North City Operations Depot
St. Margaret's Road, Ballymun, Dublin 11

PLANNING APPLICATION DOCUMENT

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Appendix B

Engineering Services Report

Prepared by

Tobin Consulting Engineers

REF	DATE	STATUS
NCOD-TOB-ZZ-XX-RP-CE-0001	06.11.17	S3

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REPORT

PROJECT:

North City Operations Depot
St. Margaret's Road, Ballymun, Dublin 11

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CLIENT:

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Appendix 8	Typical Rainwater Harvesting Details

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1 INTRODUCTION

This report has been prepared to detail the engineering solutions to roads, drainage and water supply as part of a planning submission for the development of a consolidated operations depot for Dublin City Council (DCC) north city operations including Waste Management, Housing Maintenance, Electrical Services and Public Lighting, Traffic, Surface Water Maintenance and Road Maintenance. The Operations Depot will be located on Saint Margaret's Road, Ballymun, Dublin 11.

The development is to provide a centralised Operations Depot for Dublin City Council to cover the north of Dublin City and will accommodate the following Operations Departments:

- Housing Maintenance;
- Roads Maintenance (to include winter salting);
- Traffic management;
- Waste management (street cleaning);
- Rivers and Surface Water Management;
- Public Lighting Management and Maintenance; and
- Domestic Waste Transfer (Civic Amenity Site).

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To provide for all of the above Departments Operations the following facilities are to be provided:

- Civic Amenity Site and associated office/welfare facility (for receiving segregated domestic waste for onward transfer and disposal);
- Central Stores building (for receipt and dispatch of materials necessary for the various operational departments (building materials, Personal Protection Equipment, janitorial supplies, spares etc);
- Workshops (blacksmith/metal working, carpentry, small equipment repairs, painting, signage);
- Vehicle Workshop (3 bay facility for routine repairs/replacement of minor equipment)
- Street Waste compaction;
- Vehicle garage (for vehicles containing water);
- Multi-Storey car park (for small fleet vehicles and private vehicles associated with Depot);
- Main Administration Office and Welfare/Training.

This report should be read in conjunction with the watermain, roads, foul and storm design drawings (refer to **Appendix 1** for list of drawings to accompany this planning package) as

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outlined and noted herein. In preparation for this planning application the following re-planning meetings took place on the following dates:

- 15/05/2017 Tom O'Connor, Fergus Finch, Patricia Cadogan and Peter Byrne
- 20/07/2017 Rita McGrath, Patricia Cadogan
- 11/09/2017 Fergus Finch, Sean McGrath, Diarmuid and Patricia Cadogan
- 28/09/2017 Fergus Finch

It is proposed to have access / egress to the Civic Amenity Centre via R104 along the south-western boundary of the site. Staff access / egress is proposed on St. Margaret's Road to the east of the site and Fleet access / egress is proposed to the north of the site as detailed in Section 6 of this report and shown on Tobin drawings NCOD-TOB-ZZ-XX-DR-CE-2010 to 2042.

This report details the foul and storm drainage design and the water mains for said development. The site to which this planning application relates to encompasses approximately 5.03Ha of land, is a green field site and has a boundary on all sides.

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It is proposed to discharge the foul effluent generated by the proposed development to the existing 750mm public foul sewer which runs east along St. Margaret's Road towards R108. Details of the foul drainage are outlined in detail in Section 4 below and in Tobin drawings NCOD-TOB-ZZ-XX-DR-CE-2010 to 2015.

It is proposed to discharge the storm water generated by the proposed development to the existing 900mm public storm sewer which runs east along St. Margaret's Road towards R108. The controlled discharge flow rate for the entire site will be set at the allowable Greenfield run off rate of 53.55l/s (Qall) or 14.2 l/s/Ha as detailed in Section 3 below and Tobin drawings NCOD-TOB-07-XX-DR-CE-2010 to 2015.

It is proposed that the watermain for the development will connect to the existing 300mm MOPVC public watermain located to the north of the site along St. Margaret's Road.

2 WATER SUPPLY

2.1 POTABLE WATER SUPPLY

It is proposed to connect a new 250mm diameter PE watermain to the existing 300mm diameter watermain on the north boundary of the site along St. Margaret's Road as shown on Tobin

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drawings NCOD-TOB-ZZ-XX-DR-CE-2020 to 2022. This new watermain is to include boundary boxes with integral stopcocks at the connections. Provision is also to be made for the installation of bulk flow meter chambers.

There will be two categories of water user's on-site, full time staff and fleet staff/visitors. Full time staff water usage is estimated at 60l/day/person according to Table 3 of the EPA Design Manual – Treatment Systems for Small Communities Business, Leisure Centres and Hotels. Fleet staff will only be using water periodically. As such an allowance of 20 l/per//day has been allowed for fleet staff and visitors to site. A pre-connection enquiry was issued to Irish Water on 31/07/17. Irish Water concluded that "*based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network can be facilitated".* A copy of this letter is included **Appendix 3**.

To ensure all parts of the building footprints within the site are within 46m of a fire hydrant, hydrants will be located around the development in addition to existing hydrants located along St. Margaret's Road. All hydrants are within a minimum distance of 30m to a vehicle access roadway or hard-standing area for fire appliances according to Part B of the Building Regulations. Hydrant locations are shown on drawing NCOD-TOB-ZZ-XX-DR-CE-2020 to 2022. Two water storage tanks for fire fighting purposes have also been provided to supply a flow rate of 1500 l/min as per PS 9990. These are shown on drawings NCOD-TOB-ZZ-XX-DR-CE-2020 to 2022 which are included in this planning package.

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3 SURFACE WATER

3.1 GENERAL

Irish Water records indicate a 900mm diameter surface water (SW) pipe east of the site on St. Margaret's Road. A new on site surface water drainage system has been designed in accordance with the Greater Dublin Strategic Drainage Strategy (GDSDS) and the Greater Dublin Regional Code of Practice for Drainage Works. It will ensure surface water discharge from the site is limited to the allowable greenfield runoff rate (Qall) of 53.55l/s or 14.2 l/s/Ha, in accordance with GDSDS, through a combination of attenuation storage tanks, permeable paving and a green roof. All surface water to the attenuation system will discharge to the existing surface water drain via a fuel/oil separators and vortex type flow control chambers.

The storm drainage for the entire development has been designed using the Micro Drainage's Windes Drainage design Software and in accordance with the Recommendations for Site

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Development Works for Housing Areas and also the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS). The details of the Micro Drainage outputs for the pipe designs and associated long sections are outlined at **Appendix 6** of this report. The storm water drainage has been designed to cater for surface water from public hard surfaces in the proposed development including roadways, footpaths, and the proposed building.

The drainage network has been designed so that the network pipelines and manholes will not be surcharged as a result of the critical 2-year critical rainfall and will not overflow as a result of the critical rainfall with a 30-year and 100-year storm return period intensity. The most up-to-date rainfall intensities for the site area have been derived from Met Eireann. 20% climate change has been implemented in the attenuation capacity design.

Refer to drawings NCOD-TOB-ZZ-DR-CE-20110 to 2015 for drainage drawings and **Appendix 4** for attenuation calculations.

3.2 SUDS (SUSTAINABLE URBAN DRAINAGE SYSTEMS)

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The general principal behind SUDs is to reduce the quantity and increase the quality of water leaving the site. In practice a calculation for the site runoff is carried out using the Institute of Hydrology report No. 124. This gives the limit for discharge from the site.

In accordance with the GDSDS (Greater Dublin Strategic Drainage Study), underground storage is provided for the 1 in 30 year storm with on site attenuation provided for the 1 in 100 yr storm, to ensure that there is no flooding of the buildings. A flood risk assessment is carried out to ensure that there is no risk of damage to property or people and to mitigate against flood risks, flood routing is designed into the site layout. A flood risk assessment was carried out and is included in the planning documentation.

Typical types of SUDs which may be used are Infiltration systems (Infiltration trenches, Soakaways and Permeable paving), Attenuation systems (Attenuation tanks and Proprietary systems), Attenuation Ponds, Detention Basins, Rainwater harvesting and Green Roofs.

Types of SUDs devices, which may be applicable to this development;

Given the development is to be constrcuted on a greenfield site, the following SUDs approach have been reviewed and found to be suitable for the site, subject to detail design.

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The SUDS strategy adopted was to divide the site into three seperate SUDS Zones, each with its own geocellular tank, fuel/oil seperator and vortex type flow control chamber. Each of these zones will then disharge the clean storm water to a trunk main at the controled rates. This trunk main will then discharge to the public storm sewer. The SUDS Zone hardstanding areas draining to the network are as follows;

Zone 01 – 0.42Ha
Zone 02 – 1.44Ha
Zone 03 – 1.92Ha

Attenuation

The geocellular attenuation systems units have been designed for storm periods with rainfall intensities taken for up to the 100 years return period. The proposed stormwater drainage systems in each of the SUDS Zones will be restricted by vortex type flow control chambers to the following allowable Greenfield Runoff (Qall) rates;

Zone 01: 5.97 l/s
Zone 02: 20.40 l/s
Zone 03: 27.18 l/s

This gives a combined Qall of 14.14 l/s/ha or 53.55 l/s to the existing public surface water network to the east of the site.

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Bypass Separator

It is proposed to install bypass fuel/oil separators as shown on drawings NCOD-TOB-ZZ-XX-DR-CE-2010 to 2015. The stormwater from the external paved areas will include run-off from the car park and therefore may have hydrocarbons within their flow. These hydrocarbon pollutants require removal so they are not discharged back into the environment. The separators have been sized to cater for the total external paved areas. The location of the separators is shown on drawings NCOD-TOB-ZZ-XX-DR-CE-2010 to 2015 with typical details included in **Appendix 7** of this report.

From the selection tables in the Separator Product Brochure in **Appendix 7**, the following separators or similar will be required;

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Zone 01: NSBE 010
Zone 02: NSBE 030
Zone 03: NSBE 040

These are required to cater for the hydrocarbons which may be present in the stormwater collected from this site. These separators are designed to cater for the following approximate areas which show that the separators are in fact slightly over designed;

Zone 01: 5560m2 or 0.556Ha
Zone 02: 16670m2 or 1.667Ha
Zone 03: 22222m2 or 2.22Ha

Permeable paving

It is proposed to use permeable block paving in sections of the staff car park bays. This will consist of a layer stone of gravel with a voids ratio of 40% approximately 0.5m in depth with a impermable geotextile lining under our typical surface courses.

Greenroof

It is proposed to use a sedum greenroof over the Office Building in the North East corner of the site. This is shown on Tobin drawings NCOD-TOB-ZZ-XX-DR-CE-2010.

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3.3 RAINWATER HARVESTING

Storm water from a designated section hard-standing area of the proposed site will discharge to a rainwater harvesting tank (RWHT) via Fuel/Oil Separator located to the south of the proposed Office Building. Stored water will then be distributed by pump to the vehicle wash area when required. A stopcock non-return valve will be provided to prevent backflow and overflowing of the tank. A Kingspan or similar underground commercial rainwater harvesting tank will be used. The location of the proposed tank is shown on the drainage layout drawing NCOD-TOB-ZZ-XX-DR-CE-2010 while details of a typical rainwater harvesting tanks are included in **Appendix 8**.

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4 FOUL WATER

4.1 GENERAL

An existing 750mm diameter foul sewer pipe is present running along St. Margaret's Road to the east of the site. It is proposed that the foul drainage from the proposed development will discharge to this existing 750mm diameter sewer. On-site, there will be two sources of effluent to the foul network, staff/visitors and effluent from the road sweepers/gully trucks. The discharge from staff/visitors is divided further into full time staff and fleet staff/visitors as was the case with the potable water demand calculations.

Foul Sources are as follows:

1. Staff/visitors
   i) Full Time Staff
   ii) Fleet Staff/Visitors
2. Effluent from the road sweepers/gully trucks.

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4.2 OCCUPANCY FIGURES & WASTEWATER FLOW RATES

A pre-connection enquiry was issued to Irish Water on 31/07/17. Discharge figures and associated hydraulic and organic loadings from the staff and visitors of the proposed development are in accordance with The Environmental Protection Agency Wastewater Treatment Manual "Treatment Systems for Small Communities, Business, Leisure Centres and Hotels". A wastewater flow rate for full time staff of 60 litres/person/day and 30 BOD5 grams/person/day is assumed from Table 3 of the above manual. A wastewater flow rate for fleet staff/visitors of 20 litres/person/day and 15 BOD5 grams/person/day is also assumed.

Based on a desktop study, preliminary figures for effluent from the road sweepers and gully trucks were calculated. These figures were then issued to Irish Water as part of the pre-connection enquiry. A copy of these calculations is included in **Appendix 5.** Irish Water concluded that "*based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network can be facilitated".* A copy of this letter is included **Appendix 3**.

Since this time, data has become available through testing of the effluent from similar sites which has resulted in more accurate flows and hydraulic and organic loadings from the trucks. Based

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on these new figures the loading to the public system has been reduced when compared to the original figures. A copy of these calculations is included in **Appendix 5.**

A summary of the total Hydraulic and Organic loadings based on the above is outlined below:

Source		**Hydraulic Loading (Litres/Day)**		**BOD_5 Load (Grams/Day)**		**P.E.**
Description	**Total Occupancy**	**Per Occupancy /truck**	**Total**	**Per Occupancy /truck**	**Total**	
Staff/visitors	181 Full time staff 510 Fleet Staff/Visitors	60 15	24,800	30 15	14,110	235
Trucks	8 Large Trucks 6 Small Trucks	340 170		748 281		

Table 4.2.1 – Summary of Hydraulic and Organic Loadings

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Therefore, the total Hydraulic load for the proposed development is 24,800 litres per day and the proposed PE is 235. Calculations have been provided in **Appendix 5.**

NOTE: A co-ordination exercise was carried out taking into account existing services ensuring no clashes will be encountered between new and existing services.

Please refer to **Appendix 1** for drainage drawings.

5 SITE INVESTIGATIONS

Site Investigations were carried out by Causeway Geotech Ltd. Location of site investigations are shown on drawing NCOD-TOB-ZZ-XX-DR-CE-2001. A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered typically in 150-300mm thickness in most exploratory holes.
- **Made Ground (sub-base):** 50-200mm of aggregate fill (sandy silty gravel) present in borehole BH05 from ground level and trial pit TP09 beneath 200mm of topsoil.
- **Made Ground (fill):** reworked clay fill with localised pockets of debris encountered in the majority of boreholes and trial pits across the site. Typically, sandy gravelly clay with

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fragments of brick, concrete, ceramic, glass, plastic and ash extending to a depth of 0.50-3.45m.

- **Glacial Till:** sandy gravelly clay, frequently with low cobble and occasional boulder content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

In all infiltration tests (SA01- SA05), the rate of infiltration was very low. Only SA05 was able to be calculated with an infiltration rate of 0.068m/h. The low-permeability soils are considered as such poor infiltration media, and would be deemed unsuitable for the implementation of infiltration drainage systems. A copy of the Site Investigation report can be found in the "*Environmental Considerations Report*" that accompanies the Planning Application.

