416	0.600	53.770	53.729	0.041	300.0	525	8.67	50.0
1.020	107	107_OUT	19.717	0.600	53.645	53.579	0.066	300.0	300	14.15	41.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.018	0.902	63.8	1175.9	2.657	1.411	7.373	0.0	300	0.914
1.019	0.902	63.8	1107.1	1.411	2.655	7.373	0.0	300	0.914
26.000	0.921	36.6	4.5	1.200	1.819	0.025	0.0	53	0.629
26.001	0.921	36.6	9.0	1.819	2.327	0.050	0.0	76	0.765
27.000	2.074	82.5	5.2	1.200	1.223	0.029	0.0	38	1.171
26.002	1.103	43.8	22.4	2.327	2.105	0.124	0.0	114	1.108
26.003	1.307	52.0	45.5	2.105	0.661	0.252	0.0	164	1.469
28.000	0.921	36.6	0.0	0.205	0.292	0.000	0.0	0	0.000
26.004	1.167	185.6	69.6	1.080	1.169	0.385	0.0	190	1.086
26.005	1.168	185.8	79.1	1.169	1.272	0.438	0.0	205	1.124
26.006	1.168	185.8	107.3	1.272	1.286	0.594	0.0	246	1.208
26.007	1.168	185.8	128.7	1.286	1.451	0.712	0.0	276	1.257
26.008	1.168	185.8	128.7	1.451	2.147	0.712	0.0	276	1.257
26.009	1.168	185.8	153.6	2.147	2.490	0.850	0.0	313	1.299
29.000	2.397	95.3	34.0	1.200	2.112	0.188	0.0	93	2.201
26.010	1.288	278.8	230.4	2.490	1.689	1.275	0.0	366	1.431
30.000	1.065	42.3	15.0	0.900	1.832	0.083	0.0	93	0.977
30.001	1.065	42.3	30.0	1.832	1.423	0.166	0.0	140	1.153
26.011	1.288	278.8	260.4	1.689	2.445	1.441	0.0	405	1.453
26.012	1.288	278.8	260.4	2.445	2.346	1.441	0.0	405	1.453
1.020	0.902	63.8	1305.5	2.655	2.121	8.814	0.0	300	0.914

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	68.660	150.0	225	Circular	57.320	56.200	0.895	57.300	55.742	1.333
1.001	65.454	200.0	225	Circular	57.300	55.742	1.333	56.800	55.415	1.160
2.000	56.907	150.0	225	Circular	57.160	55.930	1.005	56.800	55.551	1.024
1.002	67.671	200.0	375	Circular	56.800	55.265	1.160	56.180	54.927	0.878
3.000	74.011	200.0	225	Circular	56.680	55.440	1.015	56.180	55.070	0.885
1.003	57.761	140.0	375	Circular	56.180	54.927	0.878	56.000	54.514	1.111
1.004	13.354	200.0	450	Circular	56.000	54.425	1.125	55.830	54.358	1.022
4.000	29.534	200.0	225	Circular	55.830	54.705	0.900	56.050	54.557	1.268
4.001	9.187	200.0	225	Circular	56.050	54.557	1.268	55.830	54.511	1.094
1.005	20.608	300.0	450	Circular	55.830	54.300	1.080	56.020	54.231	1.339
1.006	17.699	300.0	525	Circular	56.020	54.156	1.339	56.170	54.097	1.548
5.000	9.612	150.0	225	Circular	56.080	54.290	1.565	56.170	54.226	1.719
1.007	43.385	300.0	525	Circular	56.170	54.070	1.575	55.150	53.925	0.700
6.000	63.002	150.0	225	Circular	57.220	55.770	1.225	56.810	55.350	1.235
6.001	3.471	89.0	300	Circular	56.810	55.275	1.235	56.900	55.236	1.364
6.002	33.518	199.5	450	Circular	56.900	55.086	1.364	56.750	54.918	1.382
7.000	26.419	90.0	225	Circular	56.900	55.400	1.275	56.750	55.106	1.419
6.003	23.049	250.5	375	Circular	56.750	54.918	1.457	56.550	54.826	1.349
6.004	33.634	300.0	450	Circular	56.550	54.751	1.349	56.860	54.639	1.771
8.000	35.562	50.0	225	Circular	57.600	56.175	1.200	57.450	55.464	1.761
8.001	45.337	100.0	225	Circular	57.450	55.464	1.761	57.140	55.011	1.904
9.000	34.693	200.0	300	Circular	57.240	55.815	1.125	57.140	55.642	1.198
8.002	56.973	200.0	375	Circular	57.140	54.861	1.904	56.860	54.576	1.909
6.005	12.795	300.0	450	Circular	56.860	54.190	2.220	57.000	54.147	2.403
6.006	36.722	300.0	450	Circular	57.000	54.155	2.395	55.150	54.033	0.667

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
2.000	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.002	4	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
3.000	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.003	6	1200	Manhole	Adoptable	7	1350	Manhole	Adoptable
1.004	7	1350	Manhole	Adoptable	10	1200	Manhole	Adoptable
4.000	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
4.001	9	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
1.005	10	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
1.006	11	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
5.000	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
1.007	13	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
6.000	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
6.001	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
6.002	16	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
7.000	17	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
6.003	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
6.004	19	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
8.000	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
8.001	21	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
9.000	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
8.002	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
6.005	24	1200	Manhole	Adoptable	25	1200	Manhole	Adoptable
6.006	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.007	19.268	300.0	375	Circular	55.150	54.033	0.742	55.150	53.969	0.806
6.008	18.542	300.0	450	Circular	55.150	53.969	0.731	55.150	53.907	0.793
10.000	15.801	20.0	225	Circular	57.000	55.075	1.700	55.150	54.285	0.640
1.008	23.382	300.0	375	Circular	55.150	53.910	0.865	55.150	53.832	0.943
11.000	70.058	150.0	225	Circular	56.830	55.900	0.705	57.450	55.433	1.792
11.001	9.716	200.0	450	Circular	57.450	55.208	1.792	57.600	55.159	1.991
11.002	22.270	50.0	450	Circular	57.600	55.159	1.991	57.050	54.714	1.886
11.003	19.444	200.0	450	Circular	57.050	54.714	1.886	56.860	54.617	1.793
12.000	22.932	200.0	225	Circular	57.020	55.650	1.145	56.830	55.535	1.070
12.001	7.480	202.2	225	Circular	56.830	55.535	1.070	56.860	55.498	1.137
11.004	38.107	300.1	525	Circular	56.860	54.429	1.906	56.410	54.302	1.583
13.000	58.799	82.1	225	Circular	56.700	55.209	1.266	56.410	54.493	1.692
11.005	20.714	300.0	450	Circular	56.410	54.302	1.658	55.150	54.233	0.467
1.009	15.787	300.0	450	Circular	55.150	53.815	0.885	56.570	53.762	2.358
14.000	34.884	200.0	225	Circular	55.750	54.825	0.700	55.750	54.651	0.874
14.001	7.097	200.0	225	Circular	55.750	54.325	1.200	56.050	54.290	1.535
14.002	31.617	200.0	225	Circular	56.050	54.290	1.535	56.060	54.132	1.703
14.003	18.928	200.0	225	Circular	56.060	54.132	1.703	56.240	54.037	1.978
14.004	26.922	250.0	300	Circular	56.240	53.962	1.978	56.630	53.854	2.476
14.005	60.186	250.0	300	Circular	56.630	53.854	2.476	56.400	53.613	2.487
14.006	6.202	250.0	300	Circular	56.400	53.613	2.487	56.450	53.588	2.562
15.000	24.021	50.0	225	Circular	56.300	54.875	1.200	56.450	54.395	1.830
14.007	8.500	250.0	375	Circular	56.450	53.839	2.236	56.570	53.805	2.390
1.010	3.349	300.0	450	Circular	56.570	53.770	2.350	56.720	53.759	2.511
16.000	58.645	200.0	225	Circular	56.790	55.365	1.200	57.200	55.072	1.903

