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PLANNING SUBMISSION

ENGINEERING REPORT FOR HAVEN FALLS LIMITED, WATERROCK, MIDLETON, CO. CORK.

NOV 2022
REVISION H
JOB NO: 21059

CONTENTS

Document Control

Document Number 21059-ER-01

Revision	Date	Prepared	Checked	Approved
A(DRAFT)	22/12/2021	E. Kingston		
B(DRAFT)	27/01/2022	E. Kingston		
C	08/03/2022	E. Kingston		
D	28/03/2022	E. Kingston	D. Butler	D. Butler
E	03/06/2022	E. Kingston	D. Butler	D. Butler
F	21/09/2022	E. Kingston	D. Butler	D. Butler
G	26/10/2022	E. Kingston	D. Butler	D. Butler
H	22/11/2022	E. Kingston	D. Butler	D. Butler

1.0 INTRODUCTION

Haven Falls Limited intend to apply for planning permission for a proposed mixed use (primarily residential) development at Water Rock, Midleton, County Cork on a circa 9.5-hectare site.

The proposed development will be served by a new public services and infrastructure with network to serve the development to be constructed in accordance with Irish Water standards.

The foul network serving the development will be constructed in accordance with Irish Water standards and connect to the new foul infrastructure being provided as part of the Midleton Load Diversion Project.

Surface water management will be based on SuDS principles.

2.0 ROADS

All road layouts have been designed by Gittens Murray Architects Ltd and O' Shea Leader Consulting Engineer's.

All road gradients are between 0.5% and 10% in compliance with the 'Recommendations for site development works for housing areas' published by the Department of the Environment.

A cross fall of 2.5% shall be provided for all roads and footpaths.

All driveways will comply with Part M of the Building Regulations.

The parking will be provided in accordance with the schedule of accommodation prepared by the architects.

The first 7m of the entrance road is designed at gradient of 2% (1:50) in compliance with the **'Recommendations for Site Development works for Housing Areas'**

All estate roads within the development which provide access to individual dwellings have a maximum slope of 5% (1:20).

Therefore, all the internal road gradients are designed in accordance with the relevant regulations and good design practice.

All driveways will comply with Part M of the Building Regulations.

2.1 COMPLIANCE WITH DMURS

The development layout has been designed in accordance with the Design Manual for Urban Roads and Streets (DMURS) as published by the Department of Transport, Tourism and Sport. Integral to the design of the development street network has been ensuring strong pedestrian connectivity, slow vehicle speeds and good visibility for road users.

The development has placed pedestrians at the top of the hierarchy. Footpath widths throughout the site are 2m and additionally a number of shared spaces for pedestrians have been provided in front of several houses. On cul-de-sacs in the site, a "shared surface" will be provided on which vehicles, bicycles and pedestrians share the same surface. This will assist in giving pedestrians priority and in reducing vehicle speeds.

The internal roads within the estate have sightlines with 23m with 2.4m setback for a given design speed of 30km/hr is consistent with the forward visibility. I refer to Design Manual for Urban Roads and Streets (DMURS) p107.

> *The minimum level of forward visibility required along a street for a driver to stop safely, should an object enter its path, is based on the Stopping Sight Distances (SSD). The SSD has 3 constituent parts:*
>
> - *Perception Distance: The distance travelled before the driver perceives a hazard.*
> - *Reaction Distance: The distance travelled following the perception of a hazard until the driver applies the brakes.*
> - *Braking Distance: The distance travelled until the vehicle decelerates to a halt.'*

The internal roads within the site have been design for Forward Visibility design speeds of 30km/hr but the speed limit of the internal roads is much less due to the additional traffic management measures that have been incorporated into the site to ensure reduced speeds within the site.

Road widths in the proposed development are as per the attached drawings and sections.

2.2 CONNECTIVITY TO LINEAR PARK

The proposed WaterRock Linear Park, to the East of the subject site, which is due to be developed by Cork County Council, has been consider with when designing the proposed development, to allow for the provision of appropriate connectivity. Levels East and West of Redline Boundary are to be aligned to ensure connection feasibility.