6 ROADS AND TRAFFIC

6.1 GENERAL

The design and layout of the internal access roads and parking areas have been developed with reference to the following:

- *Design Manual for Roads and Streets (March 2013)*
- *NRA Design Manual for Roads and Bridges*
- *Traffic Signs Manual published by the DOE*
- *DTO Traffic Management Guidelines*

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The layout of the internal roads is shown Tobin drawings NCOD-TOB-ZZ-XX-DR-CE-2040 to 2042 with drawings showing junction layouts listed in Appendix 1 of this report. These drawings have included in the planning package.

Access and egress to the site is detailed below;

Northern Junction – Fleet Vehicle Access:

The Northern Junction is proposed as the fleet vehicle access / egress to the NCOD. It is located on St. Margaret's Road adjacent to the IKEA junction. The existing signalised 3 arm junction will be modified to a 4 arm signalised junction, with the NCOD accessible via the southern arm.

At this junction, St. Margaret's Road is an urban dual carriageway with a designated speed limit of 50km/h. The intervisibility at the signalised junction is in accordance with the requirements of the TII DN-GEO-03044 (January 2005).

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Eastern Junction – Staff Access:

The Eastern Junction is proposed as the staff vehicle access / egress to the NCOD. It is located on St. Margaret's Road at the 90 degree bend, approximately 250m west of the junction of St. Margaret's Road with the R108. The existing junction is currently operation as a though flow junction. The proposed junction will be modified to a signalised junction with 3 active arms, while also retaining the existing southern arm spur for potential future development.

At this proposed junction, St. Margaret's Road is an urban dual carriageway with a designated speed limit of 50km/h. The intervisibility at the proposed signalised junction is in accordance with the requirements of the TII DN-GEO-03044 (January 2005).

Western Junction – Civic Amenity:

The Western Junction is a proposed new priority access servicing the civic amenity and will be the proposed public access to the civic amenity. The junction is located on the R104 a two-way single carriageway with a designated speed limit of 50km/h. The visibility splays are provided in accordance with the Design Manual for Urban Roads and Streets (March 2013) and are achievable in both directions. The visibility requirements are a 'x-distance' of 2.4m with a 'y-distance' of 45m.

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Entry and exit to and from the Civic Amenity Centre will be from R104 along the south-western boundary of the site. Access to the remainder of the site will be from St. Margaret's Road on the eastern side of the site. A separate exit point will be designed on the northern boundary to assist with traffic flow and increase safety.

The proposed development is within a 50km/hr speed limit zone. The visibility splay of 2.4m x 45m is in accordance with Design Manual for Urban Roads and Streets. This visibility splay at the junctions is achievable in both directions.

Dedicated pedestrian and cyclist access points will be provided, ensuring separation from the vehicle access point. A Swept Path Analysis has been carried out and concluded no issues with the proposed road layout. Please refer to auto-track drawings in **Appendix 1** of this report.

7 WORKPLACE TRAVEL PLAN

In accordance with Fingal Development Plan 2017-2023 objective DMS 116, a workplace travel plan has been prepared for this planning application. Refer to the Workplace Travel Plan included in this planning application for further details.

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8 ROAD SAFETY AUDIT

As per the scoping undertaken with the Local Authority's Transportation Planning Section, a Stage 1 Road Safety Audit has been undertaken for this planning application and is included as part of the planning package. A Stage 2 Road Safety Audit will be undertaken at Detailed Design.

9 TRAFFIC AND TRANSPORTATION ASSESSMENT

A Traffic and Transportation Assessment has been undertaken in accordance with the Traffic and Transportation Assessment Guidelines (May 2014). Scoping of the TTA was undertaken with the Transportation Planning Section. Development of the traffic generations and distributions has been prepared by TOBIN Consulting Engineer. Modelling of the NCOD associated junctions in LINSIG and preparation of the TTA has been undertaken by AECOM. Refer to the TTA included in the planning application documentation for details.

10 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

For all details relating to the environmental baseline assessment, the potential impacts of the construction phase of the development as identified by the project environmental specialists and the mitigation measures proposed to negate the potential impacts, please refer to the "*Environmental Considerations Report*" that accompanies the Planning Application.

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11 OUTLINE CONSTRUCTION TRAFFIC MANAGEMENT PLAN

An Outline Construction Traffic Management Plan has been prepared as part of this planning application in accordance with the relevant Chapters of the Traffic Signs Manual (November 2010). Refer to the OCTMP in the planning application for further details.

12 WATERMAIN DIVERSION

Pre-planning meetings were held with Irish Water (IW) on the following dates to discuss options for dealing with the existing 800mm diameter ductile iron mains that runs along the south side of the site;

- 3rd October 2017 – In attendance were Anthony Mulligan (TOBIN), Craig Scully (TOBIN), Marina Zivanovic Byrne (IW), Conor Carey (IW) and Aidan Gallagher (DCC).
- 2nd November 2017 – In attendance were Anthony Mulligan (TOBIN), Craig Scully (TOBIN), Marina Zivanovic Byrne (IW) and Aidan Gallagher (DCC).

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Following these meetings it was agreed to carry out works on the mains that will keep the watermain a minimum of 5m from any structure. It was also agreed to avoid running the mains under any storage area and to keep the mains a minimum of 3m from the boundary wall. Where the mains will pass under a boundary wall on entering and exiting the site a structural solution was proposed and discussed with IW that will keep the wall and foundations a minimum horizontal distance of 5m from the mains. It is also proposed to replace the existing mains with a joint-less pipe in these areas to minimise the number of joints and reduce the need for maintenance in the future. Please see Tobin drawing NCOD-TOB-ZZ-XX-DR-CE-2110, which has been included in this planning application, showing the proposed works.

13 GAS LINE CROSSINGS

An existing 250mm diameter Gas main runs along the eastern and northern boundary of the site. We are proposing two locations where roads and services will cross this line. In order to provide adequate protection to the mains we have agreed a solution with Gas Networks Ireland that will allow our access roads and services to pass over and under respectively. Please see Tobin drawing NCOD-TOB-ZZ-XX-DR-CE-2120, which has been included in this planning package, for details.

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APPENDIX 1

Civil and Traffic Drawing Lists

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Civil Drawings

DWG. No:		DRAWING TITLE
NCOD-TOB-ZZ-XX-DR-CE-2000		Existing Site Topography
NCOD-TOB-ZZ-XX-DR-CE-2001		Site Investigations Plan
NCOD-TOB-ZZ-XX-DR-CE-2002		Regional Site Location Map
NCOD-TOB-ZZ-XX-DR-CE-2010		Drainage Layout Master Plan
NCOD-TOB-ZZ-XX-DR-CE-2011		Drainage Layout Sheet 1 of 5
NCOD-TOB-ZZ-XX-DR-CE-2012		Drainage Layout Sheet 2 of 5
NCOD-TOB-ZZ-XX-DR-CE-2013		Drainage Layout Sheet 3 of 5
NCOD-TOB-ZZ-XX-DR-CE-2014		Drainage Layout Sheet 4 of 5
NCOD-TOB-ZZ-XX-DR-CE-2015		Drainage Layout Sheet 5 of 5
NCOD-TOB-ZZ-XX-DR-CE-2020		Watermain Layout Master Plan
NCOD-TOB-ZZ-XX-DR-CE-2021		Watermain Layout Sheet 1 of 2
NCOD-TOB-ZZ-XX-DR-CE-2022		Watermain Layout Sheet 2 of 2
NCOD-TOB-ZZ-XX-DR-CE-2030		Site Layout & Hard-standing Layout Master Plan
NCOD-TOB-ZZ-XX-DR-CE-2031		Site Layout & Hard-standing Layout Sheet 1 of 2
NCOD-TOB-ZZ-XX-DR-CE-2032		Site layout & Hard-standing Layout 2 of 2
NCOD-TOB-ZZ-XX-DR-CE-2050		Reinstatement Details
NCOD-TOB-ZZ-XX-DR-CE-2060		Manhole Details
NCOD-TOB-ZZ-XX-DR-CE-2070		Road Alignment and Long Sections Master plan
NCOD-TOB-ZZ-XX-DR-CE-2071		Road Alignment and Long Sections Sheet 1 of 3
NCOD-TOB-ZZ-XX-DR-CE-2072		Road Alignment and Long Sections Sheet 2 of 3
NCOD-TOB-ZZ-XX-DR-CE-2073		Road Alignment and Long Sections Sheet 3 of 3
NCOD-TOB-ZZ-XX-DR-CE-2075		Road Details
NCOD-TOB-ZZ-XX-DR-CE-2080		Typical Attenuation Detail
NCOD-TOB-ZZ-XX-DR-CE-2090		Watermain Details Sheet 1 of 5

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NCOD-TOB-ZZ-XX-DR-CE-2091	Watermain Details Sheet 2 of 5
NCOD-TOB-ZZ-XX-DR-CE-2092	Watermain Details Sheet 3 of 5
NCOD-TOB-ZZ-XX-DR-CE-2093	Watermain Details Sheet 4 of 5
NCOD-TOB-ZZ-XX-DR-CE-2094	Watermain Details Sheet 5 of 5
NCOD-TOB-ZZ-XX-DR-CE-2100	Autotrack Analysis Sheet 1 of 8
NCOD-TOB-ZZ-XX-DR-CE-2101	Autotrack Analysis Sheet 2 of 8
NCOD-TOB-ZZ-XX-DR-CE-2102	Autotrack Analysis Sheet 3 of 8
NCOD-TOB-ZZ-XX-DR-CE-2103	Autotrack Analysis Sheet 4 of 8
NCOD-TOB-ZZ-XX-DR-CE-2104	Autotrack Analysis Sheet 5 of 8
NCOD-TOB-ZZ-XX-DR-CE-2105	Autotrack Analysis Sheet 6 of 8
NCOD-TOB-ZZ-XX-DR-CE-2106	Autotrack Analysis Sheet 7 of 8
NCOD-TOB-ZZ-XX-DR-CE-2107	Autotrack Analysis Sheet 8 of 8
NCOD-TOB-ZZ-XX-DR-CE-2110	Watermain Diversion Masterplan
NCOD-TOB-ZZ-XX-DR-CE-2120	Gas Line Crossing Details

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Traffic Drawings

DWG. No:		DRAWING TITLE
NCOD-TOB-09-XX-DR-TE-0001		Road Layout - Overview - Proposed Junctions
NCOD-TOB-09-XX-DR-TE-0002		General Arrangement - Existing & Proposed Road Layout - Junction 2
NCOD-TOB-09-XX-DR-TE-0003		General Arrangement - Existing & Proposed Road Layout - Junction 7
NCOD-TOB-09-XX-DR-TE-0003		General Arrangement - Existing & Proposed Road Layout - Junction 8
NCOD-TOB-09-XX-DR-TE-0005		Traffic Signals & Ducting - Existing & Proposed Road Layout - Junction 2
NCOD-TOB-09-XX-DR-TE-0006		Traffic Signals & Ducting - Existing & Proposed Road Layout - Junction 7
NCOD-TOB-09-XX-DR-TE-0007		Autotrack Analysis - Max. Legal Articulated Vehicle - Proposed Road Layout - Junction 2
NCOD-TOB-09-XX-DR-TE-0008		Autotrack Analysis - Max. Legal Articulated Vehicle - Proposed Road Layout - Junction 7
NCOD-TOB-09-XX-DR-TE-0009		Autotrack Analysis - Jeep & Trailer - Proposed Road Layout - Junction 8
NCOD-TOB-09-XX-DR-TE-0010		Longitudinal & Typical Cross Section - Proposed Road Layout - Junction 2
NCOD-TOB-09-XX-DR-TE-0011		Longitudinal & Typical Cross Section - Proposed Road Layout - Junction 7
NCOD-TOB-09-XX-DR-TE-0012		Longitudinal & Typical Cross Section - Proposed Road Layout - Junction 8
NCOD-TOB-09-XX-DR-TE-0100		Outline Const. Traffic Management Plan - Proposed Construction Accesses & Haul Routes - Sheet 1 of 6
NCOD-TOB-09-XX-DR-TE-0101		Outline Const. Traffic Management Plan - Proposed Site Access - Orange Access - Sheet 2 of 6
NCOD-TOB-09-XX-DR-TE-0102		Outline Const. Traffic Management Plan - Proposed Site Access - Blue Access - Sheet 3 of 6
NCOD-TOB-09-XX-DR-TE-0103		Outline Const. Traffic Management Plan - Works Area - Site Access on St. Margaret's Road (Blue Access) - Sheet 4 of 6
NCOD-TOB-09-XX-DR-TE-0104		Outline Const. Traffic Management Plan - Works Area - Site Access on St. Margaret's Road (Junction 7) - Sheet 5 of 6
NCOD-TOB-09-XX-DR-TE-0105		Outline Const. Traffic Management Plan - Works Area - Site Access on St. Margaret's Road (Junction 8) - Sheet 6 of 6

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APPENDIX 2

Water Demand Calculations

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Checked PC

CALCULATION SHEET		Ref No:	10243
PROJECT:	North City Operations Depot	Sheet No:	1
		Designer:	CS
ELEMENT:	Potable Water Demand	Date:	19.10.17

File Location: \\FSERVER4-DUB\Tobin\Projects\10243 - Ballymun Depot, DCC North Operation\05-Design\01-
This Element: Potable Water Demand

Potable Supply

Design Population

Site	Max. No. Full Time Staff	Max. No. FleetStaff/Visitors	Total
Staff and Visitors	181.0 persons	510.0 persons	691.0 persons

Staff Water Usage Rate	60.0 l/day/person	(See Note 1)
Visitor Water Usage Rate	20.0 l/day/person	

Demand

	EPA Design Guidelines	
Avg. DailyDemand	0.244 l/sec	7682.688 m3/annum
Avg. Day Demand	0.305 l/sec	
Peak Demand	1.523 l/sec	

Potable Supply for Firewater

Demand	Peak Demand	75.000 l/sec	(See Note 2)

Pipe Sizing

ø	velocity
100	9.74 m/s
150	4.33 m/s
200	2.44 m/s
250	1.56 m/s
300	1.08 m/s

Therefore use 250mm pipe

Notes:

1. The Flow rates are obtained from Table 3 Wastewater Treatment Manuals (pg.8).
2. UK Document "National Guidance Document on the provision of water for fire fighting

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APPENDIX 3

Irish Water Correspondence

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Letter Ref: CDSCOF2 - CDSCOF5

Craig Scully
Tobin Engineers
Block 10-4,
Blanchardstown Corporate Park,
Dublin 15 D15X98N

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

09 October 2017

Dear Sir/Madam,

Re: 1147376321 pre-connection enquiry - Subject to contract | Contract denied
Connection for non-domestic premises at Saint Margaret's Road, Ballymun, Dublin 11

Irish Water has reviewed your pre-connection enquiry in relation to
water and wastewater connections at Saint Margaret's Road, Ballymun, Dublin 11
Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network can be facilitated.