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.007	26	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
6.008	27	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
10.000	28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
1.008	29	1200	Manhole	Adoptable	39	1200	Manhole	Adoptable
11.000	30	1200	Manhole	Adoptable	31	1200	Manhole	Adoptable
11.001	31	1200	Manhole	Adoptable	32	1200	Manhole	Adoptable
11.002	32	1200	Manhole	Adoptable	33	1200	Manhole	Adoptable
11.003	33	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable
12.000	34	1200	Manhole	Adoptable	35	1200	Manhole	Adoptable
12.001	35	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable
11.004	36	1200	Manhole	Adoptable	38	1200	Manhole	Adoptable
13.000	37	1200	Manhole	Adoptable	38	1200	Manhole	Adoptable
11.005	38	1200	Manhole	Adoptable	39	1200	Manhole	Adoptable
1.009	39	1200	Manhole	Adoptable	49	1500	Manhole	Adoptable
14.000	40	1200	Manhole	Adoptable	41	1200	Manhole	Adoptable
14.001	41	1200	Manhole	Adoptable	42	1200	Manhole	Adoptable
14.002	42	1200	Manhole	Adoptable	43	1200	Manhole	Adoptable
14.003	43	1200	Manhole	Adoptable	44	1200	Manhole	Adoptable
14.004	44	1200	Manhole	Adoptable	45	1200	Manhole	Adoptable
14.005	45	1200	Manhole	Adoptable	46	1200	Manhole	Adoptable
14.006	46	1200	Manhole	Adoptable	48	1200	Manhole	Adoptable
15.000	47	1200	Manhole	Adoptable	48	1200	Manhole	Adoptable
14.007	48	1200	Manhole	Adoptable	49	1500	Manhole	Adoptable
1.010	49	1500	Manhole	Adoptable	57	1200	Manhole	Adoptable
16.000	50	1200	Manhole	Adoptable	51	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
16.001	30.147	150.0	225	Circular	57.200	55.072	1.903	57.030	54.871	1.934
17.000	49.518	200.0	225	Circular	56.690	55.150	1.315	57.030	54.902	1.903
16.002	59.934	300.0	300	Circular	57.030	54.796	1.934	56.600	54.596	1.704
16.003	24.943	300.0	300	Circular	56.600	54.596	1.704	56.700	54.513	1.887
18.000	45.393	200.0	225	Circular	56.700	55.275	1.200	56.700	55.048	1.427
16.004	10.102	200.0	375	Circular	56.700	54.438	1.887	56.720	54.387	1.958
1.011	13.370	300.0	450	Circular	56.720	53.760	2.510	55.740	53.715	1.575
1.012	38.339	300.0	375	Circular	55.740	54.825	0.540	55.750	54.697	0.678
1.013	9.851	300.0	450	Circular	55.750	54.685	0.615	56.900	54.652	1.798
1.014	16.013	41.1	450	Circular	56.900	54.600	1.850	56.580	54.210	1.920
19.000	27.740	200.0	225	Circular	57.410	55.985	1.200	57.610	55.846	1.539
20.000	22.338	56.0	225	Circular	57.400	56.170	1.005	57.610	55.771	1.614
19.001	29.145	75.0	225	Circular	57.610	55.771	1.614	57.170	55.382	1.563
19.002	11.999	200.0	300	Circular	57.170	55.307	1.563	57.180	55.247	1.633
19.003	39.685	200.0	300	Circular	57.180	55.247	1.633	56.750	55.049	1.401
21.000	58.609	150.0	225	Circular	57.110	55.710	1.175	56.800	55.319	1.256
21.001	33.880	200.5	300	Circular	56.800	55.244	1.256	56.750	55.075	1.375
19.004	25.057	200.0	375	Circular	56.750	54.974	1.401	56.800	54.849	1.576
19.005	19.401	300.0	375	Circular	56.800	54.849	1.576	56.800	54.784	1.641
19.006	10.907	300.0	450	Circular	56.800	54.709	1.641	56.700	54.673	1.577
22.000	18.649	100.0	225	Circular	57.100	55.675	1.200	57.100	55.489	1.386
22.001	49.328	100.0	225	Circular	57.100	55.489	1.386	56.700	54.996	1.479
19.007	12.581	300.0	450	Circular	56.700	54.673	1.577	56.700	54.631	1.619
19.008	16.849	300.0	450	Circular	56.700	54.631	1.619	56.000	54.575	0.975
23.000	42.182	200.0	300	Circular	56.520	55.090	1.130	57.620	54.879	2.441