Levels on subject site allow for the tie in with same. The tie-in point should be at 12.270m, as per CCC, and suit existing levels to the west of the redline boundary, with the levels of the Water-Rock Linear Park being designed to link in with same. (Level to East, as shown on the accompanying drawings, are indicative only). Proposed Path Levels indicated to allow for path, north of Apartment Block, to be at a gradient >1:20.

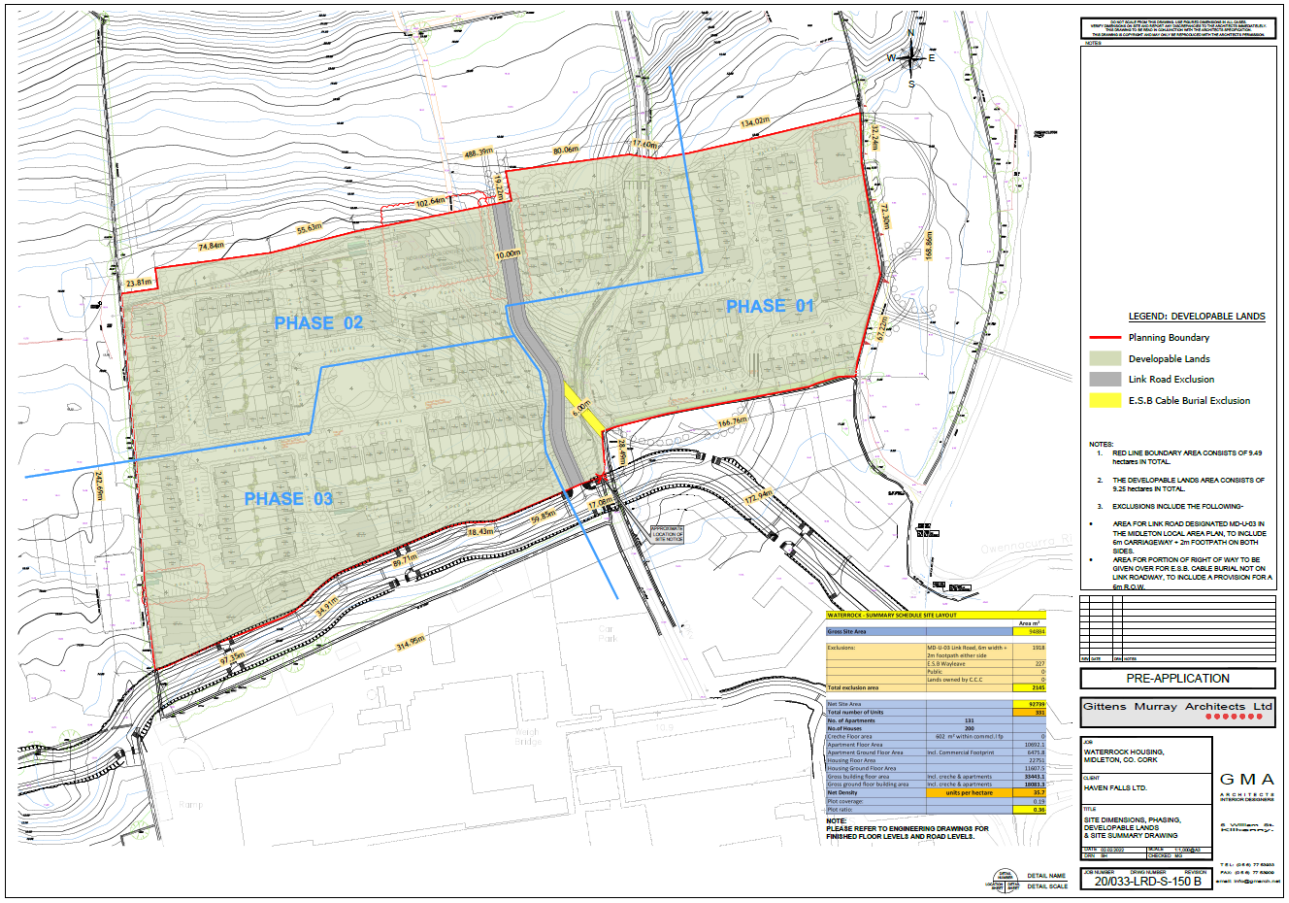
Final Levels are to be agreed with Cork County Council following full design of the proposed URDF park to the East taking account any level differential.