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There is an existing 800mm HL watermain along south edge of the site. New connections for water and wastewater to the existing network are feasible subject to required diversion of the watermain being assessed as feasible.
Before completing the design of services infrastructure at the Premises (including diversion proposals), and prior to submitting any planning application, you are advised to contact Irish Water. The design has to be in accordance with published Irish Water Code of Practice and Standard Details (for water and wastewater)

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

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

If you have any further questions, please contact Marina Byrne from the design team on 01 8925991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections**

TOBIN CONSULTING ENGINEERS
PROJECT NO.
Date Received 12 OCT 2017
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Yours sincerely,

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Maria O'Dwyer
Connections and Developer Services

Stiúrthóirí / Directors: Michael McNicholas (Chairman), Brendan Murphy, Michael O'Sullivan, Jerry Grant, Cathal Marley
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

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APPENDIX 4

Attenuation Calculations

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Zone 01 Stormwater Storage and Control Calculations

INPUT	Institute of Hydrology Report No. 124 for Sites Up To 24 Ha		
OUTPUT	Greater Dublin Strategic Drainage Study		
	By	Checked	
SITE DETAILS:	CS	AM	

Location	Ballymun Depot		St Margarets Road		
Site Area	1.04	Acre	0.42	Ha	4,220 m^2
Impervious Area Draining To Piped Network			100%	4,220	m^2
Impervious Area Draining to Infiltration			0%	-	m^2
Pervious Area			0%	-	m^2
Allowance for Impervious Green Area			0%	-	m^3

RIVER REGIME PROTECTION

Allowable Discharge From Site: $QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

$Q_{BAR:}$	Mean Annual Peak Flow From Site	m^3/s			
AREA:	Area of Site	km^2			
SAAR:	Standard Annual Average Rainfall	775		mm	
SOIL:	Soil Index	SOIL TYPE	4	SOIL	0.470

1	0.1	Very Low	Sandy, well drained
2	0.3	Low	Intermediate Soil (silty)
3	0.37	Moderate	Intermediate Soil (sandy)
4	0.47	High	Clayey, poorly drained
5	0.53	Very High	Steep, rocky area

Rainfall Intensities

Climate Change F 20%

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If site is <50Ha, calculate Q-Bar for 50Ha and linearly interpolate for Site Area

QT estimated from old data where not specified by

QBAR 50 Ha - STANDARD				Return Period	QT Factor	$Q_{ALL.}$	$Q_{ALL.}$	V
AREA	Ha/Km2	50	0.5	Yrs	-	l/s	l/s/ha	m^3
Q_{BAR}	=	0.2719	m^3/s	1	0.85	1.95	4.62	59
Q_{BAR}	=	271.92	l/s	2	1	2.30	5.44	65
Q_{BAR}	=	5.44	l/s/Ha	5	1.3	2.98	7.07	91
QBAR Development - RESTRICTED				10	1.7	3.90	9.25	98
AREA	Ha/Km^2	0.422	0.00422	20	1.9	4.36	10.33	128
Q_{BAR}	=	0.0023	m^3/s	30	2.1	4.82	11.42	141
Q_{BAR}	=	2.30	l/s	50	2.31	5.30	12.56	151
Q_{BAR}	=	5.44	l/s/Ha	100	2.6	5.97	14.14	193

Interceptor Designed YES

Flow Control Designed at Outlet Manhole with overflow YES

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Zone 02 Stormwater Storage and Control Calculations

INPUT	Institute of Hydrology Report No. 124 for Sites Up To 24 Ha	
OUTPUT	Greater Dublin Strategic Drainage Study	
	By	Checked
SITE DETAILS:	CS	AM

Location	Ballymun Depot		St Margarets Road			
Site Area	3.57	Acre	1.44	Ha	14,430	m^2
Impervious Area Draining To Piped Network			100%	14,430	m^2	
Impervious Area Draining to Infiltration			0%	-	m^2	
Pervious Area			0%	-	m^2	
Allowance for Impervious Green Area			0%	-	m^3	

RIVER REGIME PROTECTION

Allowable Discharge From Site: $QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

$Q_{BAR:}$	Mean Annual Peak Flow From Site	m^3/s			
AREA:	Area of Site	km^2			
SAAR:	Standard Annual Average Rainfall	775		mm	
SOIL:	Soil Index	SOIL TYPE	4	SOIL	0.470

1	0.1	Very Low	Sandy, well drained
2	0.3	Low	Intermediate Soil (silty)
3	0.37	Moderate	Intermediate Soil (sandy)
4	0.47	High	Clayey, poorly drained
5	0.53	Very High	Steep, rocky area

Rainfall Intensities

Climate Change F 20%

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If site is <50Ha, calculate Q-Bar for 50Ha and linearly interpolate for Site Area

QT estimated from old data where not specified by

QBAR 50 Ha - STANDARD				Return Period	QT Factor	$Q_{ALL.}$	$Q_{ALL.}$	V
AREA	Ha/Km2	50	0.5	Yrs	-	l/s	l/s/ha	m^3
Q_{BAR}	=	0.2719	m^3/s	1	0.85	6.67	4.62	201
Q_{BAR}	=	271.92	l/s	2	1	7.85	5.44	221
Q_{BAR}	=	5.44	l/s/Ha	5	1.3	10.20	7.07	311
QBAR Development - RESTRICTED				10	1.7	13.34	9.25	336
AREA	Ha/Km^2	1.443	0.0144301	20	1.9	14.91	10.33	439
Q_{BAR}	=	0.0078	m^3/s	30	2.1	16.48	11.42	482
Q_{BAR}	=	7.85	l/s	50	2.31	18.13	12.56	517
Q_{BAR}	=	5.44	l/s/Ha	100	2.6	20.40	14.14	659

Interceptor Designed YES

Flow Control Designed at Outlet Manhole with overflow YES

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Zone 03 Stormwater Storage and Control Calculations

INPUT	Institute of Hydrology Report No. 124 for Sites Up To 24 Ha	
OUTPUT	Greater Dublin Strategic Drainage Study	
	By	Checked
SITE DETAILS:	CS	AM

Location	Ballymun Depot		St Margarets Road			
Site Area	4.75	Acre	1.92	Ha	19,220	m^2
Impervious Area Draining To Piped Network			100%	19,220	m^2	
Impervious Area Draining to Infiltration			0%	-	m^2	
Pervious Area			0%	-	m^2	
Allowance for Impervious Green Area			0%	-	m^3	

RIVER REGIME PROTECTION

Allowable Discharge From Site: $QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

$Q_{BAR:}$	Mean Annual Peak Flow From Site	m^3/s			
AREA:	Area of Site	km^2			
SAAR:	Standard Annual Average Rainfall	775		mm	
SOIL:	Soil Index	SOIL TYPE	4	SOIL	0.470

1	0.1	Very Low	Sandy, well drained
2	0.3	Low	Intermediate Soil (silty)
3	0.37	Moderate	Intermediate Soil (sandy)
4	0.47	High	Clayey, poorly drained
5	0.53	Very High	Steep, rocky area

Rainfall Intensities

Climate Change F 20%

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If site is <50Ha, calculate Q-Bar for 50Ha and linearly interpolate for Site Area

QT estimated from old data where not specified by

QBAR 50 Ha - STANDARD				Return Period	QT Factor	$Q_{ALL.}$	$Q_{ALL.}$	V
AREA	Ha/Km2	50	0.5	Yrs	-	l/s	l/s/ha	m^3
Q_{BAR}	=	0.2719	m^3/s	1	0.85	8.88	4.62	267
Q_{BAR}	=	271.92	l/s	2	1	10.45	5.44	295
Q_{BAR}	=	5.44	l/s/Ha	5	1.3	13.59	7.07	414
QBAR Development - RESTRICTED				10	1.7	17.77	9.25	448
AREA	Ha/Km^2	1.922	0.0192201	20	1.9	19.86	10.33	584
Q_{BAR}	=	0.0105	m^3/s	30	2.1	21.95	11.42	642
Q_{BAR}	=	10.45	l/s	50	2.31	24.15	12.56	689
Q_{BAR}	=	5.44	l/s/Ha	100	2.6	27.18	14.14	878

Interceptor Designed YES

Flow Control Designed at Outlet Manhole with overflow YES

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APPENDIX 5

Foul Water Discharge

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CALCULATION SHEET	Ref No:	10243
	Sheet No:	1
PROJECT: Ballymun Depot	Designer:	CS
ELEMENT: Foul Water Discharge Loading	Date:	31.07.2017

File location: \\FSERVER4-DUB\Tobin\Projects\10243 - Ballymun Depot, DCC North Operation\05-Design\01-
This Element: Foul Water Discharge Loading

Sanitary Wastewater

Applying BS EN 752:
Design Population

Site	Max. No. Fleet Staff + Visitors	Max. No. Full time Staff
Office + Workshop	510.0 persons	181.0 persons

Site	Max. No. Large Road Sweepers per day x2 (discharge twice a day)	Max. No. Small Road Sweepers per day x2 (discharge twice a day)
Sweepers	16.0 large sweepers	12.0 small sweepers

Average DWF

Full time Staff	60.0 l/person/day
Fleet Staff + Visitors	20.0 l/person/day
Large Road Sweeper Waste Material	1800.000 l/day
Small Road Sweeper Waste Material	600.000 l/day

Peak Design Flow

DWF	0.424 l/sec	or	36.620 m³/d
6*DWF	2.543 l/sec	or	219.720 m³/d

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Colebrook-White Formula

Q =	2.543 l/sec	**Pipe Dia. Ø =**	225.00 mm	
ks =	1.50 mm	**Gradient =**	1 in 225.0	
Kinematic viscosity	1.141x10^-6 m²/sec	**Q =**	30.342 l/sec	**OK**
Self Cleansing Vel.	0.750 m/sec	**v =**	0.763 m/sec	**OK**

BOD_5

Full time Staff BOD_5	30.0 g/person/day
Fleet Staff Vissitors BOD_5	15.0 g/person/day
Large RS BOD_5	900.0 g/sweeper/day
Small RS BOD_5	300.0 g/sweeper/day
Total BOD_5	22.08 kg/day

PE

PE	368

This is a copy of the original foul calculations sent as part of the per-connection enquiry to Irish Water. These have now been superseded by the calculations overleaf. Please see Section 4 for further details

Summary

Use 225mmØ min. pipe size if using gravity sewers

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		Checked	PC
CALCULATION SHEET		**Ref No:**	**10243**
		Sheet No:	**1**
PROJECT:	**Ballymun Depot**	**Designer:**	**CS**
ELEMENT:	**Foul Water Discharge Loading**	**Date:**	**19.09.2017**

File location: \\FSERVER4-DUB\Tobin\Projects\10243 - Ballymun Depot, DCC North Operation\05-Design\01-
This Element: Foul Water Discharge Loading

Sanitary Wastewater

Applying BS EN 752:
Design Population

Site	Max. No. Fleet Staff + Visitors	Max. No. Full time Staff
Offices + Workshops	510.0 persons	181.0 persons

Site	Max. No. Large Trucks (decanted once a week)	Max. No. Small Trucks (decanted once a week)
Road Sweepers	8.0 large sweepers	6.0 small sweepers

Full time Staff	60.0 l/person/day	
Fleet Staff + Visitors	20.0 l/person/day	
Large Road Sweeper Waste Material	340.000 l/day	per large sweeper
Small Road Sweeper Waste Material	170.000 l/day	per small sweeper

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Average Flow Office and Workshop	DWF	0.244 l/sec	or	21.060 m³/d	
Peak Design Flow Offices and Workshops	6*DWF	1.463 l/sec	or	126.360 m³/d	
Average Flow Road Sweepers	DWF	0.043 l/sec	or	3.740 m³/d	
Peak Design Flow Road Sweepers	6*DWF	0.260 l/sec	or	22.440 m³/d	
Average Flow Site	DWF	0.287 l/sec	or	24.800 m³/d	
Peak Design Flow for Site	6*DWF	1.722 l/sec	or	148.800 m³/d	

Colebrook-White Formula

Q =	1.722 l/sec	**Pipe Dia. Ø =**	225.00 mm	
ks =	1.50 mm	**Gradient =**	1 in 200.0	
Kinematic viscosity	1.141x10^-6 m²/sec	**Q =**	32.197 l/sec	**OK**
Self Cleansing Vel.	0.750 m/sec	**v =**	0.810 m/sec	**OK**

BOD_5

Full time Staff BOD_5	30.0 g/person/day
Fleet Staff Vissitors	15.0 g/person/day
Large RS BOD_5	93.5 g/sweeper/day
Small RS BOD_5	46.8 g/sweeper/day
Total BOD_5	14.11 kg/day
PE	235

These are the most current foul loading calculations that now supersede the ones sent to Irish Water. Please see Section 4 of report for further details

Summary

Use 225mmØ min. pipe size if using gravity sewers

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APPENDIX 6

Storm Network Micro-drainage Design
Storm Longsections
Typical Pipe Specification

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes GDSDS Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Add Flow / Climate Change (%)	20
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.200
Ratio R	0.300	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	0.75
Foul Sewage (l/s/ha)	1.000	Min Slope for Optimisation (1:X)	200
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm at outfall S6 (pipe S1.004)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.235	4-8	0.128

Total Area Contributing (ha) = 0.363

Total Pipe Volume (m³) = 10.290

Time Area Diagram at outfall S33 (pipe S3.009)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.736	4-8	0.800	8-12	0.017

Total Area Contributing (ha) = 1.554

Total Pipe Volume (m³) = 39.111

Time Area Diagram at outfall S50 (pipe S9.006)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.529	4-8	0.582	8-12	0.008

Total Area Contributing (ha) = 1.118

Total Pipe Volume (m³) = 24.952

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Time Area Diagram at outfall S50 (pipe S14.001)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.061	4-8	0.020

Total Area Contributing (ha) = 0.081

Total Pipe Volume (m³) = 1.188

Time Area Diagram at outfall S50 (pipe S15.000)

Time (mins)	Area (ha)
0-4	0.000

Total Area Contributing (ha) = 0.000

Total Pipe Volume (m³) = 0.316

Time Area Diagram at outfall S19 (pipe S16.011)