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
16.001	51	1200	Manhole	Adoptable	53	1200	Manhole	Adoptable
17.000	52	1200	Manhole	Adoptable	53	1200	Manhole	Adoptable
16.002	53	1200	Manhole	Adoptable	54	1200	Manhole	Adoptable
16.003	54	1200	Manhole	Adoptable	56	1200	Manhole	Adoptable
18.000	55	1200	Manhole	Adoptable	56	1200	Manhole	Adoptable
16.004	56	1200	Manhole	Adoptable	57	1200	Manhole	Adoptable
1.011	57	1200	Manhole	Adoptable	58	1200	Manhole	Adoptable
1.012	58	1200	Manhole	Adoptable	59	1200	Manhole	Adoptable
1.013	59	1200	Manhole	Adoptable	60	1350	Manhole	Adoptable
1.014	60	1350	Manhole	Adoptable	84	1800	Manhole	Adoptable
19.000	61	1200	Manhole	Adoptable	63	1200	Manhole	Adoptable
20.000	62	1200	Manhole	Adoptable	63	1200	Manhole	Adoptable
19.001	63	1200	Manhole	Adoptable	64	1200	Manhole	Adoptable
19.002	64	1200	Manhole	Adoptable	65	1200	Manhole	Adoptable
19.003	65	1200	Manhole	Adoptable	68	1200	Manhole	Adoptable
21.000	66	1200	Manhole	Adoptable	67	1200	Manhole	Adoptable
21.001	67	1200	Manhole	Adoptable	68	1200	Manhole	Adoptable
19.004	68	1200	Manhole	Adoptable	69	1200	Manhole	Adoptable
19.005	69	1200	Manhole	Adoptable	70	1200	Manhole	Adoptable
19.006	70	1200	Manhole	Adoptable	73	1200	Manhole	Adoptable
22.000	71	1200	Manhole	Adoptable	72	1200	Manhole	Adoptable
22.001	72	1200	Manhole	Adoptable	73	1200	Manhole	Adoptable
19.007	73	1200	Manhole	Adoptable	74	1350	Manhole	Adoptable
19.008	74	1350	Manhole	Adoptable	80	1350	Manhole	Adoptable
23.000	75	1200	Manhole	Adoptable	77	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
24.000	34.708	200.0	225	Circular	57.020	55.770	1.025	57.620	55.596	1.799
23.001	52.984	300.0	375	Circular	57.620	54.870	2.375	57.000	54.693	1.932
23.002	12.774	300.0	375	Circular	57.000	54.630	1.995	56.000	54.587	1.038
23.003	25.689	298.7	375	Circular	56.000	54.587	1.038	56.000	54.501	1.124
19.009	16.535	300.6	450	Circular	56.000	54.426	1.124	56.860	54.371	2.039
25.000	43.897	50.0	225	Circular	57.000	55.875	0.900	57.000	54.997	1.778
25.001	30.805	200.0	225	Circular	57.000	54.997	1.778	56.860	54.843	1.792
19.010	10.838	300.0	450	Circular	56.860	54.265	2.145	56.580	54.229	1.901
1.015	27.827	300.0	300	Circular	56.580	54.210	2.070	56.240	54.117	1.823
1.016	11.984	300.0	300	Circular	56.240	54.110	1.830	56.020	54.070	1.650
1.017	38.165	300.0	300	Circular	56.020	54.070	1.650	56.900	53.943	2.657
1.018	7.294	300.0	300	Circular	56.900	53.943	2.657	55.630	53.919	1.411
1.019	82.343	300.0	300	Circular	55.630	53.919	1.411	56.600	53.645	2.655
26.000	19.890	200.0	225	Circular	57.380	55.955	1.200	57.900	55.856	1.819
26.001	33.584	200.0	225	Circular	57.900	55.856	1.819	58.240	55.688	2.327
27.000	25.331	40.0	225	Circular	58.850	57.425	1.200	58.240	56.792	1.223
26.002	24.854	140.0	225	Circular	58.240	55.688	2.327	57.840	55.510	2.105
26.003	39.554	100.0	225	Circular	57.840	55.510	2.105	56.000	55.114	0.661
28.000	17.416	200.0	225	Circular	56.000	55.570	0.205	56.000	55.483	0.292
26.004	26.758	300.7	450	Circular	56.000	54.470	1.080	56.000	54.381	1.169
26.005	30.915	300.1	450	Circular	56.000	54.381	1.169	56.000	54.278	1.272
26.006	4.319	300.0	450	Circular	56.000	54.278	1.272	56.000	54.264	1.286
26.007	49.445	300.0	450	Circular	56.000	54.264	1.286	56.000	54.099	1.451
26.008	31.884	300.0	450	Circular	56.000	54.099	1.451	56.590	53.993	2.147
26.009	33.969	300.0	450	Circular	56.590	53.993	2.147	56.820	53.880	2.490

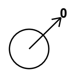
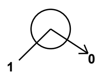
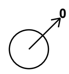
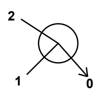
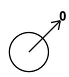
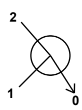
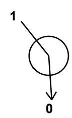
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
24.000	76	1200	Manhole	Adoptable	77	1350	Manhole	Adoptable
23.001	77	1350	Manhole	Adoptable	78	1350	Manhole	Adoptable
23.002	78	1350	Manhole	Adoptable	79	1350	Manhole	Adoptable
23.003	79	1350	Manhole	Adoptable	80	1350	Manhole	Adoptable
19.009	80	1350	Manhole	Adoptable	83	1350	Manhole	Adoptable
25.000	81	1200	Manhole	Adoptable	82	1200	Manhole	Adoptable
25.001	82	1200	Manhole	Adoptable	83	1350	Manhole	Adoptable
19.010	83	1350	Manhole	Adoptable	84	1800	Manhole	Adoptable
1.015	84	1800	Manhole	Adoptable	85	1200	Manhole	Adoptable
1.016	85	1200	Manhole	Adoptable	86	1200	Manhole	Adoptable
1.017	86	1200	Manhole	Adoptable	87	1200	Manhole	Adoptable
1.018	87	1200	Manhole	Adoptable	88	1200	Manhole	Adoptable
1.019	88	1200	Manhole	Adoptable	107	1200	Manhole	Adoptable
26.000	89	1200	Manhole	Adoptable	90	1200	Manhole	Adoptable
26.001	90	1200	Manhole	Adoptable	92	1200	Manhole	Adoptable
27.000	91	1200	Manhole	Adoptable	92	1200	Manhole	Adoptable
26.002	92	1200	Manhole	Adoptable	93	1200	Manhole	Adoptable
26.003	93	1200	Manhole	Adoptable	95	1200	Manhole	Adoptable
28.000	94	1200	Manhole	Adoptable	95	1200	Manhole	Adoptable
26.004	95	1200	Manhole	Adoptable	96	1200	Manhole	Adoptable
26.005	96	1200	Manhole	Adoptable	97	1200	Manhole	Adoptable
26.006	97	1200	Manhole	Adoptable	98	1200	Manhole	Adoptable
26.007	98	1200	Manhole	Adoptable	99	1200	Manhole	Adoptable
26.008	99	1200	Manhole	Adoptable	100	1200	Manhole	Adoptable
26.009	100	1200	Manhole	Adoptable	102	1200	Manhole	Adoptable

Pipeline Schedule

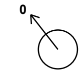
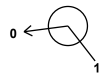
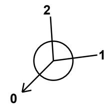
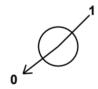
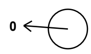
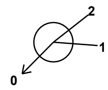
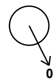
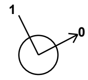
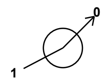
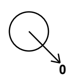
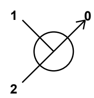
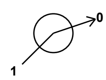
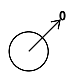
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
29.000	98.766	30.0	225	Circular	59.200	57.775	1.200	56.820	54.483	2.112
26.010	5.644	300.0	525	Circular	56.820	53.805	2.490	56.000	53.786	1.689
30.000	57.308	150.0	225	Circular	56.000	54.875	0.900	56.550	54.493	1.832
30.001	21.225	150.0	225	Circular	56.550	54.493	1.832	56.000	54.352	1.423
26.011	4.776	300.0	525	Circular	56.000	53.786	1.689	56.740	53.770	2.445
26.012	12.416	300.0	525	Circular	56.740	53.770	2.445	56.600	53.729	2.346
1.020	19.717	300.0	300	Circular	56.600	53.645	2.655	56.000	53.579	2.121

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
29.000	101	1200	Manhole	Adoptable	102	1200	Manhole	Adoptable
26.010	102	1200	Manhole	Adoptable	105	1500	Manhole	Adoptable
30.000	103	1200	Manhole	Adoptable	104	1200	Manhole	Adoptable
30.001	104	1200	Manhole	Adoptable	105	1500	Manhole	Adoptable
26.011	105	1500	Manhole	Adoptable	106	1200	Manhole	Adoptable
26.012	106	1200	Manhole	Adoptable	107	1200	Manhole	Adoptable
1.020	107	1200	Manhole	Adoptable	107_OUT	1200	Manhole	Adoptable