3.0 WATER SERVICES

Outlined below is a brief description of the proposals to provide for water services infrastructure, including, evidence that Irish Water have confirmed that it is feasible to provide the appropriate services and that the relevant network has/ will have the capacity to service the proposed development.

It is expected, pending a positive decision, that development of the site will commence in early 2023.

The planning is to be over 10-years and phasing of the development will be planned to suit.



Phase 1 will be carried out over 3 years '23-'26
Phase 2 will be carried out over 3 years '26-'29
Phase 3 will be carried out over 3 years '29-'32

3.1 Proposed Water and Wastewater

A pre-connection enquiry was submitted to Irish Water and a Confirmation of Feasibility Letter was subsequently received. This letter of feasibility (Connection Reference No CDS20001567 pre-connection enquiry**)** outlines that a connection the Irish Water Network(s) can be facilitated connection to the new foul sewerage infrastructure network extension project scheduled to be completed in 2023.

We have also received a Statement of Design Acceptance with respect to site specific design information.

This information forms part of detailed drawings associated with and accompanying this report.

Refer to 3.2 Irish Water Confirmation of Feasibility.

The connection of both water and wastewater will be such that the proposed development will connect by gravity to the services.

This detailed design submission includes for water demand and wastewater discharge as outlined in the tables below.

Water Demand

Total Average Day/Peak Week Demand (ADPW)	=	*139,519*	*Litres per day*
	=	*2.008*	*Litres per second*
Total Peak Water Demand	=	*675,587*	*Litres per day*
	=	*9.753*	*Litres per second*

Phased Water Demand

Phase 1 Average Day/Peak Week Demand (ADPW)	=	*41,856*	*Litres per day*
	=	*0.602*	*Litres per second*
Total Phase 1 Peak Water Demand	=	*202,676*	*Litres per day*
	=	*2.926*	*Litres per second*
Phase 1&2 Average Day/Peak Week Demand (ADPW)	=	*90,688*	*Litres per day*
	=	*1.305*	*Litres per second*
Total Phase 1&2 Peak Water Demand	=	*439,131*	*Litres per day*
	=	*6.339*	*Litres per second*

Wastewater Effluent

Total Average Discharge	=	*161,975*	*Litres per day*
	=	*1.875*	*Litres per second*
Total Peak Discharge	=	*971,850*	*Litres per day*
	=	*11.248*	*Litres per second*

Phased Discharge

Phase 1 Average Discharge	=	*48,593*	*Litres per day*
	=	*0.562*	*Litres per second*
Total Phase 1 Peak Discharge	=	*291,555*	*Litres per day*
	=	*3.374*	*Litres per second*
Phase 1&2 Average Discharge	=	*105,283*	*Litres per day*
	=	*1.219*	*Litres per second*
Total Phase 1&2 Peak Discharge	=	*631,702*	*Litres per day*
	=	*7.311*	*Litres per second*

3.2 Irish Water Confirmation of Feasibility

Havenfalls Ltd,
C/o Brian Murphy,
MHL & Associates,
Carraig Mor House,
10 High Street,
Douglas Road,
Cork
14 November 2022

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

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

www.water.ie

Dear Brian,

Re: Connection Reference No CDS20001567 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 404 unit(s) at Water Rock, Knockgriffin, Co. Cork.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Water Rock, Knockgriffin, Co. Cork.

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

Wastewater Connection: To accomodate this development, the waste must be pumped to the Carrigtohill Wastewater Treatment Plant (WWTP). This involves the construction of a pump station and rising main. Irish Water currently has a project underway which will provide the necessary infrastructure. This network extension project is scheduled to be completed in 2023 (this may be subject to change) and the proposed connection could be completed as soon as possibly practicable after this date.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water for review.
You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

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

If you have any further questions, please contact Michael Galvin from the design team on 022 52294 or email mgalvin@water.ie. For further information, visit www.water.ie/connections.