Time (mins)	Area (ha)
0-4	0.000

Total Area Contributing (ha) = 0.000

Total Pipe Volume (m³) = 27.185

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	12.377	0.124	99.8	0.025	5.00	0.0	0.600	o	225	
S1.001	88.248	0.441	200.0	0.117	0.00	0.0	0.600	o	225	
S1.002	11.460	0.148	77.6	0.016	0.00	0.0	0.600	o	225	
S1.003	22.081	0.300	73.6	0.033	0.00	0.0	0.600	o	225	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	42.97	5.16	68.888	0.025	0.0	0.0	0.6	1.31	52.0	3.5
S1.001	38.59	6.75	68.764	0.142	0.0	0.1	3.0	0.92	36.6	17.9
S1.002	38.29	6.88	68.323	0.158	0.0	0.2	3.3	1.49	59.1	19.8
S1.003	37.73	7.12	68.175	0.190	0.0	0.2	3.9	1.53	60.7	23.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S2.000	9.258	0.185	50.0	0.011	5.00	0.0	0.600	o	225	
S2.001	23.668	0.237	99.9	0.017	0.00	0.0	0.600	o	225	
S2.002	76.286	0.628	121.5	0.109	0.00	0.0	0.600	o	225	
S1.004	15.411	0.400	38.5	0.036	0.00	0.0	0.600	o	225	
S3.000	18.007	0.090	200.0	0.089	5.00	0.0	0.600	o	225	
S3.001	62.363	0.312	200.0	0.095	0.00	0.0	0.600	o	225	
S3.002	24.443	0.122	200.0	0.036	0.00	0.0	0.600	o	225	
S3.003	89.257	2.570	34.7	0.331	0.00	0.0	0.600	o	225	
S4.000	14.595	0.086	169.7	0.049	5.00	0.0	0.600	o	225	
S5.000	9.217	0.061	151.1	0.041	5.00	0.0	0.600	o	225	
S4.001	17.394	0.087	200.0	0.000	0.00	0.0	0.600	o	225	
S6.000	30.759	0.154	200.0	0.071	0.00	0.0	0.600	o	225	
S3.004	33.720	0.169	200.0	0.049	0.00	0.0	0.600	o	375	

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Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/ID (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	43.20	5.08	68.925	0.011	0.0	0.0	0.3	1.85	73.7	1.6
S2.001	42.27	5.38	68.740	0.028	0.0	0.0	0.6	1.31	52.0	3.9
S2.002	39.32	6.46	68.503	0.137	0.0	0.1	2.9	1.19	47.1	17.7
S1.004	37.46	7.25	67.875	0.363	0.0	0.4	7.4	2.11	84.1	44.6
S3.000	42.45	5.33	67.125	0.089	0.0	0.1	2.1	0.92	36.6	12.4
S3.001	39.33	6.45	67.035	0.184	0.0	0.2	4.0	0.92	36.6	23.8
S3.002	38.26	6.90	66.723	0.220	0.0	0.2	4.6	0.92	36.6	27.6
S3.003	36.77	7.56	66.601	0.552	0.0	0.6	11.1	2.23	88.6	66.6
S4.000	42.70	5.24	64.425	0.049	0.0	0.0	1.1	1.00	39.8	6.8
S5.000	43.01	5.14	65.025	0.041	0.0	0.0	1.0	1.06	42.2	5.8
S4.001	41.76	5.56	64.339	0.090	0.0	0.1	2.1	0.92	36.6	12.3
S6.000	41.76	5.56	64.185	0.071	0.0	0.1	1.6	0.92	36.6	9.7
S3.004	35.86	8.00	63.881	0.756	0.0	0.8	14.8	1.28	141.1	89.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S7.000	78.558	0.393	200.0	0.278	5.00	0.0	0.600	o	225	
S7.001	32.767	0.247	132.5	0.102	0.00	0.0	0.600	o	300	
S7.002	62.544	1.787	35.0	0.182	0.00	0.0	0.600	o	300	
S3.005	30.524	0.153	200.0	0.086	0.00	0.0	0.600	o	450	
S3.006	21.818	0.109	200.0	0.049	0.00	0.0	0.600	o	450	
S8.000	14.473	0.096	150.8	0.051	5.00	0.0	0.600	o	225	
S3.007	26.072	0.521	50.0	0.051	0.00	0.0	0.600	o	450	
S3.008	4.912	0.093	52.8	0.000	0.00	0.0	0.600	o	450	
S3.009	7.047	0.141	50.0	0.000	0.00	0.0	0.600	o	450	
S9.000	30.214	0.151	200.0	0.071	5.00	0.0	0.600	o	225	
S10.000	31.332	0.251	124.8	0.145	5.00	0.0	0.600	o	225	
S9.001	12.135	0.061	200.0	0.045	0.00	0.0	0.600	o	225	
S9.002	11.708	0.059	200.0	0.008	0.00	0.0	0.600	o	225	
S9.003	75.848	0.379	200.0	0.322	0.00	0.0	0.600	o	300	
S9.004	61.131	0.306	200.0	0.141	0.00	0.0	0.600	o	375	

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Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.000	39.41	6.42	67.035	0.278	0.0	0.3	6.0	0.92	36.6	35.9
S7.001	38.43	6.82	66.567	0.379	0.0	0.4	8.0	1.36	96.4	47.8
S7.002	37.53	7.21	66.320	0.562	0.0	0.6	11.5	2.67	188.5	69.2
S3.005	35.17	8.36	63.638	1.403	0.0	1.4	27.0	1.43	228.1	162.0
S3.006	34.70	8.61	63.485	1.452	0.0	1.5	27.6	1.43	228.1	165.5
S8.000	42.75	5.23	63.575	0.051	0.0	0.1	1.2	1.06	42.2	7.1
S3.007	34.42	8.76	63.254	1.554	0.0	1.6	29.3	2.88	457.9	175.7
S3.008	34.37	8.79	62.733	1.554	0.0	1.6	29.3	2.80	445.7	175.7
S3.009	34.30	8.83	62.708	1.554	0.0	1.6	29.3	2.88	458.2	175.7
S9.000	41.79	5.55	62.475	0.071	0.0	0.1	1.6	0.92	36.6	9.7
S10.000	42.08	5.45	62.575	0.145	0.0	0.1	3.3	1.17	46.5	20.1
S9.001	41.16	5.77	62.324	0.261	0.0	0.3	5.9	0.92	36.6	35.2
S9.002	40.57	5.98	62.263	0.269	0.0	0.3	6.0	0.92	36.6	35.7
S9.003	37.75	7.12	62.130	0.591	0.0	0.6	12.2	1.11	78.3	73.2
S9.004	36.04	7.92	61.675	0.732	0.0	0.7	14.4	1.28	141.1	86.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S11.000	39.633	0.520	76.2	0.120	5.00	0.0	0.600	o	225	
S12.000	35.492	0.220	161.3	0.081	5.00	0.0	0.600	o	225	
S11.001	19.972	0.290	68.9	0.019	0.00	0.0	0.600	o	225	
S13.000	42.579	0.580	73.4	0.108	5.00	0.0	0.600	o	225	
S11.002	29.552	0.445	66.4	0.035	0.00	0.0	0.600	o	225	
S9.005	18.202	0.091	200.0	0.024	0.00	0.0	0.600	o	375	
S9.006	7.098	0.035	200.0	0.000	0.00	0.0	0.600	o	375	
S14.000	13.916	0.300	46.4	0.081	5.00	0.0	0.600	o	225	
S14.001	15.970	0.430	37.1	0.000	0.00	0.0	0.600	o	225	
S15.000	7.941	0.230	34.5	0.000	5.00	0.0	0.600	o	225	
S16.000	73.946	2.094	35.3	0.000	0.00	0.0	0.600	o	225	
S16.001	77.427	0.430	180.1	0.000	0.00	0.0	0.600	o	225	
S16.002	33.000	0.183	180.3	0.000	0.00	0.0	0.600	o	225	
S16.003	22.902	0.127	180.3	0.000	0.00	0.0	0.600	o	225	

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Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.000	42.10	5.44	62.775	0.120	0.0	0.1	2.8	1.50	59.6	16.6
S12.000	41.70	5.58	62.475	0.081	0.0	0.1	1.8	1.03	40.8	11.1
S11.001	41.10	5.79	62.255	0.220	0.0	0.2	4.9	1.58	62.7	29.7
S13.000	42.03	5.46	62.545	0.108	0.0	0.1	2.5	1.53	60.8	14.9
S11.002	40.26	6.09	61.965	0.363	0.0	0.4	8.0	1.61	63.9	47.9
S9.005	35.57	8.15	61.370	1.118	0.0	1.1	21.8	1.28	141.1	130.6
S9.006	35.39	8.25	61.279	1.118	0.0	1.1	21.8	1.28	141.1	130.6
S14.000	43.08	5.12	62.275	0.081	0.0	0.1	1.9	1.93	76.6	11.5
S14.001	42.70	5.24	61.975	0.081	0.0	0.1	1.9	2.15	85.6	11.5
S15.000	43.28	5.06	59.810	0.000	27.1	0.0	4.5	2.23	88.8	27.1
S16.000	41.76	5.56	66.280	0.000	6.0	0.0	1.0	2.21	87.8	6.0
S16.001	38.28	6.89	64.186	0.000	6.0	0.0	1.2	0.97	38.6	7.2
S16.002	37.01	7.45	63.744	0.000	6.0	0.0	1.2	0.97	38.6	7.2
S16.003	36.18	7.85	63.561	0.000	6.0	0.0	1.2	0.97	38.6	7.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S16.004	31.530	0.175	180.2	0.000	0.00	0.0	0.600	o	225	
S16.005	61.052	0.934	65.4	0.000	0.00	0.0	0.600	o	225	
S17.000	14.502	0.073	198.7	0.000	5.00	0.0	0.600	o	225	
S16.006	35.181	0.176	199.9	0.000	0.00	0.0	0.600	o	375	
S16.007	34.579	0.173	199.9	0.000	0.00	0.0	0.600	o	375	
S16.008	14.801	0.074	199.9	0.000	0.00	0.0	0.600	o	375	
S16.009	9.811	0.054	181.7	0.000	0.00	0.0	0.600	o	375	
S18.000	8.706	0.102	85.4	0.000	5.00	0.0	0.600	o	225	
S16.010	28.677	0.143	200.0	0.000	0.00	0.0	0.600	o	375	
S16.011	6.788	0.034	200.0	0.000	0.00	0.0	0.600	o	375	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S16.004	35.12	8.39	63.434	0.000	6.0	0.0	1.2	0.97	38.6	7.2
S16.005	33.98	9.02	63.259	0.000	6.0	0.0	1.2	1.62	64.4	7.2
S17.000	42.64	5.26	61.530	0.000	20.4	0.0	3.4	0.92	36.7	20.4
S16.006	33.20	9.47	61.462	0.000	26.4	0.0	5.3	1.28	141.1	31.7
S16.007	32.48	9.93	61.306	0.000	26.4	0.0	5.3	1.28	141.1	31.7
S16.008	32.18	10.12	61.133	0.000	26.4	0.0	5.3	1.28	141.1	31.7
S16.009	31.99	10.24	59.758	0.000	26.4	0.0	5.3	1.34	148.1	31.7
S18.000	43.14	5.10	60.975	0.000	3.0	0.0	0.5	1.42	56.3	3.0
S16.010	31.44	10.62	59.704	0.000	29.4	0.0	5.9	1.28	141.1	35.3
S16.011	31.32	10.70	59.561	0.000	29.4	0.0	5.9	1.28	141.1	35.3

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	70.313	1.425	Open Manhole	1200	S1.000	68.888	225				
S2	70.300	1.536	Open Manhole	1200	S1.001	68.764	225	S1.000	68.764	225	
S3	69.750	1.427	Open Manhole	1200	S1.002	68.323	225	S1.001	68.323	225	
S4	69.600	1.425	Open Manhole	1200	S1.003	68.175	225	S1.002	68.175	225	
S20	70.350	1.425	Open Manhole	1200	S2.000	68.925	225				
S21	70.400	1.660	Open Manhole	1200	S2.001	68.740	225	S2.000	68.740	225	
S22	70.150	1.647	Open Manhole	1200	S2.002	68.503	225	S2.001	68.503	225	
S5	69.300	1.425	Open Manhole	1200	S1.004	67.875	225	S1.003	67.875	225	
								S2.002	67.875	225	
S6	68.900	1.425	Open Manhole	1200		OUTFALL		S1.004	67.475	225	
S23	68.550	1.425	Open Manhole	1200	S3.000	67.125	225				
S24	68.550	1.515	Open Manhole	1200	S3.001	67.035	225	S3.000	67.035	225	
S25	68.660	1.937	Open Manhole	1200	S3.002	66.723	225	S3.001	66.723	225	
S26	68.750	2.149	Open Manhole	1200	S3.003	66.601	225	S3.002	66.601	225	
S35	65.850	1.425	Open Manhole	1200	S4.000	64.425	225				
S37	66.450	1.425	Open Manhole	1200	S5.000	65.025	225				
S36	67.250	2.911	Open Manhole	1200	S4.001	64.339	225	S4.000	64.339	225	
								S5.000	64.964	225	625
S38	65.610	1.425	Open Manhole	1200	S6.000	64.185	225				
S27	67.100	3.219	Open Manhole	1350	S3.004	63.881	375	S3.003	64.031	225	
								S4.001	64.252	225	221
								S6.000	64.031	225	
S39	68.460	1.425	Open Manhole	1200	S7.000	67.035	225				
S40	68.290	1.723	Open Manhole	1200	S7.001	66.567	300	S7.000	66.642	225	
S41	67.820	1.500	Open Manhole	1200	S7.002	66.320	300	S7.001	66.320	300	
S28	66.830	3.192	Open Manhole	1350	S3.005	63.638	450	S3.004	63.713	375	
								S7.002	64.533	300	745
S29	65.800	2.315	Open Manhole	1350	S3.006	63.485	450	S3.005	63.485	450	
S42	65.000	1.425	Open Manhole	1200	S8.000	63.575	225				
S30	65.050	1.796	Open Manhole	1350	S3.007	63.254	450	S3.006	63.376	450	122
								S8.000	63.479	225	
S31	64.200	1.467	Open Manhole	1350	S3.008	62.733	450	S3.007	62.733	450	
S32	64.290	1.650	Open Manhole	1350	S3.009	62.708	450	S3.008	62.640	450	
S33	64.200	1.633	Open Manhole	1350		OUTFALL		S3.009	62.567	450	
S43	63.900	1.425	Open Manhole	1200	S9.000	62.475	225				
S51	64.000	1.425	Open Manhole	1200	S10.000	62.575	225				
S44	63.760	1.436	Open Manhole	1200	S9.001	62.324	225	S9.000	62.324	225	
								S10.000	62.324	225	