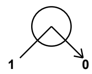
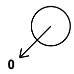
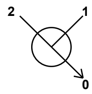
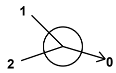
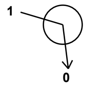
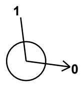
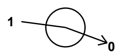
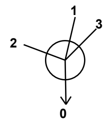
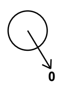
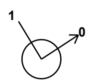
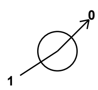
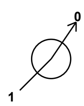
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	707582.615	733130.913	57.320	1.120	1200		0	1.000	56.200	225
2	707631.554	733179.070	57.300	1.558	1200		1	1.000	55.742	225
							0	1.001	55.742	225
3	707646.088	733103.044	57.160	1.230	1200		0	2.000	55.930	225
4	707686.346	733143.264	56.800	1.535	1200		1	2.000	55.551	225
							2	1.001	55.415	225
							0	1.002	55.265	375
5	707678.677	733040.140	56.680	1.240	1200		0	3.000	55.440	225
6	707731.036	733092.449	56.180	1.253	1200		1	3.000	55.070	225
							2	1.002	54.927	375
							0	1.003	54.927	375
7	707766.868	733047.149	56.000	1.575	1350		1	1.003	54.514	375
							0	1.004	54.425	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
8	707795.011	733011.704	55.830	1.125	1200		0	4.000	54.705	225
9	707776.870	733035.010	56.050	1.493	1200		1	4.000	54.557	225
							0	4.001	54.557	225
10	707767.760	733033.825	55.830	1.530	1200		1	4.001	54.511	225
							2	1.004	54.358	450
							0	1.005	54.300	450
11	707753.222	733019.219	56.020	1.864	1200		1	1.005	54.231	450
							0	1.006	54.156	525
12	707748.849	733007.619	56.080	1.790	1200		0	5.000	54.290	225
13	707739.264	733008.337	56.170	2.100	1200		1	5.000	54.226	225
							2	1.006	54.097	525
							0	1.007	54.070	525
14	707552.358	733030.718	57.220	1.450	1200		0	6.000	55.770	225
15	707580.419	732974.310	56.810	1.535	1200		1	6.000	55.350	225
							0	6.001	55.275	300
16	707583.499	732975.911	56.900	1.814	1200		1	6.001	55.236	300
							0	6.002	55.086	450
17	707588.629	733018.388	56.900	1.500	1200		0	7.000	55.400	225
18	707607.207	732999.605	56.750	1.832	1200		1	7.000	55.106	225
							2	6.002	54.918	450
							0	6.003	54.918	375
19	707623.498	733015.910	56.550	1.799	1200		1	6.003	54.826	375
							0	6.004	54.751	450
20	707557.536	733073.568	57.600	1.425	1200		0	8.000	56.175	225

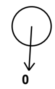
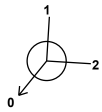
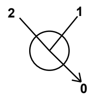
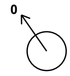
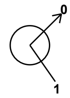
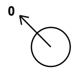
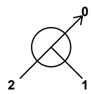
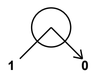
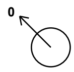
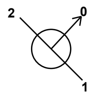
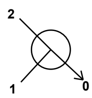
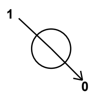
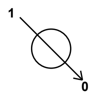
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
21	707582.693	733098.703	57.450	1.986	1200		1	8.000	55.464	225
							0	8.001	55.464	225
22	707639.436	733091.309	57.240	1.425	1200		0	9.000	55.815	300
23	707614.894	733066.788	57.140	2.279	1200		1	9.000	55.642	300
							2	8.001	55.011	225
							0	8.002	54.861	375
24	707655.360	733026.683	56.860	2.670	1200		1	8.002	54.576	375
							2	6.004	54.639	450
							0	6.005	54.190	450
25	707667.633	733023.067	57.000	2.853	1200		1	6.005	54.147	450
							0	6.006	54.155	450
26	707672.207	732986.631	55.150	1.117	1200		1	6.006	54.033	450
							0	6.007	54.033	375
27	707691.305	732984.076	55.150	1.181	1200		1	6.007	53.969	375
							0	6.008	53.969	450
28	707712.245	732992.966	57.000	1.925	1200		0	10.000	55.075	225
29	707708.670	732977.575	55.150	1.243	1200		1	10.000	54.285	225
							2	6.008	53.907	450
							3	1.007	53.925	525
							0	1.008	53.910	375
30	707590.871	732955.923	56.830	0.930	1200		0	11.000	55.900	225
31	707627.313	732896.089	57.450	2.242	1200		1	11.000	55.433	225
							0	11.001	55.208	450
32	707635.462	732901.380	57.600	2.441	1200		1	11.001	55.159	450
							0	11.002	55.159	450
33	707651.237	732917.100	57.050	2.336	1200		1	11.002	54.714	450
							0	11.003	54.714	450

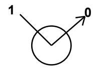
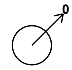
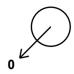
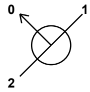
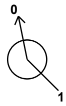
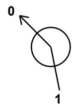
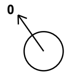
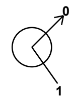
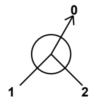
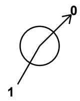
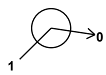
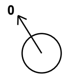
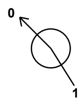
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
34	707638.572	732948.769	57.020	1.370	1200	0	12.000	55.650	225
35	707654.753	732932.519	56.830	1.295	1200	1	12.000	55.535	225
						0	12.001	55.535	225
36	707662.206	732933.154	56.860	2.431	1200	1	12.001	55.498	225
						2	11.003	54.617	450
						0	11.004	54.429	525
37	707647.642	733001.609	56.700	1.491	1200	0	13.000	55.209	225
38	707689.219	732960.032	56.410	2.108	1200	1	13.000	54.493	225
						2	11.004	54.302	525
						0	11.005	54.302	450
39	707709.094	732954.197	55.150	1.335	1200	1	11.005	54.233	450
						2	1.008	53.832	375
						0	1.009	53.815	450
40	707809.077	732993.635	55.750	0.925	1200	0	14.000	54.825	225
41	707830.504	732966.107	55.750	1.425	1200	1	14.000	54.651	225
						0	14.001	54.325	225
42	707830.561	732959.010	56.050	1.760	1200	1	14.001	54.290	225
						0	14.002	54.290	225
43	707808.187	732936.671	56.060	1.928	1200	1	14.002	54.132	225
						0	14.003	54.132	225
44	707793.010	732925.360	56.240	2.278	1200	1	14.003	54.037	225
						0	14.004	53.962	300
45	707773.973	732906.324	56.630	2.776	1200	1	14.004	53.854	300
						0	14.005	53.854	300
46	707731.229	732948.695	56.400	2.787	1200	1	14.005	53.613	300
						0	14.006	53.613	300