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

3.3 Irish Water Map Extract of Existing Services

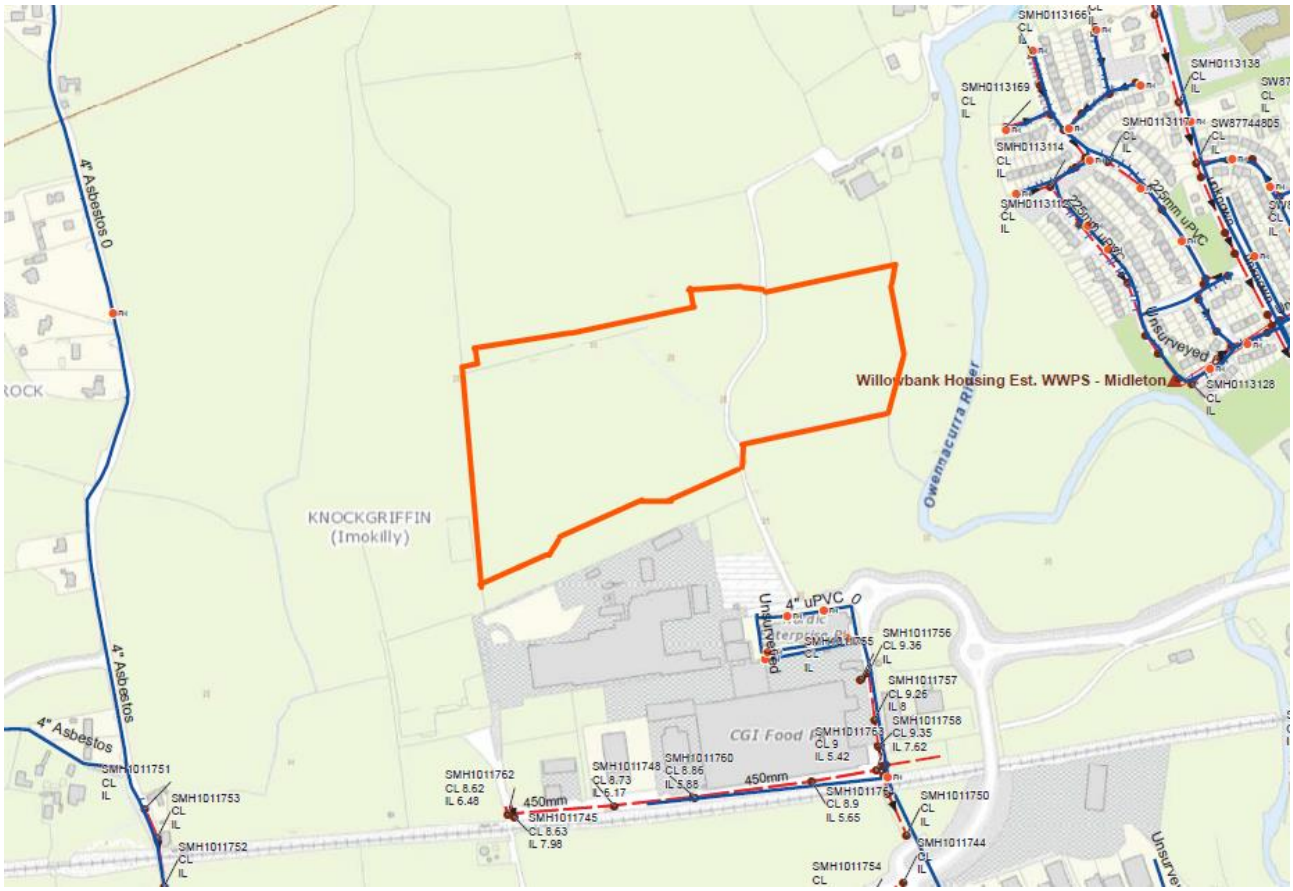


Figure 1 Existing Water Supply: Site Outlined Red

4.0 FOUL SEWER

The foul sewer for the proposed units is a gravity flow system connecting into the existing Foul pipes 225mm diameter located within the existing LIHAF road.

The entire foul sewer network on located within the public road and green area is a combination of 150mm & 225mm diameter sewer.

4.1 Proposed Foul Drainage

A pre-connection enquiry was submitted to Irish Water and a Confirmation of Feasibility Letter was subsequently received. This letter of feasibility (Connection Reference No CDS20001567 pre-connection enquiry**)** outlines that a connection the Irish Water Network(s) can be facilitated connection to the new foul sewerage infrastructure network extension project scheduled to be completed in 2023.

We have also received a Statement of Design Acceptance with respect to site specific design information.

This information forms part of detailed drawings associated with and accompanying this report.