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S45	63.880	1.617	Open Manhole	1200	S9.002	62.263	225	S9.001	62.263	225	
S46	63.890	1.760	Open Manhole	1200	S9.003	62.130	300	S9.002	62.205	225	
S47	63.970	2.295	Open Manhole	1350	S9.004	61.675	375	S9.003	61.750	300	
S52	64.200	1.425	Open Manhole	1200	S11.000	62.775	225				
S55	63.900	1.425	Open Manhole	1200	S12.000	62.475	225				
S53	63.680	1.425	Open Manhole	1200	S11.001	62.255	225	S11.000	62.255	225	
								S12.000	62.255	225	
S56	63.970	1.425	Open Manhole	1200	S13.000	62.545	225				
S54	63.390	1.425	Open Manhole	1200	S11.002	61.965	225	S11.001	61.965	225	
								S13.000	61.965	225	
S48	63.000	1.630	Open Manhole	1350	S9.005	61.370	375	S9.004	61.370	375	
								S11.002	61.520	225	
S49	63.000	1.721	Open Manhole	1350	S9.006	61.279	375	S9.005	61.279	375	
S50	62.970	1.727	Open Manhole	0		OUTFALL		S9.006	61.243	375	
S57	63.700	1.425	Open Manhole	1200	S14.000	62.275	225				
S58	63.400	1.425	Open Manhole	1200	S14.001	61.975	225	S14.000	61.975	225	
S50	62.970	1.425	Open Manhole	0		OUTFALL		S14.001	61.545	225	
S59	63.200	3.390	Open Manhole	1200	S15.000	59.810	225				
S50	62.970	3.390	Open Manhole	0		OUTFALL		S15.000	59.580	225	
S7	68.450	2.170	Open Manhole	1200	S16.000	66.280	225				
S8	68.440	4.254	Open Manhole	1200	S16.001	64.186	225	S16.000	64.186	225	
S9	67.000	3.256	Open Manhole	1200	S16.002	63.744	225	S16.001	63.756	225	12
S10	66.530	2.969	Open Manhole	1200	S16.003	63.561	225	S16.002	63.561	225	
S11	65.860	2.426	Open Manhole	1200	S16.004	63.434	225	S16.003	63.434	225	
S12	64.940	1.681	Open Manhole	1200	S16.005	63.259	225	S16.004	63.259	225	
S34	63.500	1.970	Open Manhole	1200	S17.000	61.530	225				
S13	63.750	2.293	Open Manhole	1350	S16.006	61.482	375	S16.005	62.325	225	693
								S17.000	61.457	225	
S14	63.270	1.964	Open Manhole	1350	S16.007	61.306	375	S16.006	61.306	375	
S15	63.000	1.867	Open Manhole	1350	S16.008	61.133	375	S16.007	61.133	375	
S16	62.970	3.212	Open Manhole	1350	S16.009	59.758	375	S16.008	61.059	375	1301
S61	62.400	1.425	Open Manhole	1200	S18.000	60.975	225				
S17	62.580	2.876	Open Manhole	1350	S16.010	59.704	375	S16.009	59.704	375	
								S18.000	60.873	225	1019
S18	61.730	2.169	Open Manhole	1350	S16.011	59.561	375	S16.010	59.561	375	
S19	61.360	1.833	Open Manhole	0		OUTFALL		S16.011	59.527	375	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	70.313	68.888	1.200	Open Manhole	1200
S1.001	o	225	S2	70.300	68.764	1.311	Open Manhole	1200
S1.002	o	225	S3	69.750	68.323	1.202	Open Manhole	1200
S1.003	o	225	S4	69.600	68.175	1.200	Open Manhole	1200
S2.000	o	225	S20	70.350	68.925	1.200	Open Manhole	1200
S2.001	o	225	S21	70.400	68.740	1.435	Open Manhole	1200
S2.002	o	225	S22	70.150	68.503	1.422	Open Manhole	1200
S1.004	o	225	S5	69.300	67.875	1.200	Open Manhole	1200
S3.000	o	225	S23	68.550	67.125	1.200	Open Manhole	1200
S3.001	o	225	S24	68.550	67.035	1.290	Open Manhole	1200
S3.002	o	225	S25	68.660	66.723	1.712	Open Manhole	1200
S3.003	o	225	S26	68.750	66.601	1.924	Open Manhole	1200
S4.000	o	225	S35	65.850	64.425	1.200	Open Manhole	1200
S5.000	o	225	S37	66.450	65.025	1.200	Open Manhole	1200
S4.001	o	225	S36	67.250	64.339	2.686	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	12.377	99.8	S2	70.300	68.764	1.311	Open Manhole	1200
S1.001	88.248	200.0	S3	69.750	68.323	1.202	Open Manhole	1200
S1.002	11.460	77.6	S4	69.600	68.175	1.200	Open Manhole	1200
S1.003	22.081	73.6	S5	69.300	67.875	1.200	Open Manhole	1200
S2.000	9.258	50.0	S21	70.400	68.740	1.435	Open Manhole	1200
S2.001	23.668	99.9	S22	70.150	68.503	1.422	Open Manhole	1200
S2.002	76.286	121.5	S5	69.300	67.875	1.200	Open Manhole	1200
S1.004	15.411	38.5	S6	68.900	67.475	1.200	Open Manhole	1200
S3.000	18.007	200.0	S24	68.550	67.035	1.290	Open Manhole	1200
S3.001	62.363	200.0	S25	68.660	66.723	1.712	Open Manhole	1200
S3.002	24.443	200.0	S26	68.750	66.601	1.924	Open Manhole	1200
S3.003	89.257	34.7	S27	67.100	64.031	2.844	Open Manhole	1350
S4.000	14.595	169.7	S36	67.250	64.339	2.686	Open Manhole	1200
S5.000	9.217	151.1	S36	67.250	64.964	2.061	Open Manhole	1200
S4.001	17.394	200.0	S27	67.100	64.252	2.623	Open Manhole	1350

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.000	o	225	S38	65.610	64.185	1.200	Open Manhole	1200
S3.004	o	375	S27	67.100	63.881	2.844	Open Manhole	1350
S7.000	o	225	S39	68.460	67.035	1.200	Open Manhole	1200
S7.001	o	300	S40	68.290	66.567	1.423	Open Manhole	1200
S7.002	o	300	S41	67.820	66.320	1.200	Open Manhole	1200
S3.005	o	450	S28	66.830	63.638	2.742	Open Manhole	1350
S3.006	o	450	S29	65.800	63.485	1.865	Open Manhole	1350
S8.000	o	225	S42	65.000	63.575	1.200	Open Manhole	1200
S3.007	o	450	S30	65.050	63.254	1.346	Open Manhole	1350
S3.008	o	450	S31	64.200	62.733	1.017	Open Manhole	1350
S3.009	o	450	S32	64.290	62.700	1.132	Open Manhole	1350
S9.000	o	225	S43	63.900	62.475	1.200	Open Manhole	1200
S10.000	o	225	S51	64.000	62.575	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.000	30.759	200.0	S27	67.100	64.031	2.844	Open Manhole	1350
S3.004	33.720	200.0	S28	66.830	63.713	2.742	Open Manhole	1350
S7.000	78.558	200.0	S40	68.290	66.642	1.423	Open Manhole	1200
S7.001	32.767	132.5	S41	67.820	66.320	1.200	Open Manhole	1200
S7.002	62.544	35.0	S28	66.830	64.533	1.997	Open Manhole	1350
S3.005	30.524	200.0	S29	65.800	63.485	1.865	Open Manhole	1350
S3.006	21.818	200.0	S30	65.050	63.376	1.224	Open Manhole	1350
S8.000	14.473	150.8	S30	65.050	63.479	1.346	Open Manhole	1350
S3.007	26.072	50.0	S31	64.200	62.733	1.017	Open Manhole	1350
S3.008	4.912	52.8	S32	64.290	62.640	1.200	Open Manhole	1350
S3.009	7.047	50.0	S33	64.200	62.567	1.183	Open Manhole	1350
S9.000	30.214	200.0	S44	63.760	62.324	1.211	Open Manhole	1200
S10.000	31.332	124.8	S44	63.760	62.324	1.211	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S9.001	o	225	S44	63.760	62.324	1.211	Open Manhole	1200
S9.002	o	225	S45	63.880	62.263	1.392	Open Manhole	1200
S9.003	o	300	S46	63.890	62.130	1.460	Open Manhole	1200
S9.004	o	375	S47	63.970	61.675	1.920	Open Manhole	1350
S11.000	o	225	S52	64.200	62.775	1.200	Open Manhole	1200
S12.000	o	225	S55	63.900	62.475	1.200	Open Manhole	1200
S11.001	o	225	S53	63.680	62.255	1.200	Open Manhole	1200
S13.000	o	225	S56	63.970	62.545	1.200	Open Manhole	1200
S11.002	o	225	S54	63.390	61.965	1.200	Open Manhole	1200
S9.005	o	375	S48	63.000	61.370	1.255	Open Manhole	1350
S9.006	o	375	S49	63.000	61.279	1.346	Open Manhole	1350
S14.000	o	225	S57	63.700	62.275	1.200	Open Manhole	1200
S14.001	o	225	S58	63.400	61.975	1.200	Open Manhole	1200

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Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S9.001	12.135	200.0	S45	63.880	62.263	1.392	Open Manhole	1200
S9.002	11.708	200.0	S46	63.890	62.205	1.460	Open Manhole	1200
S9.003	75.848	200.0	S47	63.970	61.750	1.920	Open Manhole	1350
S9.004	61.131	200.0	S48	63.000	61.370	1.255	Open Manhole	1350
S11.000	39.633	76.2	S53	63.680	62.255	1.200	Open Manhole	1200
S12.000	35.492	161.3	S53	63.680	62.255	1.200	Open Manhole	1200
S11.001	19.972	68.9	S54	63.390	61.965	1.200	Open Manhole	1200
S13.000	42.579	73.4	S54	63.390	61.965	1.200	Open Manhole	1200
S11.002	29.552	66.4	S48	63.000	61.520	1.255	Open Manhole	1350
S9.005	18.202	200.0	S49	63.000	61.279	1.346	Open Manhole	1350
S9.006	7.098	200.0	S50	62.970	61.243	1.352	Open Manhole	0
S14.000	13.916	46.4	S58	63.400	61.975	1.200	Open Manhole	1200
S14.001	15.970	37.1	S50	62.970	61.545	1.200	Open Manhole	0

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S15.000	o	225	S59	63.200	59.810	3.165	Open Manhole	1200
S16.000	o	225	S7	68.450	66.280	1.945	Open Manhole	1200
S16.001	o	225	S8	68.440	64.186	4.029	Open Manhole	1200
S16.002	o	225	S9	67.000	63.744	3.031	Open Manhole	1200
S16.003	o	225	S10	66.530	63.561	2.744	Open Manhole	1200
S16.004	o	225	S11	65.860	63.434	2.201	Open Manhole	1200
S16.005	o	225	S12	64.940	63.259	1.456	Open Manhole	1200
S17.000	o	225	S34	63.500	61.530	1.745	Open Manhole	1200
S16.006	o	375	S13	63.750	61.482	1.589	Open Manhole	1350
S16.007	o	375	S14	63.270	61.306	1.589	Open Manhole	1350
S16.008	o	375	S15	63.000	61.133	1.492	Open Manhole	1350
S16.009	o	375	S16	62.970	59.704	2.837	Open Manhole	1350
S18.000	o	225	S61	62.400	61.275	1.200	Open Manhole	1200
S16.010	o	375	S17	62.580	59.704	2.501	Open Manhole	1350
S16.011	o	375	S18	61.730	59.561	1.794	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S15.000	7.941	34.5	S50	62.970	59.580	3.165	Open Manhole	0
S16.000	73.946	35.3	S8	68.440	64.186	4.029	Open Manhole	1200
S16.001	77.427	180.1	S9	67.000	63.756	3.019	Open Manhole	1200
S16.002	33.000	180.3	S10	66.530	63.561	2.744	Open Manhole	1200
S16.003	22.902	180.3	S11	65.860	63.434	2.201	Open Manhole	1200
S16.004	31.530	180.2	S12	64.940	63.259	1.456	Open Manhole	1200
S16.005	61.052	65.4	S13	63.750	62.325	1.200	Open Manhole	1350
S17.000	14.502	198.7	S13	63.750	61.457	2.068	Open Manhole	1350
S16.006	35.181	199.9	S14	63.270	61.306	1.589	Open Manhole	1350
S16.007	34.579	199.9	S15	63.000	61.133	1.492	Open Manhole	1350
S16.008	14.801	199.9	S16	62.970	61.059	1.536	Open Manhole	1350
S16.009	9.811	181.7	S17	62.580	59.704	2.501	Open Manhole	1350
S18.000	8.706	85.4	S17	62.580	60.873	1.482	Open Manhole	1350
S16.010	28.677	200.0	S18	61.730	59.561	1.794	Open Manhole	1350
S16.011	6.788	200.0	S19	61.360	59.527	1.458	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.025	0.025	0.025
1.001	User	-	100	0.117	0.117	0.117
1.002	User	-	100	0.016	0.016	0.016
1.003	User	-	100	0.033	0.033	0.033
2.000	User	-	100	0.011	0.011	0.011
2.001	User	-	100	0.017	0.017	0.017
2.002	User	-	100	0.109	0.109	0.109
1.004	User	-	100	0.036	0.036	0.036
3.000	User	-	100	0.089	0.089	0.089
3.001	User	-	100	0.095	0.095	0.095
3.002	User	-	100	0.036	0.036	0.036
3.003	User	-	100	0.331	0.331	0.331
4.000	User	-	100	0.049	0.049	0.049
5.000	User	-	100	0.041	0.041	0.041
4.001	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.071	0.071	0.071
3.004	User	-	100	0.043	0.043	0.043
7.000	User	-	100	0.278	0.278	0.278
7.001	User	-	100	0.102	0.102	0.102
7.002	User	-	100	0.182	0.182	0.182
3.005	User	-	100	0.086	0.086	0.086
3.006	User	-	100	0.049	0.049	0.049
8.000	User	-	100	0.051	0.051	0.051
3.007	User	-	100	0.051	0.051	0.051
3.008	-	-	100	0.000	0.000	0.000
3.009	-	-	100	0.000	0.000	0.000
9.000	User	-	100	0.071	0.071	0.071
10.000	User	-	100	0.145	0.145	0.145
9.001	User	-	100	0.045	0.045	0.045
9.002	User	-	100	0.008	0.008	0.008
9.003	User	-	100	0.322	0.322	0.322
9.004	User	-	100	0.141	0.141	0.141
11.000	User	-	100	0.120	0.120	0.120
12.000	User	-	100	0.081	0.081	0.081
11.001	User	-	100	0.019	0.019	0.019
13.000	User	-	100	0.108	0.108	0.108
11.002	User	-	100	0.035	0.035	0.035
9.005	User	-	100	0.024	0.024	0.024
9.006	-	-	100	0.000	0.000	0.000
14.000	User	-	100	0.081	0.081	0.081
14.001	-	-	100	0.000	0.000	0.000
15.000	-	-	100	0.000	0.000	0.000
16.000	-	-	100	0.000	0.000	0.000
16.001	-	-	100	0.000	0.000	0.000
16.002	-	-	100	0.000	0.000	0.000
16.003	-	-	100	0.000	0.000	0.000
16.004	-	-	100	0.000	0.000	0.000
16.005	-	-	100	0.000	0.000	0.000
17.000	-	-	100	0.000	0.000	0.000
16.006	-	-	100	0.000	0.000	0.000
16.007	-	-	100	0.000	0.000	0.000

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
16.008	-	-	100	0.000	0.000	0.000
16.009	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.000	0.000	0.000
16.010	-	-	100	0.000	0.000	0.000
16.011	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.116	3.116	3.116

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S6	68.900	67.475	66.280	1200	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S3.009	S33	64.200	62.567	61.580	1350	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S9.006	S50	62.970	61.243	59.784	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S14.001	S50	62.970	61.545	59.784	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S15.000	S50	62.970	59.580	59.784	0	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S16.011	S19	61.360	59.527	57.960	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	1.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	30
Ratio R	0.300		