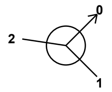
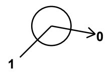
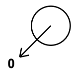
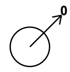
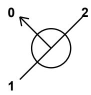
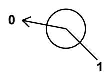
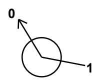
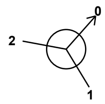
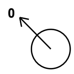
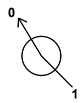
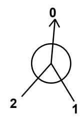
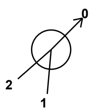
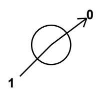
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
47	707726.510	732973.051	56.300	1.425	1200		0	15.000	54.875	225
48	707725.039	732949.075	56.450	2.862	1200		1	15.000	54.395	225
							2	14.006	53.588	300
							0	14.007	53.839	375
49	707719.676	732942.481	56.570	2.808	1500		1	14.007	53.805	375
							2	1.009	53.762	450
							0	1.010	53.770	450
50	707667.288	732838.488	56.790	1.425	1200		0	16.000	55.365	225
51	707633.852	732886.667	57.200	2.128	1200		1	16.000	55.072	225
							0	16.001	55.072	225
52	707690.123	732872.909	56.690	1.540	1200		0	17.000	55.150	225
53	707655.169	732907.984	57.030	2.234	1200		1	17.000	54.902	225
							2	16.001	54.871	225
							0	16.002	54.796	300
54	707697.549	732950.364	56.600	2.004	1200		1	16.002	54.596	300
							0	16.003	54.596	300
55	707747.278	732900.622	56.700	1.425	1200		0	18.000	55.275	225
56	707715.184	732932.724	56.700	2.262	1200		1	18.000	55.048	225
							2	16.003	54.513	300
							0	16.004	54.438	375
57	707722.058	732940.127	56.720	2.961	1200		1	16.004	54.387	375
							2	1.010	53.759	450
							0	1.011	53.760	450
58	707731.855	732931.029	55.740	2.025	1200		1	1.011	53.715	450
							0	1.012	54.825	375
59	707758.967	732903.921	55.750	1.065	1200		1	1.012	54.697	375
							0	1.013	54.685	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
60	707765.933	732896.955	56.900	2.300	1350		1	1.013	54.652	450
							0	1.014	54.600	450
61	707734.942	732764.697	57.410	1.425	1200		0	19.000	55.985	225
62	707770.349	732800.111	57.400	1.230	1200		0	20.000	56.170	225
63	707754.555	732784.314	57.610	1.839	1200		1	20.000	55.771	225
							2	19.000	55.846	225
							0	19.001	55.771	225
64	707733.946	732804.922	57.170	1.863	1200		1	19.001	55.382	225
							0	19.002	55.307	300
65	707731.572	732816.684	57.180	1.933	1200		1	19.002	55.247	300
							0	19.003	55.247	300
66	707713.370	732772.930	57.110	1.400	1200		0	21.000	55.710	225
67	707679.556	732820.801	56.800	1.556	1200		1	21.000	55.319	225
							0	21.001	55.244	300
68	707703.518	732844.753	56.750	1.776	1200		1	21.001	55.075	300
							2	19.003	55.049	300
							0	19.004	54.974	375
69	707715.962	732866.502	56.800	1.951	1200		1	19.004	54.849	375
							0	19.005	54.849	375
70	707729.757	732880.144	56.800	2.091	1200		1	19.005	54.784	375
							0	19.006	54.709	450
71	707785.360	732827.871	57.100	1.425	1200		0	22.000	55.675	225
72	707775.426	732843.654	57.100	1.611	1200		1	22.000	55.489	225
							0	22.001	55.489	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
73	707740.545	732878.534	56.700	2.027	1200		1	22.001	54.996	225
							2	19.006	54.673	450
							0	19.007	54.673	450
74	707749.441	732887.430	56.700	2.069	1350		1	19.007	54.631	450
							0	19.008	54.631	450
75	707859.264	732852.421	56.520	1.430	1200		0	23.000	55.090	300
76	707804.877	732798.070	57.020	1.250	1200		0	24.000	55.770	225
77	707829.427	732822.604	57.620	2.750	1350		1	24.000	55.596	225
							2	23.000	54.879	300
							0	23.001	54.870	375
78	707791.921	732860.029	57.000	2.370	1350		1	23.001	54.693	375
							0	23.002	54.630	375
79	707779.375	732862.434	56.000	1.413	1350		1	23.002	54.587	375
							0	23.003	54.587	375
80	707766.010	732884.373	56.000	1.574	1350		1	23.003	54.501	375
							2	19.008	54.575	450
							0	19.009	54.426	450
81	707824.072	732839.343	57.000	1.125	1200		0	25.000	55.875	225
82	707793.051	732870.402	57.000	2.003	1200		1	25.000	54.997	225
							0	25.001	54.997	225
83	707777.022	732896.708	56.860	2.595	1350		1	25.001	54.843	225
							2	19.009	54.371	450
							0	19.010	54.265	450
84	707777.981	732907.503	56.580	2.370	1800		1	19.010	54.229	450
							2	1.014	54.210	450
							0	1.015	54.210	300
85	707797.658	732927.180	56.240	2.130	1200		1	1.015	54.117	300
							0	1.016	54.110	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
86	707807.268	732934.340	56.020	1.950	1200	1	1.016	54.070	300
						0	1.017	54.070	300
87	707834.498	732961.081	56.900	2.957	1200	1	1.017	53.943	300
						0	1.018	53.943	300
88	707841.014	732964.358	55.630	1.711	1200	1	1.018	53.919	300
						0	1.019	53.919	300
89	707813.378	732773.344	57.380	1.425	1200	0	26.000	55.955	225
90	707816.530	732753.705	57.900	2.044	1200	1	26.000	55.856	225
						0	26.001	55.856	225
91	707874.700	732763.043	58.850	1.425	1200	0	27.000	57.425	225
92	707849.689	732759.028	58.240	2.552	1200	1	27.000	56.792	225
						2	26.001	55.688	225
						0	26.002	55.688	225
93	707845.749	732783.568	57.840	2.330	1200	1	26.002	55.510	225
						0	26.003	55.510	225
94	707885.570	732824.307	56.000	0.430	1200	0	28.000	55.570	225
95	707873.258	732811.989	56.000	1.530	1200	1	28.000	55.483	225
						2	26.003	55.114	225
						0	26.004	54.470	450
96	707892.179	732793.068	56.000	1.619	1200	1	26.004	54.381	450
						0	26.005	54.381	450
97	707922.702	732797.973	56.000	1.722	1200	1	26.005	54.278	450
						0	26.006	54.278	450
98	707925.756	732801.027	56.000	1.736	1200	1	26.006	54.264	450
						0	26.007	54.264	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
99	707890.793	732835.990	56.000	1.901	1200	1	26.007	54.099	450
						0	26.008	54.099	450
100	707868.297	732858.585	56.590	2.597	1200	1	26.008	53.993	450
						0	26.009	53.993	450
101	707962.141	732812.736	59.200	1.425	1200				
						0	29.000	57.775	225
102	707892.325	732882.596	56.820	3.015	1200	1	29.000	54.483	225
						2	26.009	53.880	450
						0	26.010	53.805	525
103	707845.472	732946.315	56.000	1.125	1200				
						0	30.000	54.875	225
104	707881.315	732901.600	56.550	2.057	1200	1	30.000	54.493	225
						0	30.001	54.493	225
105	707896.317	732886.586	56.000	2.214	1500	1	30.001	54.352	225
						2	26.010	53.786	525
						0	26.011	53.786	525
106	707899.695	732889.962	56.740	2.970	1200	1	26.011	53.770	525
						0	26.012	53.770	525
107	707892.284	732899.924	56.600	2.955	1200	1	26.012	53.729	525
						2	1.019	53.645	300
						0	1.020	53.645	300
107_OUT	707907.707	732912.208	56.000	2.421	1200	1	1.020	53.579	300