Refer to 3.2 Irish Water Confirmation of Feasibility.

4.1.1 Hydraulic & Organic Loading

Daily foul discharge has been estimated based on proposed dwelling numbers and sizes in accordance with EPA and Irish Water Guidelines. Based on recommendations from the Irish Water Code of Practice, a unit occupancy of 2.7 is assumed.

The projected total wastewater discharge is as shown in Table 4.1 below:

Table 4.1 Hydraulic and Organic Loading

Development Type	No of Units	No. of Persons per Unit	Total Population	L/Person /Day	l/Day	BOD (g/Day per Person)	Organic Loading (g/Day BOD)
Residential	330	2.7	891	150	133650	60	53460
Commercial (Creche)			60	90	5400	60	3600
Commercial (Retail/Offices)			82	100	8200	60	4920

In accordance with Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (2020), a 10% of unit consumption allowance has been made for infiltration.

Max Design Flow: = 147,250 x 1.1 = 161,975 litres per day.

In accordance with Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (2020), assuming 3.0 times dry weather flow (DWF), the peak hydraulic discharge arising from this development is: 5.62 l/second.

The pipe network shall be designed to ensure that sufficient hydraulic capacity and cleansing velocities are achieved, in accordance with Irish Water Code of Practice.

Max Organic Load: = 61.98 kg (BOD5)/day.

Population Equivalent Value: = 1033 P.E.

All internal foul drainage shall be constructed in accordance with Irish Water Requirements.

Refer to Drawing 21059-P-103 for proposed foul water drainage layouts.

5.0 SITE SPECIFIC FLOOD RISK ASSESSMENT - SUMMARY

IE Consulting have undertaken a Site-Specific Flood Risk Assessment (SSFRA) in support of a planning application for the proposed residential development at Waterrock, Midleton, Co Cork for Havenfalls Ltd.

This SSFRA has been undertaken in consideration of the relevant Cork County Council development plan and in accordance with the DOEHLG guidelines *'The Planning System and Flood Risk Management Guidelines'*.

The site of the proposed development has been screened, scoped, and assessed for flood risk in accordance with the above guidance document and in consideration of the present day and mid-range future climate change scenarios.

The primary and direct potential flood risk to the site of the proposed development can be attributed to an extreme fluvial flood event in the Owennacurra River located beyond the eastern boundary of the site. The site not a risk of primary or direct coastal, pluvial or groundwater flooding.

Based on OPW CFRAMS flood data relative to the area of the proposed development site, the predictive 1% AEP (1 in 100 year – Flood Zone 'A') and 0.1% AEP (1 in 1000 year – Flood Zone 'B') flood levels applicable to the site range from 10.46m OD (1% AEP) – 10.51m OD (0.1% AEP) at the upstream extent of the site to 10.034m OD (1% AEP) – 10.137 (0.1% AEP) at the downstream extent of the site.

Reference to topographical survey data for the proposed development site indicates that predictive 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) flood extent would extent to the existing embankment that forms the eastern boundary of the site but would not exceed the top level of the embankment. The proposed development site is naturally elevated above the predictive 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) flood levels as presented above, therefore the proposed development site falls within Flood Zone 'C'.

Reference to the proposed site layout drawing indicates that the lowest finished floor level of the proposed dwelling houses within the eastern area of the site is 12.40m OD and the lowest finished road level is 12.05m OD. These levels are significantly elevated above the predictive 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) flood levels presented above.

Reference to the Surface Water Layout drawing prepared for the proposed development indicate that the development shall be served by an appropriately designed surface water management system in accordance with the local authority drainage code of practice and which shall limit surface water runoff from the development to pre-development greenfield runoff rates.

In summary, the assessment and analysis undertaken as part of the Site-Specific Flood Risk Assessment indicates that the fluvial flood risk to and pluvial flood risk from the development as proposed, is considered to be low.

The development as proposed is not expected to result in an adverse impact to the existing hydrological regime of the area or increase flood risk elsewhere and is therefore considered to be appropriate from a flood risk perspective.

6.0 SURFACE WATER SYSTEM

The proposed network will outfall to the new surface water drainage infrastructure to be constructed as part of the LIHAF funded road scheme being provided by Cork County Council. The LIHAF funded road scheme has been designed to take runoff from the development at a rate of 2l/sec/ha.