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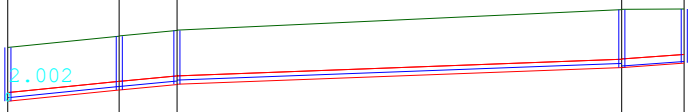
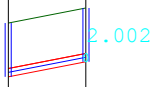
TOBIN Consulting Engineers		Page 1
Block 10-3 Blanchardstown Corporate Park Dublin 15	10243 NCOD	
Date 25.10.17 File 17.10.24 DRAINAGE DESIG...	Designed by CS Checked by AM	
Micro Drainage	Network 2014.1.1	

MH Name	S5	S4		S2		
Hor Scale 1500 Ver Scale 200 Datum (m) 64.000						
PN		S1.003		S1.001		
Dia (mm)		225		225		
Slope (1:X)		73.6		200.0		
Cover Level (m)	69.300	69.600	69.750	70.300	70.313	
Invert Level (m)		67.875	68.175	68.175	68.323	68.323	68.764	68.764	68.888
Length (m)		22.081		88.248		

MH Name	S6		
Hor Scale 1500 Ver Scale 200 Datum (m) 64.000			
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	68.900	69.300	
Invert Level (m)		67.475	67.875	
Length (m)			

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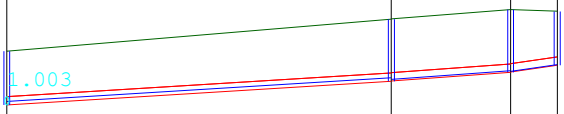
MH Name	S5	S22	S21		
Hor Scale 1500 Ver Scale 200 Datum (m) 65.000					
PN		S2.002	S2.001		
Dia (mm)		225	225		
Slope (1:X)		121.5	99.9		
Cover Level (m)	69.300	70.150	70.400	70.350	
Invert Level (m)		67.875 / 68.503	68.503 / 68.740	68.925	
Length (m)		76.286	23.668		

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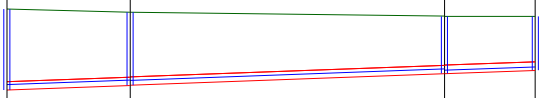
MH Name	S26	S25	S24		
Hor Scale 1500 Ver Scale 200 Datum (m) 63.000					
PN		S3.002	S3.001		
Dia (mm)		225	225		
Slope (1:X)		200.0	200.0		
Cover Level (m)	68.750	68.660	68.550	68.550	
Invert Level (m)		66.601 / 66.723	66.723 / 67.035	67.035 / 67.125	
Length (m)		24.443	62.363		

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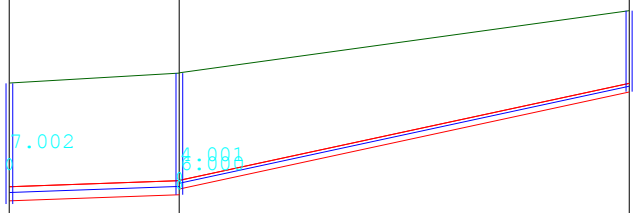
MH Name	S28	S27	S26
Hor Scale 1500 Ver Scale 200 Datum (m) 62.000			
PN		S3.004	S3.003
Dia (mm)		375	225
Slope (1:X)		200.0	34.7
Cover Level (m)	66.830	67.100	68.750
Invert Level (m)		63.713 / 63.881	66.601
Length (m)		33.220	89.257

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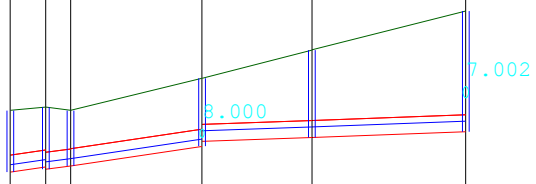
MH Name	S33			S30	S29	S28
Hor Scale 1500 Ver Scale 200 Datum (m) 60.000						
PN				S3.007	S3.006	S3.005
Dia (mm)				450	450	450
Slope (1:X)				50.0	200.0	200.0
Cover Level (m)	64.200	64.290		65.050	65.800	66.830
Invert Level (m)		62.708	62.733	63.254	63.376 / 63.485	63.485 / 63.638
Length (m)				26.072	21.818	30.524

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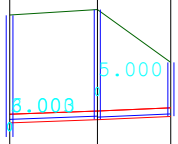
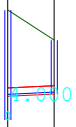
MH Name	S27			
Hor Scale 1500 Ver Scale 200 Datum (m) 61.000				
PN				
Dia (mm)				
Slope (1:X)				
Cover Level (m)	67.100	67.250	65.850	
Invert Level (m)	64.252	64.339	64.425	
Length (m)				

MH Name	S36		
Hor Scale 1500 Ver Scale 200 Datum (m) 61.000			
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	67.250	66.450	
Invert Level (m)		65.025	
Length (m)			

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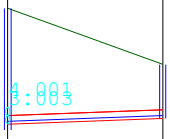
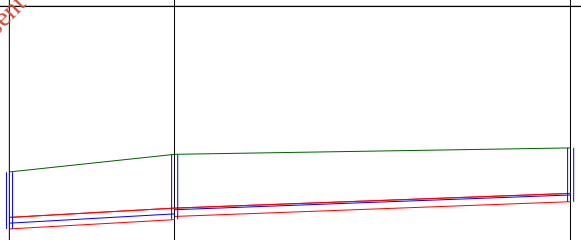
MH Name	S27	S38	
Hor Scale 1500 Ver Scale 200 Datum (m) 61.000			
PN		S6.000	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	67.100	65.610	
Invert Level (m)	64.031	64.185	
Length (m)		30.759	

MH Name	S41	S40	S39	
Hor Scale 1500 Ver Scale 200 Datum (m) 63.000				
PN		S7.001	S7.000	
Dia (mm)		300	225	
Slope (1:X)		132.5	200.0	
Cover Level (m)	67.820	68.290	68.460	
Invert Level (m)		66.320 66.567	66.642 67.035	
Length (m)		32.767	78.558	

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MH Name	S28	S41	
Hor Scale 1500 Ver Scale 200 Datum (m) 61.000		3.004	
PN		S7.002	
Dia (mm)		300	
Slope (1:X)		35.0	
Cover Level (m)	66.830	67.820	
Invert Level (m)	64.533	66.320	
Length (m)		62.544	

MH Name	S30		
Hor Scale 1500 Ver Scale 200 Datum (m) 60.000		3.006	
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	65.050	65.000	
Invert Level (m)		63.479 63.575	
Length (m)			

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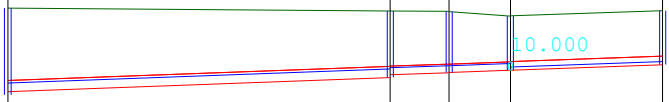
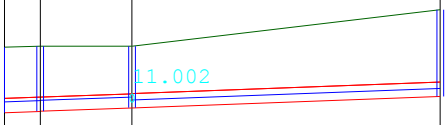
MH Name	S47		S46			S43	
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000							
PN		S9.003				S9.000	
Dia (mm)		300				225	
Slope (1:X)		200.0				200.0	
Cover Level (m)	63.970		63.890	63.880	63.760	63.900	
Invert Level (m)		61.750	62.130	62.205	62.263	62.263	62.324	62.324	62.475	
Length (m)		75.848				30.214	

MH Name	S50			S47	
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000					
PN			S9.004		
Dia (mm)			375		
Slope (1:X)			200.0		
Cover Level (m)	62.970	63.000	63.000	63.970	
Invert Level (m)		61.279	61.279	61.370	61.370	61.675	
Length (m)			61.131		

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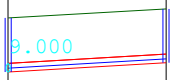
MH Name	S44	S51	
Hor Scale 1500 Ver Scale 200 Datum (m) 59.000			
PN		S10.000	
Dia (mm)		225	
Slope (1:X)		124.8	
Cover Level (m)	63.760	64.000	
Invert Level (m)	62.324	62.575	
Length (m)		31.332	

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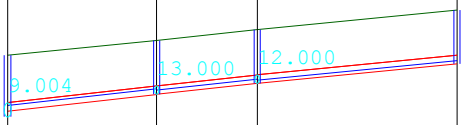
MH Name	S48	S54	S53	S52	
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000					
PN		S11.002	S11.001	S11.000	
Dia (mm)		225	225	225	
Slope (1:X)		66.4	68.9	76.2	
Cover Level (m)	63.000	63.390	63.680	64.200	
Invert Level (m)		61.520 61.965	61.965 62.255	62.255 62.775	
Length (m)		29.552	19.972	39.633	

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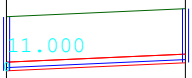
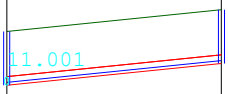
MH Name	S53	S55	
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000			
PN		S12.000	
Dia (mm)		225	
Slope (1:X)		161.3	
Cover Level (m)	63.680	63.900	
Invert Level (m)	62.255	62.475	
Length (m)		35.492	

MH Name	S54	S56	
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000			
PN		S13.000	
Dia (mm)		225	
Slope (1:X)		73.4	
Cover Level (m)	63.390	63.970	
Invert Level (m)	61.965	62.545	
Length (m)		42.579	

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MH Name	S50			
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000				
PN				
Dia (mm)				
Slope (1:X)				
Cover Level (m)	62.970	63.400	63.700	
Invert Level (m)	61.545	61.975	61.975	62.275
Length (m)				

MH Name	S50		
Hor Scale 1500 Ver Scale 200 Datum (m) 57.000			
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	62.970	63.200	
Invert Level (m)		59.810	
Length (m)			

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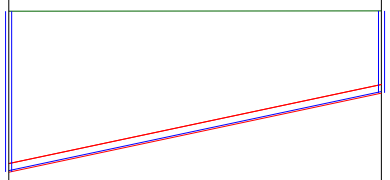
MH Name	S8	S7	
Hor Scale 1500 Ver Scale 200 Datum (m) 62.000			
PN		S16.000	
Dia (mm)		225	
Slope (1:X)		35.3	
Cover Level (m)	68.440	68.450	
Invert Level (m)	64.186	66.280	
Length (m)		73.946	

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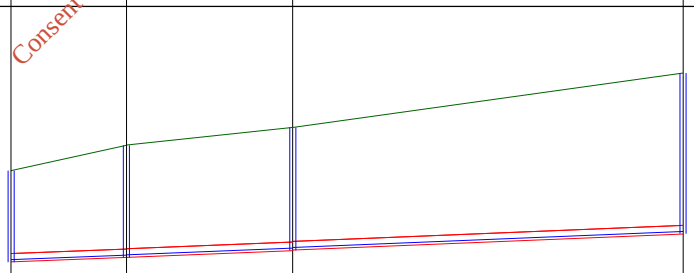
MH Name	S11	S10	S9	S8	
Hor Scale 1500 Ver Scale 200 Datum (m) 61.000					
PN		S16.003	S16.002	S16.001	
Dia (mm)		225	225	225	
Slope (1:X)		180.3	180.3	180.1	
Cover Level (m)	65.860	66.530	67.000	68.440	
Invert Level (m)		63.434 63.561	63.561 63.744	63.756 64.186	
Length (m)		22.902	33.000	77.427	

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MH Name	S14	S13	S12	S11	
Hor Scale 1500 Ver Scale 200 Datum (m) 59.000			17.000		
PN		S16.006	S16.005	S16.004	
Dia (mm)		375	225	225	
Slope (1:X)		199.9	65.4	180.2	
Cover Level (m)	63.270	63.750	64.940	65.860	
Invert Level (m)		61.306	61.482 / 61.305	63.259 / 63.259	63.434
Length (m)		35.181	61.052	31.530	

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MH Name	S19		S17			S14	
Hor Scale 1500 Ver Scale 200 Datum (m) 57.000				18.000			
PN			S16.010			S16.007	
Dia (mm)			375			375	
Slope (1:X)			200.0			199.9	
Cover Level (m)	61.360	61.730	62.580	62.970	63.000	63.270	
Invert Level (m)		59.561	59.561 / 59.704	59.758	61.059 / 61.133	61.133 / 61.306	
Length (m)			28.677			34.579	

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MH Name	S13		
Hor Scale 1500 Ver Scale 200 Datum (m) 58.000		16.009	
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	63.750	63.500	
Invert Level (m)	61.457	61.530	
Length (m)			

MH Name	S17		
Hor Scale 1500 Ver Scale 200 Datum (m) 57.000		16.009	
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	62.580	62.400	
Invert Level (m)		60.975	
Length (m)			

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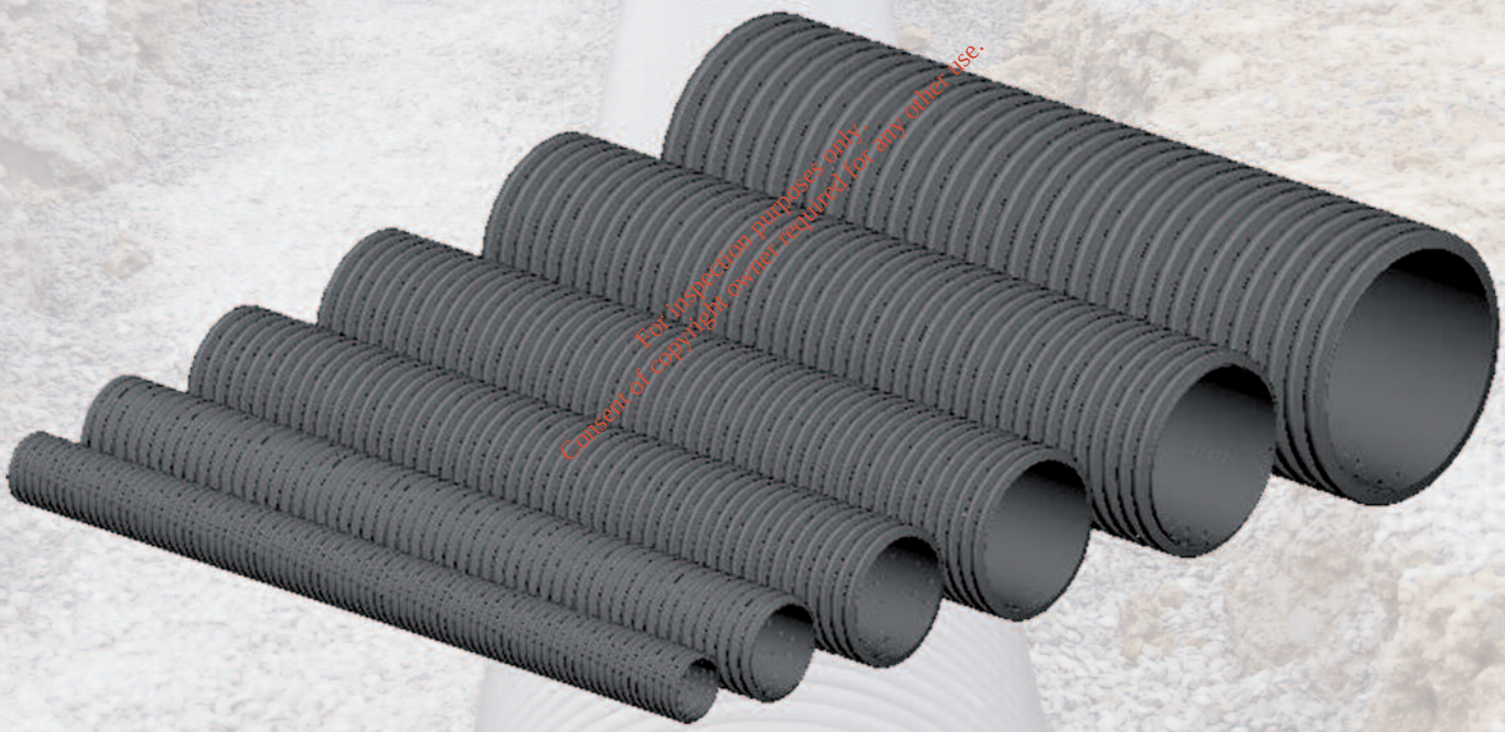
CorriPipe™
Technical Specification



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CorriPipe™ Technical Specification

1. Introduction

CorriPipe™ is a twin wall high density polyethylene pipe manufactured from a blended black polyethylene by a twin extrusion process.