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m^3/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	20	0	0

Node 49 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	53.770	Product Number	CTL-SHE-0135-1180-2500-1180
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	11.8	Min Node Diameter (mm)	1500

Node 84 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	54.210	Product Number	CTL-SHE-0181-1940-2000-1940
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	19.4	Min Node Diameter (mm)	1800

Node 106 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	53.770	Product Number	CTL-SHE-0075-3400-2000-3400
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.4	Min Node Diameter (mm)	1200

Node 26 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.033
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1198.0	0.0	1.200	1198.0	0.0	1.201	0.0	0.0

Node 27 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	53.969
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	105.0	0.0	1.200	105.0	0.0	1.201	0.0	0.0

Node 49 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	53.762
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	295.0	0.0	1.200	295.0	0.0	1.201	0.0	0.0

Node 59 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.685
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	429.0	0.0	0.550	429.0	0.0	0.551	0.0	0.0

Node 78 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.630
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	120

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	250.0	0.0	1.600	250.0	0.0	1.601	0.0	0.0

Node 80 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.426
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	665.0	0.0	0.250	665.0	0.0	0.251	0.0	0.0

Node 99 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.099
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	680.0	0.0	1.650	680.0	0.0	1.651	0.0	0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 98.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	57.320	1.120	40.6	3.0666	1.3030	FLOOD
15 minute winter	2	11	57.221	1.479	70.5	3.4579	0.0000	FLOOD RISK
15 minute winter	3	11	56.982	1.052	53.1	3.2081	0.0000	FLOOD RISK
15 minute winter	4	11	56.580	1.315	143.3	3.9384	0.0000	FLOOD RISK
15 minute winter	5	10	56.680	1.240	83.8	5.1224	5.1497	FLOOD
15 minute winter	6	10	56.180	1.253	253.7	5.1373	9.4476	FLOOD
15 minute winter	7	11	55.618	1.193	223.0	2.6169	0.0000	SURCHARGED
15 minute winter	8	11	55.686	0.981	26.2	2.1208	0.0000	FLOOD RISK
15 minute winter	9	11	55.621	1.064	44.3	2.0306	0.0000	SURCHARGED
15 minute winter	10	11	55.521	1.221	277.5	2.3383	0.0000	SURCHARGED
15 minute winter	11	11	55.298	1.142	299.0	2.0272	0.0000	SURCHARGED
60 minute winter	12	39	55.250	0.960	13.4	1.6969	0.0000	SURCHARGED
60 minute winter	13	39	55.246	1.176	247.9	2.4275	0.0000	SURCHARGED
30 minute winter	14	13	57.220	1.450	291.3	18.1192	116.3607	FLOOD
15 minute summer	15	9	56.763	1.488	80.9	3.2732	0.0000	FLOOD RISK
15 minute winter	16	8	56.722	1.636	88.5	1.8499	0.0000	FLOOD RISK
15 minute winter	17	8	56.757	1.357	26.6	1.8973	0.0000	FLOOD RISK
15 minute winter	18	8	56.722	1.804	126.6	3.7151	0.0000	FLOOD RISK
15 minute winter	19	8	56.550	1.799	546.3	18.9938	110.0247	FLOOD
15 minute winter	20	10	57.476	1.301	41.4	1.8733	0.0000	FLOOD RISK
15 minute summer	21	10	57.450	1.986	62.7	3.8469	0.2864	FLOOD
15 minute winter	22	10	57.209	1.394	53.1	3.8847	0.0000	FLOOD RISK
15 minute winter	23	10	57.117	2.256	188.2	6.7464	0.0000	FLOOD RISK
15 minute summer	24	9	56.615	2.425	411.3	6.6481	0.0000	FLOOD RISK
15 minute winter	25	8	56.526	2.379	448.4	2.6908	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	30.1	0.854	0.710	2.7307	
15 minute winter	2	1.001	4	50.0	1.257	1.365	2.6032	
15 minute winter	3	2.000	4	41.8	1.159	0.987	2.2633	
15 minute winter	4	1.002	6	141.6	1.284	1.003	7.4639	
15 minute winter	5	3.000	6	42.8	1.076	1.169	2.9435	
15 minute winter	6	1.003	7	196.0	1.777	1.160	6.3709	
15 minute winter	7	1.004	10	217.3	1.372	0.953	2.1159	
15 minute winter	8	4.000	9	22.0	0.603	0.600	1.1746	
15 minute winter	9	4.001	10	43.9	1.104	1.200	0.3654	
15 minute winter	10	1.005	11	272.5	1.720	1.466	3.2652	
15 minute winter	11	1.006	13	294.9	1.365	1.058	3.8236	
60 minute winter	12	5.000	13	11.9	0.680	0.282	0.3823	
60 minute winter	13	1.007	29	246.3	1.140	0.884	9.3726	
30 minute winter	14	6.000	15	80.2	2.017	1.895	2.5057	
15 minute summer	15	6.001	16	92.3	1.598	0.783	0.2444	
15 minute winter	16	6.002	18	104.5	0.999	0.458	5.3107	
15 minute winter	17	7.000	18	-21.0	0.662	-0.383	1.0507	
15 minute winter	18	6.003	19	139.1	1.301	1.105	2.5422	
15 minute winter	19	6.004	24	278.1	1.756	1.497	5.3291	
15 minute winter	20	8.000	21	-32.9	-0.879	-0.446	1.4143	
15 minute summer	21	8.001	23	46.1	1.159	0.886	1.8031	
15 minute winter	22	9.000	23	53.1	0.876	0.678	2.4431	
15 minute winter	23	8.002	24	187.9	1.703	1.332	6.2840	
15 minute summer	24	6.005	25	425.4	2.685	2.290	2.0273	
15 minute winter	25	6.006	26	461.3	4.057	2.482	5.1273	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 98.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	26	4080	55.150	1.117	15.0	1339.4290	2097.4730	FLOOD
4320 minute winter	27	1860	55.150	1.181	15.4	125.3407	13.1771	FLOOD
120 minute summer	28	132	55.151	0.076	11.4	0.1305	0.0000	OK
5760 minute winter	29	2460	55.150	1.243	12.7	2.5457	899.9350	FLOOD
15 minute winter	30	11	56.830	0.930	37.4	2.7119	0.9265	FLOOD
15 minute winter	31	11	56.760	1.552	389.6	13.2747	0.0000	SURCHARGED
15 minute winter	32	11	56.532	1.373	342.2	1.5529	0.0000	SURCHARGED
15 minute winter	33	11	56.160	1.446	358.2	2.1298	0.0000	SURCHARGED
15 minute winter	34	12	55.814	0.164	12.6	0.2530	0.0000	OK
15 minute winter	35	12	55.792	0.257	25.2	0.4016	0.0000	SURCHARGED
15 minute winter	36	11	55.785	1.356	407.5	2.5379	0.0000	SURCHARGED
15 minute winter	37	12	55.530	0.321	24.4	0.5957	0.0000	SURCHARGED
15 minute winter	38	12	55.451	1.149	442.5	1.9649	0.0000	SURCHARGED
1440 minute winter	39	690	55.150	1.335	34.9	1.5099	727.5891	FLOOD
15 minute winter	40	12	55.579	0.754	26.2	1.7973	0.0000	FLOOD RISK
15 minute winter	41	12	55.532	1.207	43.8	2.3472	0.0000	FLOOD RISK
15 minute winter	42	12	55.479	1.189	45.4	1.7377	0.0000	SURCHARGED
60 minute winter	43	38	55.437	1.305	32.2	1.8681	0.0000	SURCHARGED
60 minute winter	44	38	55.342	1.380	40.8	2.1178	0.0000	SURCHARGED
60 minute winter	45	39	55.299	1.445	51.8	2.2165	0.0000	SURCHARGED
60 minute summer	46	39	55.283	1.670	75.4	2.5838	0.0000	SURCHARGED
60 minute winter	47	38	55.296	0.421	13.6	0.8189	0.0000	SURCHARGED
60 minute summer	48	39	55.242	1.654	90.1	1.8703	0.0000	SURCHARGED
60 minute winter	49	38	55.206	1.444	323.8	356.6983	0.0000	SURCHARGED
15 minute winter	50	12	56.757	1.392	35.2	3.0985	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
10080 minute winter	26	6.007	27	5.1	0.394	0.044	2.1252	
4320 minute winter	27	6.008	29	-15.4	0.223	-0.083	2.9379	
120 minute summer	28	10.000	29	11.4	1.352	0.097	0.4068	
5760 minute winter	29	1.008	39	8.1	0.420	0.071	2.5790	
15 minute winter	30	11.000	31	38.3	1.060	0.906	2.7863	
15 minute winter	31	11.001	32	342.2	2.160	1.501	1.5394	
15 minute winter	32	11.002	33	342.8	2.164	0.748	3.5285	
15 minute winter	33	11.003	36	358.9	2.265	1.574	3.0808	
15 minute winter	34	12.000	35	12.6	0.584	0.344	0.8121	
15 minute winter	35	12.001	36	24.8	0.973	0.681	0.2975	
15 minute winter	36	11.004	38	405.7	1.878	1.456	8.2324	
15 minute winter	37	13.000	38	23.2	0.817	0.404	2.3385	
15 minute winter	38	11.005	39	436.1	2.752	2.347	3.2820	
1440 minute winter	39	1.009	49	13.3	0.917	0.071	2.5013	
15 minute winter	40	14.000	41	18.3	0.895	0.501	1.3874	
15 minute winter	41	14.001	42	34.7	0.873	0.948	0.2823	
15 minute winter	42	14.002	43	43.5	1.094	1.189	1.2574	
60 minute winter	43	14.003	44	30.9	0.876	0.844	0.7528	
60 minute winter	44	14.004	45	39.4	0.639	0.563	1.8958	
60 minute winter	45	14.005	46	50.1	0.712	0.717	4.2383	
60 minute summer	46	14.006	48	73.2	1.040	1.046	0.4367	
60 minute winter	47	15.000	48	30.3	1.331	0.411	0.9553	
60 minute summer	48	14.007	49	86.9	0.788	0.690	0.9375	
60 minute winter	49	Hydro-Brake®	57	4.2				
15 minute winter	50	16.000	51	25.9	0.760	0.709	2.3324	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 98.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	12	56.599	1.527	55.9	2.8471	0.0000	SURCHARGED
15 minute winter	52	12	56.338	1.188	24.8	2.1913	0.0000	SURCHARGED
15 minute winter	53	12	56.264	1.468	83.5	2.2919	0.0000	SURCHARGED
15 minute winter	54	11	55.891	1.295	113.1	2.5623	0.0000	SURCHARGED
15 minute winter	55	11	55.761	0.486	38.3	1.1293	0.0000	SURCHARGED
360 minute winter	56	344	55.739	1.301	33.9	2.4498	0.0000	SURCHARGED
360 minute winter	57	344	55.739	1.980	37.3	2.2393	0.0000	SURCHARGED
360 minute winter	58	344	55.739	2.024	37.1	2.2890	0.0000	FLOOD RISK
360 minute winter	59	344	55.739	1.054	63.4	237.3561	0.0000	FLOOD RISK
360 minute winter	60	344	55.739	1.139	29.8	1.6293	0.0000	SURCHARGED
15 minute winter	61	12	57.281	1.296	26.2	2.5198	0.0000	FLOOD RISK
15 minute winter	62	12	57.322	1.152	41.9	3.0442	0.0000	FLOOD RISK
15 minute winter	63	12	57.239	1.468	87.0	3.1443	0.0000	SURCHARGED
15 minute winter	64	12	56.528	1.221	87.1	1.9457	0.0000	SURCHARGED
15 minute winter	65	11	56.409	1.162	100.7	1.8311	0.0000	SURCHARGED
15 minute winter	66	11	56.325	0.615	35.2	1.3813	0.0000	SURCHARGED
15 minute winter	67	11	56.138	0.894	65.3	1.9077	0.0000	SURCHARGED
15 minute winter	68	11	56.032	1.058	184.1	2.1624	0.0000	SURCHARGED
15 minute winter	69	11	55.746	0.897	198.9	1.4103	0.0000	SURCHARGED
360 minute winter	70	344	55.739	1.030	46.8	2.0033	0.0000	SURCHARGED
15 minute winter	71	10	55.772	0.097	19.4	0.1684	0.0000	OK
360 minute winter	72	344	55.740	0.251	5.8	0.4171	0.0000	SURCHARGED
360 minute winter	73	344	55.739	1.066	54.5	1.6583	0.0000	SURCHARGED
360 minute winter	74	344	55.739	1.108	53.7	1.5859	0.0000	SURCHARGED
360 minute winter	75	344	55.739	0.649	8.1	1.8150	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	16.001	53	50.1	1.260	1.184	1.1990	
15 minute winter	52	17.000	53	18.6	0.767	0.509	1.9694	
15 minute winter	53	16.002	54	85.0	1.207	1.332	4.2205	
15 minute winter	54	16.003	56	112.4	1.596	1.762	1.7565	
15 minute winter	55	18.000	56	33.8	0.985	0.922	1.8053	
360 minute winter	56	16.004	57	33.8	0.569	0.240	1.1142	
360 minute winter	57	1.011	58	37.1	0.234	0.200	2.1184	
360 minute winter	58	1.012	59	36.1	0.884	0.314	4.2287	