Two high density polyethylene walls are extruded simultaneously, one inside the other, and heat-welded together in one continuous process. The outer wall is corrugated and the inner wall is smooth finished.

It is a combination of the corrugations, and the heat-welding of the two walls, that give CorriPipe™ its excellent structural strength while its smooth inner wall ensures increased flow capacity.

Its applications include surface and storm water drainage in civil engineering, construction, sports amenity, agricultural and other sub-soil applications.

CorriPipe™ is fully BBA (British Board of Agrément) approved and HAPAS (Highways Agency Product Approval Scheme) certified.

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Figure 1. – CorriPipe™

2. Dimensions

CorriPipe™ comes in a complete range between 100m and 600mm and is available in either carrier of filter pipe. CorriPipe™ also has a complete range of fittings and junctions as detailed below.

Nominal Size (mm)	Inside Diameter (mm)	Outside Diameter (mm)	Pipe Length (m)
94	94	110	6
150	149	176	6
225	221	265	6
300	295	354	6
375	370	426	6
450	445	512	6
600	590	680	6

Table 1. – CorriPipe™ Dimensions

Nominal Size (mm)	No. of slots per alternate dwell	Nom. Slot Width (mm)	Pefrorated Area (mm²/m)
94	4	1.5	7920
150	4	2	6120
225	4	2	4680
300	4	2	5120
375	3	3	4263
450	3	3	4024
600	3	3	4942

Table 2. – Perforated Pipe Detail

Note: CorriPipe also available in various perforation specification. e.g. half perforated, double perforated.

Nominal Size (mm)	Code	Fitting Type
150	150TB30	30° Bend
150	150TB45	45° Bend
150	150TB90	90° Bend
150	150TT90	Equal Tee
150	150TY45	Equal Wye
150	150SWSTT90	Single Wall Tee
225	225TB30	30° Bend
225	225TB45	45° Bend
225	225TB90	90° Bend
225	225TT90	Equal Tee
225	225TY45	Equal Wye
225	225/150TT90	Unequal Tee 150
225	225/150TY45	Unequal Wye 150
225	225SWSTT90	Single Wall Tee
300	300TB30	30° Bend
300	300TB45	45° Bend
300	300TB90	90° Bend
300	300TT90	Equal Tee
300	300TY45	Equal Wye
300	300/150TT90	Unequal Tee 150
300	300/150TY45	Unequal Wye 150
300	300/225TT90	Unequal Tee 225
300	300/225TY45	Unequal Wye 225
300	300SWSTT90	Single Wall Tee

Table 3. – CorriPipe™ Fittings

Note: Larger fitting sizes fabricated on request

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CorriPipe™ Technical Specification

3. Hydraulic Capacity

There are two main formulas used in hydraulic calculations of gravity flow pipelines – Manning's and Colebrook-White:

Manning's

Manning's is the most popular equation for stormwater design because it is simple to apply and it generally provides an acceptable level of accuracy.

$$Q = \frac{1}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

Q = Water Discharge [m^3/s]

n = Manning's roughness factor [s/m1/3]]

A = Cross-sectional area [m2]

R = Hydraulic radius [m]

S = Surface Water Slope [m/m]

Colebrook-White

A more accurate method for calculations involving FRC™ pipes is to utilize the Colebrook-White formula. The Colebrook-White design chart for FRC™ should allow quick and easy estimates without involved calculations.

$$V = -2\sqrt{2gDS}\log\left(\frac{k}{3.7D} + \frac{2.51v}{d\sqrt{2gDS}}\right)$$

V = Velocity (m/s)

S = Hydraulic gradient (m/m)

k = Hydraulic roughness (m)

R = Hydraulic radius = D/4 (m)

D = Pipe internal diameter (m)

g = Gravitational acceleration (m/s2)

v = Kinematic viscosity of water (m2/s)

4. Cover Depths

Minimum Cover Depths

JFC Manufacturing Limited recommends the following minimum cover depths.

- 0.6m for non trafficked green areas
- 0.9m to finished surface for trafficked areas not subject to Highways Agency or National Roads Authority requirements
- 1.2m to finished surface for trafficked areas subject to Highways Agency or National Roads Authority requirements.

In certain circumstances lower minimum cover levels may be allowed. e.g. installation with rigid pavement, concrete surround etc. Please contact JFC for more information.

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Maximum Cover Depths

The maximum cover depth for CorriPipe™ is normally between 6-10 meters when installed in accordance with series 500 of the MCDHW Volume 1 as detailed in the CorriPipe™ BBA certificate.

The actual maximum allowable cover level is dependent on the following installation parameters and is often well in excess of 6-10 meters:

- The native soil stiffness
- The pipe bed and surround stiffness
- The size of the trench
- The density of the overburden
- Hydrostatic loading
- Factor of Safety
- Maximum allowable deflection limit

For specific site conditions JFC can calculate the maximum pipe deflection based on the above parameters. Contact JFC for more details.

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CorriPipe™ Technical Specification

4. Installation

JFC CorriPipe is to be installed in accordance with the following national guidelines. In countries outside that specified contact JFC for more details.

Ireland

The Manual of Contract Documents for Road Works, Volume 1 series 500, clauses 503 and 505 as published by the NRA.

United Kingdom

The Manual of Contract Documents for Highway Works, Volume 1 series 500, clauses 503, 505, 518.7 and 518.8 as published by the Highways Agency

Trench Preparation

The trench width is generally between OD+300mm and OD+600mm but larger trenches are permissible. The trench should provide for a minimum of 150mm pipe bed and local soft spots must be removed and replaced with hardcore. The pipe must sit evenly on the bed and must be free of voids under the pipe. The trench should not be excavated too far in advance of pipe installation. All trenches are to be excavated in accordance with national health and safety regulations and local building regulations.

Sidefill

CorriPipe™ is to backfilled as described in the MCDHW, Volume 1, Series 500. Sidefill material is dependent on specification but is normally a well graded granular material or small single size aggregate. The pipe surround material must fully support the pipe. Compaction may be required depending on ground conditions and sidefill material used. If compaction is required the compaction equipment must not come in contact with the pipe. The sidefill material should extend to 100mm over the crown of the pipe.

Backfill

Backfill is to continue to a minimum of 300mm above the crown of the pipe with suitable material as per specification. The material should be free of any stone particles greater than 50mm. Compaction should not be carried out until a minimum cover of 300mm is achieved. Compaction equipment should be sized so as not to exert any undue stress in the pipe. Further backfill to the required level should be carried out in layer no greater than 300mm.

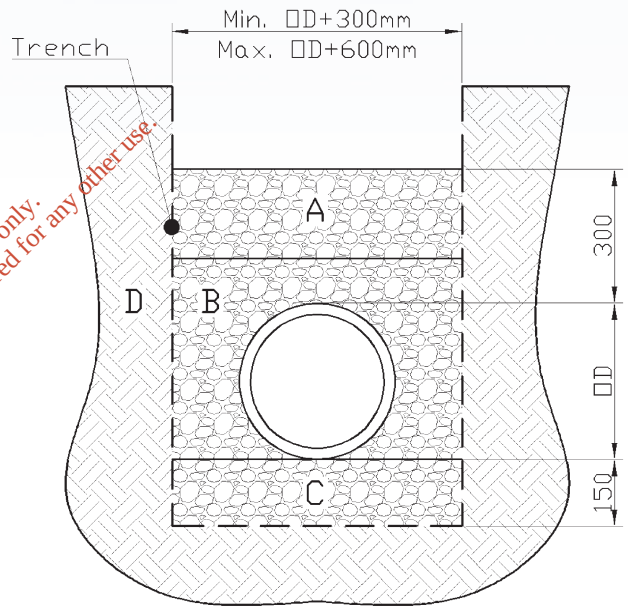

Figure 2. – Typical Installation Details

A = Backfill

B = Sidefill

C = Bed

D = Earth

OD = Outside Diameter of Pipe

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5. Jointing

CorriPipe™ is manufactured in 6 meter lengths and is joined with straight couplers or suitable fittings (e.g. tees, wyes, bends etc.)

CorriPipe™ provides a fully watertight seal when installed in accordance with JFC recommendations.

Leak tightness is in accordance with BS EN 1277:1997. The maximum permitted angular deflection is 2°.

Rubber seals used in watertight applications are in accordance with BS EN 681-1:1996

JFC recommends the following procedure for joining CorriPipe™ and associated fittings / couplers.

- Cut the pipe to the require length with a conventional handsaw.
- Clean the end of the pipe and accompanying coupler / fitting.
- Install a ring seal in the first dwell of the pipe for watertight joints.
- Ring seals are bi directional
- Lubricate the ring seal and accompanying coupler / fitting.
- Offer the fitting / coupler up to the pipe
- Lever the fitting / coupler onto the pipe with a piece of timber ensuring not to damage the pipe. Larger pipes may require mechanical assistance.
- Ensure the fitting / coupler is butted fully against the pipe.
- For joining pipes to the opposite side of the fitting / coupler follow the same steps as outlined above.

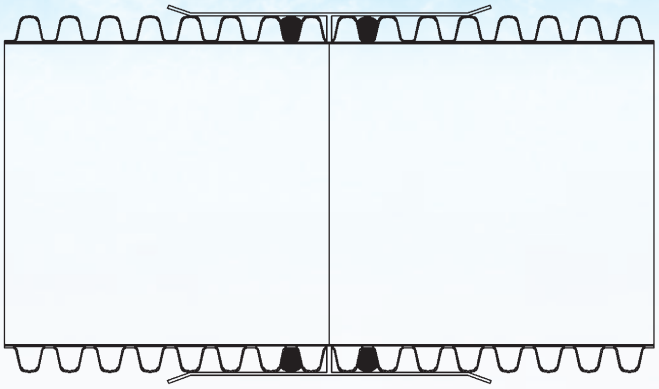

Figure 3. – Typical Joint Details

6. Pressure Testing

There are two methods of pressure testing, the air test method and the water test method. The most common method is the air test method and the test procedure is outlined below.

- Block the ends of the pipe / fitting with a suitable expanding stopper, ensuring both plug and pipe are cleaned prior to fitting.
- Fill a U-Tube manometer with water to the correct level, ensuring there are no trapped air bubbles in the water.
- Connect the u-tube to the fitting on the expandable stopper.
- Increase the pressure in the pipe until a head of water of 100mm is reached.
- Allow the pressure to stabilise for a number of minutes, increasing the pressure if it drops.
- Record the pressure drop over a five minute period.
- To pass the test the pressure should not drop below a 75mm head of water.

Note: Temperature has a critical effect on the test, a 1°C change in air temperature inside the pipe is sufficient for the test to fail.

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6. Transportation, Handling and Storage

General

Handling should be done carefully and in accordance with national health and safety guidelines. Dragging of pipes and fittings must be avoided. HDPE pipes and fittings become slippery in wet or in cold weather and extra precautions may be necessary.

Pipes up to 450mm in size are palletised with wooden frames and steel straps. 600mm pipes are generally steel banded in two's but can also be supplied loose.

Nominal Size (mm)	Number of Pipes per Pallet
100	100
150	33
225	14
300	8
375	5
450	4
600	2 / steel banded

Table 4. – CorriPipe™ Pallet Quantities

Storage

All materials should be carefully inspected at the time of delivery and any defects should be notified and reported immediately. All pipe stacks should be made on firm, flat ground to support the weight of the pipes and lifting equipment. For safety and Pipes and fittings should be transported and stored in their packaging.

Delivery vehicles should be provided with a clean, flat bed, free from sharp objects. Care must be taken to prevent slippage or excessive bowing of the pipes. Tie the load well to prevent rubbing. Use nylon straps, not chains or ropes.

The stacking height for pipes should be limited to not more than 3 meters. Pipes should be not be stored in open areas subject to high winds.

It is recommended that CorriPipe™ is not stored in direct sunlight for more than 3 months.

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APPENDIX 7

Bypass Separator Details

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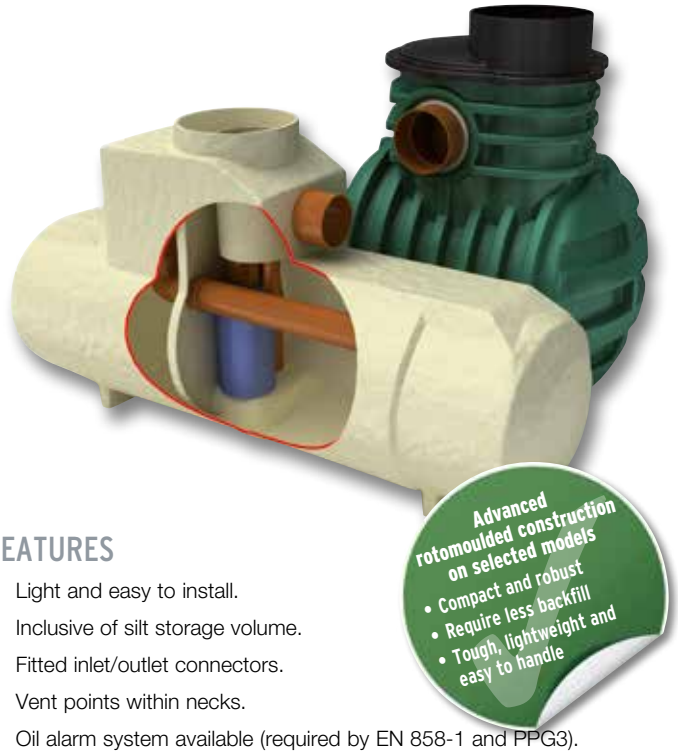
Bypass NSB RANGE



APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

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FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m²)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction GRP chamber construction * Some units have more than one access shaft – diameter of largest shown.