360 minute winter	59	1.013	60	-29.0	0.732	-0.156	1.5608	
360 minute winter	60	1.014	84	-29.8	0.196	-0.059	2.5372	
15 minute winter	61	19.000	63	19.4	0.787	0.531	1.1032	
15 minute winter	62	20.000	63	34.1	1.005	0.490	0.8884	
15 minute winter	63	19.001	64	75.0	1.886	1.248	1.1591	
15 minute winter	64	19.002	65	89.5	1.272	1.143	0.8450	
15 minute winter	65	19.003	68	103.9	1.475	1.327	2.7946	
15 minute winter	66	21.000	67	30.1	1.067	0.711	2.3309	
15 minute winter	67	21.001	68	55.3	0.909	0.707	2.3858	
15 minute winter	68	19.004	69	185.1	1.678	1.312	2.7637	
15 minute winter	69	19.005	70	199.9	1.813	1.739	2.1399	
360 minute winter	70	19.006	73	45.8	0.721	0.247	1.7281	
15 minute winter	71	22.000	72	19.4	0.901	0.374	0.4016	
360 minute winter	72	22.001	73	5.9	0.867	0.113	1.9618	
360 minute winter	73	19.007	74	53.7	0.859	0.289	1.9934	
360 minute winter	74	19.008	80	52.7	0.935	0.284	2.6696	
360 minute winter	75	23.000	77	8.1	0.579	0.103	2.9704	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 98.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	76	10	55.894	0.124	20.7	0.2319	0.0000	OK
360 minute winter	77	344	55.739	0.869	17.0	1.7821	0.0000	SURCHARGED
360 minute winter	78	344	55.739	1.109	56.2	278.9014	0.0000	SURCHARGED
360 minute winter	79	344	55.739	1.152	46.2	2.1385	0.0000	FLOOD RISK
360 minute winter	80	344	55.739	1.313	63.0	168.9632	0.0000	FLOOD RISK
15 minute winter	81	10	55.980	0.105	32.9	0.2541	0.0000	OK
360 minute winter	82	344	55.739	0.742	10.3	1.4175	0.0000	SURCHARGED
360 minute winter	83	344	55.739	1.474	50.1	2.9963	0.0000	SURCHARGED
360 minute winter	84	344	55.739	1.529	49.4	3.8901	0.0000	SURCHARGED
360 minute winter	85	160	54.232	0.122	19.4	0.1377	0.0000	OK
360 minute winter	86	160	54.185	0.115	19.4	0.1298	0.0000	OK
15 minute summer	87	37	54.066	0.123	19.4	0.1396	0.0000	OK
15 minute summer	88	37	54.031	0.112	19.4	0.1266	0.0000	OK
15 minute winter	89	11	56.900	0.945	34.1	1.3999	0.0000	SURCHARGED
15 minute winter	90	11	56.875	1.019	20.7	1.4027	0.0000	SURCHARGED
15 minute winter	91	10	57.487	0.062	13.1	0.0955	0.0000	OK
15 minute winter	92	11	56.844	1.156	43.7	1.7151	0.0000	SURCHARGED
15 minute winter	93	11	56.647	1.137	91.7	2.5348	0.0000	SURCHARGED
15 minute summer	94	1	55.570	0.000	0.0	0.0000	0.0000	OK
15 minute winter	95	9	55.522	1.052	141.1	3.0180	0.0000	SURCHARGED
2880 minute winter	96	2760	55.518	1.137	6.5	2.0306	0.0000	SURCHARGED
2880 minute winter	97	2760	55.518	1.240	8.7	3.6491	0.0000	SURCHARGED
2880 minute winter	98	2760	55.518	1.254	10.4	3.1223	0.0000	SURCHARGED
2880 minute winter	99	2760	55.518	1.419	18.1	966.4634	0.0000	SURCHARGED
2880 minute winter	100	2760	55.518	1.525	7.9	3.3456	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	76	24.000	77	20.5	0.938	0.560	0.7588	
360 minute winter	77	23.001	78	16.5	0.731	0.143	5.8440	
360 minute winter	78	23.002	79	-47.4	-0.751	-0.412	1.4089	
360 minute winter	79	23.003	80	-44.8	0.588	-0.389	2.8334	
360 minute winter	80	19.009	83	34.6	0.633	0.186	2.6199	
15 minute winter	81	25.000	82	32.9	0.985	0.446	1.2693	
360 minute winter	82	25.001	83	10.3	0.779	0.280	1.2251	
360 minute winter	83	19.010	84	49.4	0.410	0.266	1.7172	
360 minute winter	84	Hydro-Brake®	85	19.4				
360 minute winter	85	1.016	86	19.4	0.751	0.304	0.3091	
360 minute winter	86	1.017	87	19.4	0.744	0.303	0.9934	
15 minute summer	87	1.018	88	19.4	1.008	0.304	0.1869	
15 minute summer	88	1.019	107	19.4	0.754	0.304	2.1255	
15 minute winter	89	26.000	90	-22.8	0.606	-0.622	0.7910	
15 minute winter	90	26.001	92	24.4	0.614	0.666	1.3357	
15 minute winter	91	27.000	92	13.1	1.502	0.159	0.2210	
15 minute winter	92	26.002	93	45.5	1.144	1.038	0.9885	
15 minute winter	93	26.003	95	89.9	2.261	1.730	1.5731	
15 minute summer	94	28.000	95	0.0	0.000	0.000	0.0273	
15 minute winter	95	26.004	96	149.7	0.945	0.806	4.2396	
2880 minute winter	96	26.005	97	6.4	0.378	0.035	4.8983	
2880 minute winter	97	26.006	98	8.6	0.439	0.047	0.6843	
2880 minute winter	98	26.007	99	10.4	0.582	0.056	7.8342	
2880 minute winter	99	26.008	100	-7.8	0.268	-0.042	5.0518	
2880 minute winter	100	26.009	102	-5.8	0.320	-0.031	5.3822	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 98.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	101	10	57.956	0.181	84.7	0.6810	0.0000	OK
15 minute summer	102	10	55.566	1.761	241.7	4.7595	0.0000	SURCHARGED
15 minute summer	103	10	56.000	1.125	37.4	2.9329	1.1315	FLOOD
15 minute summer	104	10	55.892	1.399	60.1	2.7110	0.0000	SURCHARGED
15 minute summer	105	10	55.568	1.782	76.1	3.1482	0.0000	SURCHARGED
15 minute summer	106	10	55.567	1.797	15.5	2.0326	0.0000	SURCHARGED
2880 minute winter	107	2700	53.773	0.128	22.6	0.1447	0.0000	OK
2880 minute winter	107_OUT	2700	53.693	0.114	22.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	101	29.000	102	84.0	2.151	0.882	3.6516	
15 minute summer	102	26.010	105	-89.1	0.598	-0.320	1.2193	
15 minute summer	103	30.000	104	36.4	0.916	0.860	2.2792	
15 minute summer	104	30.001	105	70.1	1.762	1.654	0.8441	
15 minute summer	105	26.011	106	15.5	0.680	0.056	1.0318	
15 minute summer	106	Hydro-Brake®	107	3.2				
2880 minute winter	107	1.020	107_OUT	22.6	0.847	0.354	0.5254	3107.1

UK and Ireland Office Locations