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APPENDIX 8

Rainwater Harvesting Tank Details

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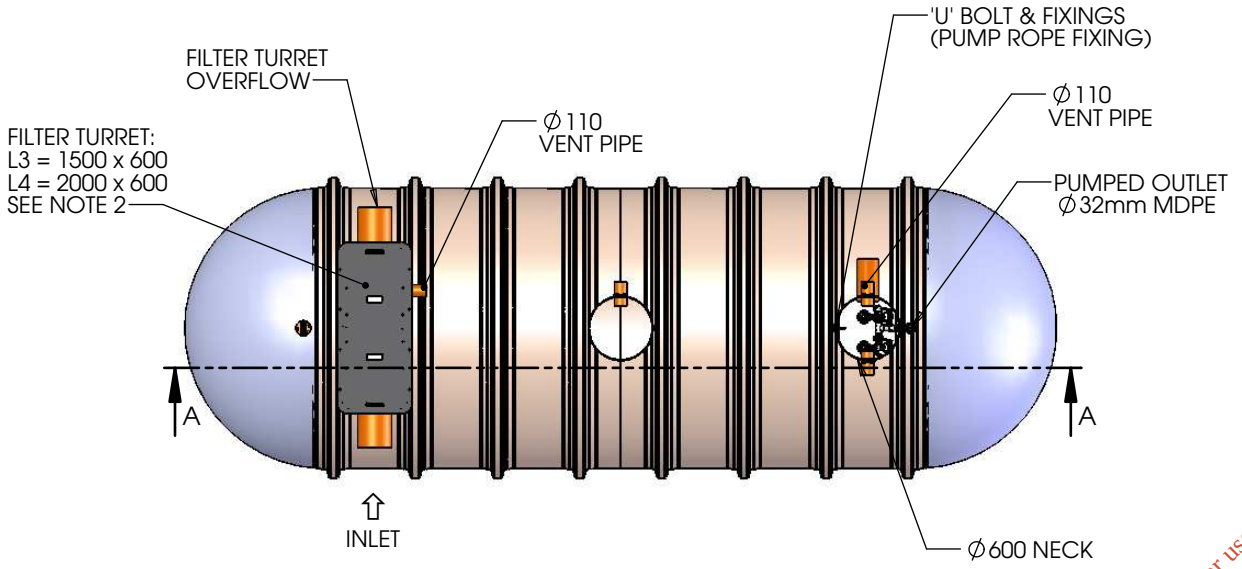
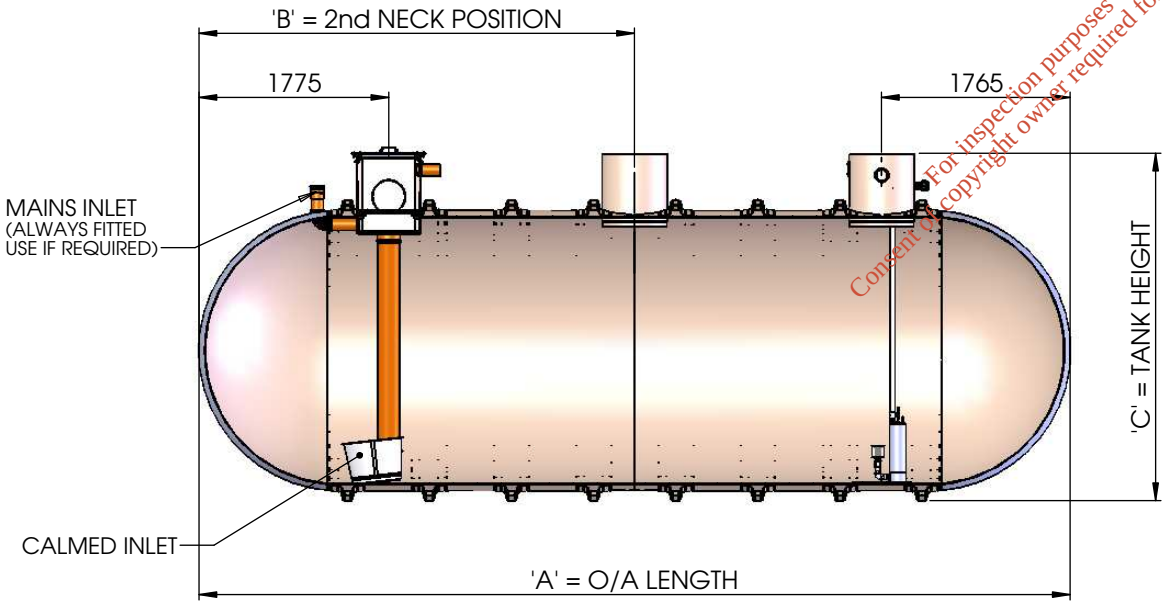
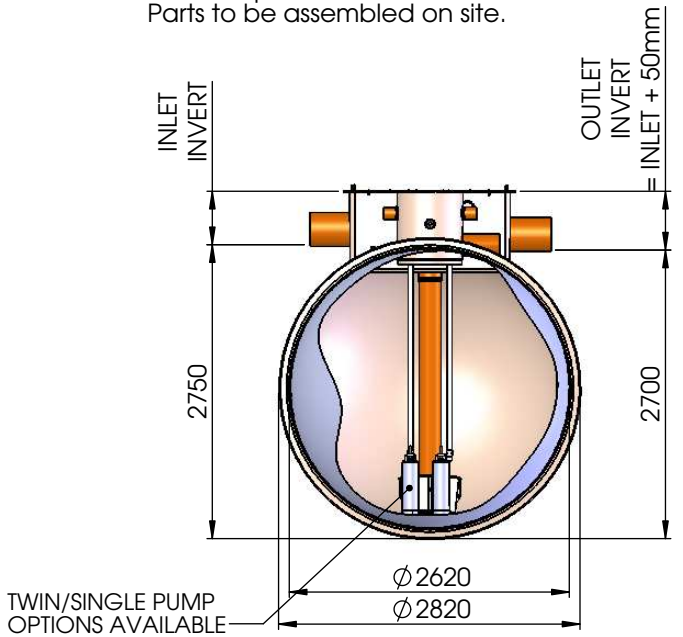


Dimension Table									
System	Dim 'A' (mm)	Dim 'B' (mm)	Height Dim 'C' (Invert Option)				Volume (L)	Approx kg (Empty)	Tank Ø (mm)
			Inlet Invert 500mm	Inlet Invert 1000mm	Inlet Invert 1500mm	Inlet Invert 2000mm			
ENV0625	4,315	-	3210	3710	4210	4710	18,000	960	2,820
ENV0765	5,075	-	3210	3710	4210	4710	22,000	1,080	2,820
ENV0900	5,840	-	3210	3710	4210	4710	26,000	1,300	2,820
ENV1040	6,605	-	3210	3710	4210	4710	30,000	1,480	2,820
ENV1320	8,150	4,075	3210	3710	4210	4710	38,000	1,860	2,820
ENV1460	8,920	3,310	3210	3710	4210	4710	42,000	2,050	2,820
ENV1735	10,455	4,075	3210	3710	4210	4710	50,000	2,420	2,820
ENV2050	11,995	4,850	3210	3710	4210	4710	59,000	2,940	2,820
ENV2325	13,530	4,850	3210	3710	4210	4710	67,000	3,210	2,820
ENV2745	15,885	5,615	3210	3710	4210	4710	79,000	3,770	2,820

Notes:-
1. For Inlet/Overflow pipe sizes see Article Structure.
2. Filter Options (*For details consult Technical Sales)
   L3 = Flow Rate *70ltrs/sec (Av. Roof Area 10000m²)
   L4 = Flow Rate *100ltrs/sec (Av. Roof Area 14000m²)
3. Rectangular filter turret (L3,L4) always fitted
   Dimension 'B' when alone indicates a single circular neck unit.
   Dimensions 'B' & 'C' together indicate a twin circular neck unit.
4. It is essential that this drawing is read in conjunction with GL0051P (supplied with unit) installation details. This drawing should be used for dimensional information only.
5. If unit requires neck extensions, consult Technical Sales. Parts to be assembled on site.



SECTION A-A



Filter Std. Pipe Dia's.
C=160mm **D**=200mm **F**=250mm **G**=315mm (See Article Structure)

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Please check with Kingspan Environmental that this drawing is the latest issue				
Issue	Date	Drawn by	Approved by	Description
01	30.01.12	P.T.C		INITIAL RELEASE - CC1025

Material : Various	Tolerance :
Finish :	Thickness : n/a
Weight : 1597.10 Kg Kgs	Surface Area :

Drawing : DS1162P

18000L To 79000L RWH Storage Tanks + Filter

All dimensions in mm

Scale: Not to scale

Y:\Engineering Projects\GENERAL PROJECTS\Commercial RWH\Drawings\DS1162P

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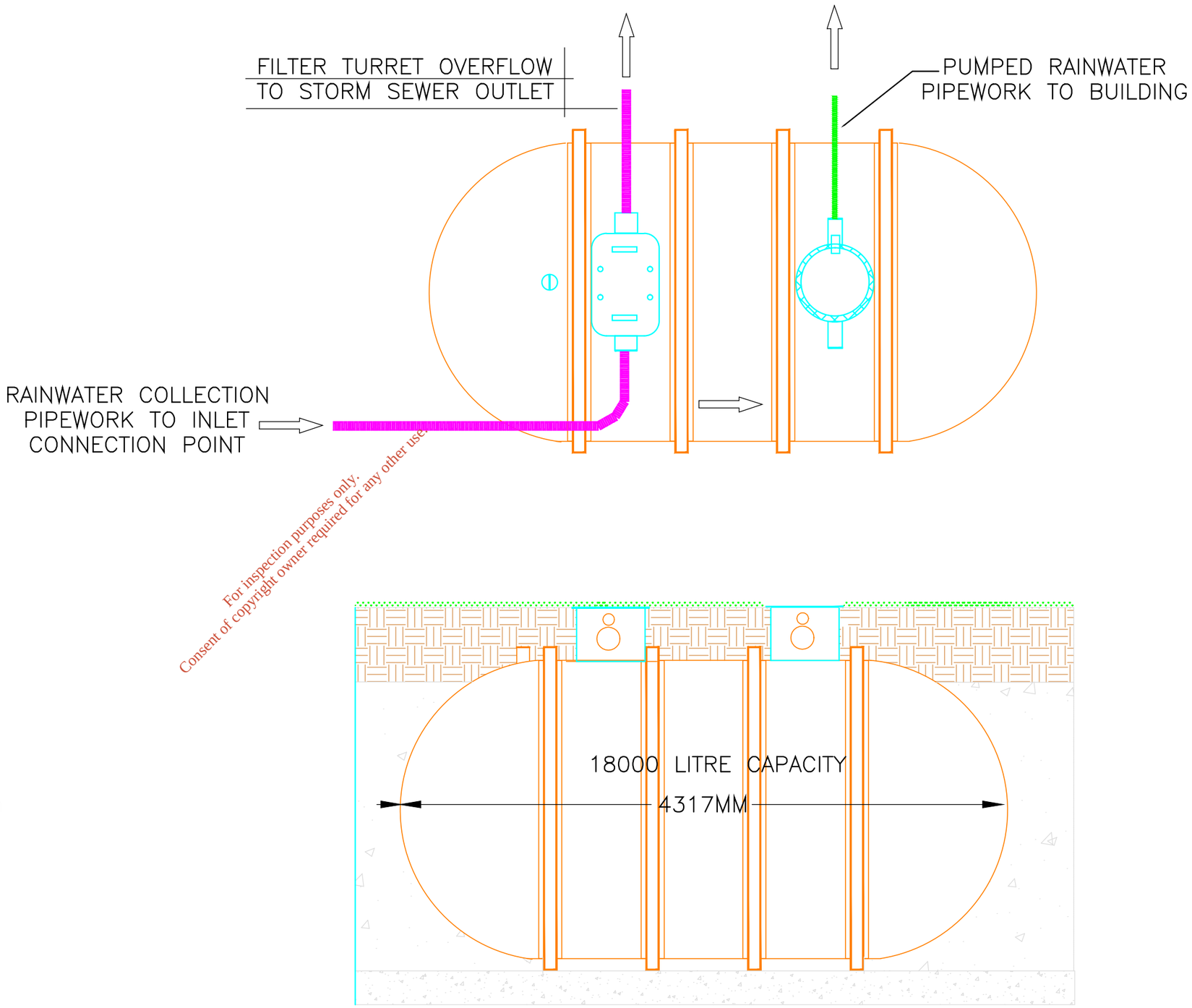
TYPICAL UNDERGROUND TANK DETAILS
FOR RAINWATER HARVESTING APPLICATIONS
SCALE NTS

CONTRACTOR TO REFER TO MANUFACTURERS INSTALLATION GUIDELINES FOR FULL DETAILS THESE DRAWINGS ARE ONLY FOR TENDER GUIDELINE PURPOSES



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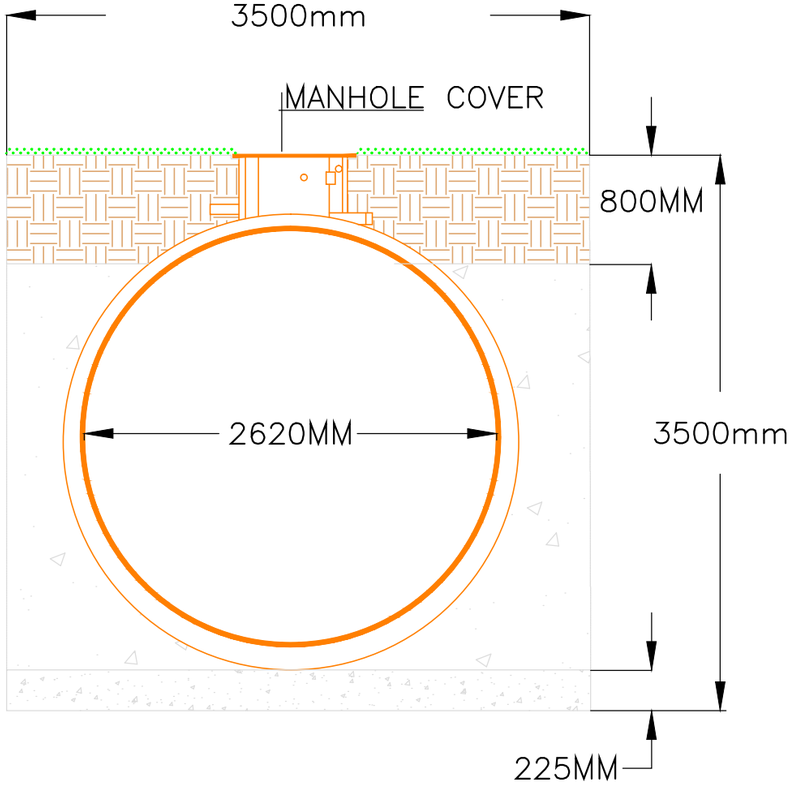

SECTION VIEW

ELEVATION

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