Surface water from the site will be collected and attenuated on site, with a peak discharge rate of 2l/s/ha for the 1 in 100 Year rainfall event (including an allowance for climate change). As part of the development, several different SuDS measures will be provided to minimise the impact on water quality and water quantity of the runoff and maximise the amenity and biodiversity opportunities within the site.

There is an existing watercourse channel running through the site, in a NW-SE direction, eventually out-falling to the Owenacurra river. In the interest of safety and to allow for the safe control of this natural drainage line, it is proposed to partially culvert same, using a 600mm pipe.

The natural topography of the site, to either side of the proposed culvert, lends itself to allowing for the surface water network to be split into 2, with both sections ultimately discharging to the proposed 225mm dia pip on the LIFAH road.

A suitable location will be agreed to provide for the storm water to pass through a grit sump and class 1 hydrocarbon interceptor (CNSB20s/21) before connecting to the proposed public main line.

The surface water system is designed to accommodate a 1:100, 1:30 and 1:5-year storm event + 20% climate change without flooding any property. The remainder of the site will be attenuated through parking spaces with a permeable stone base which has been designed with a storage capacity for a 1:5, 1:30 and 1:100 storm event + 20% climate change. There is an outlet pipe to the main storm sewer after the storm water is attenuated through the permeable stone layers. All pipe velocities in the surface water pipeline are above 1m/s as shown in the accompanying calculations.

We have included for a swale and permeable parking spaces, permeable paving, and tree pits in our design. Locations of the swale and permeable parking spaces are shown on drawing 21059-GA-02. model is designed with a rainfall intensity of 60mm/hr, an M5-60 OF 15mm, a ratio (R) of 0.300. A return period of 5, 30 and 100 years was used and shows that the highest water level at the extreme rainfall events is below the finished floor levels of each property to ensure no flooding occurs.

A 60mm/hour rainfall intensity has been used for the Wallingford method of pipe size calculation as attached Surface water Pipe Design.

The storm system and attenuation area has been designed considering the overall site.

All sewers shall have a minimum cover of 1.2m on roads and 0.9m on footpaths and green areas.

All storm sewers are to be minimum 225mm diameter.

All storm sewer material is to be un-plasticized polyvinylchloride IPVC-UL pipes and fittings in accordance with IS424 or spigot and socket concrete pipes in accordance with the requirements of IS6.

All sewers and drains designed to BS 5572 ‘drains and sewer systems outside buildings.

The rainfall figures for the storm durations have been obtained from Met Eireann weather data.

All gullies will be positioned and designed in accordance with ‘The recommendations for site development works for housing areas’ published by the Department of the Environment’

The revised system has been revised to incorporate an attenuation tank in one area of the site as close to source as reasonable possible within a sloped site to comply with Sustainable Urban Drainage best practice.

6.1 SURFACE WATER ATTENUATION DESIGN

Determination of storm water runoff and a suitable control system for this site at Waterrock, Midleton, determined in accordance with the requirements of Dublin Corporation's "Storm water Management Policy for Developers" (SMPD). This document outlines the storm water management policy to be applied to surface water discharges to sewers and to adjacent watercourses from new developments in Dublin City Council's administrative area. To date Dublin City Council is the only Local Authority in Ireland to have produced such a document and it was determined that this document be used as a guidance document for the proposed development.

The policy as outlined in the SMPD is "the maximum permitted surface water outflow from any new development is to be restricted to that for the greenfield/brownfield site before the proposed development takes place". This can be basically achieved by reducing runoff by increasing infiltration to subsurface strata, control maximum discharge rates by attenuation the discharge and using a combination of the two.

The specification of a permitted surface water outflow requires an understanding of the river catchment and urban drainage system in which the development site exists. Generally, this information is not available, and an estimation is made of the runoff generated from a site for a storm of specific return period and duration. In the SMPD, the basis for determining the storm water runoff and discharge from the undeveloped greenfield site is based on the scale of the proposed development with developments categorised into the following sizes:

Category	Area	Outflow Limits
Small	A < 4 ha	Q < 10 l/s
Medium	4 < A < 24 ha	10 < Q < 50 l/s
Large	A > 24 ha	Q > 50 l/s

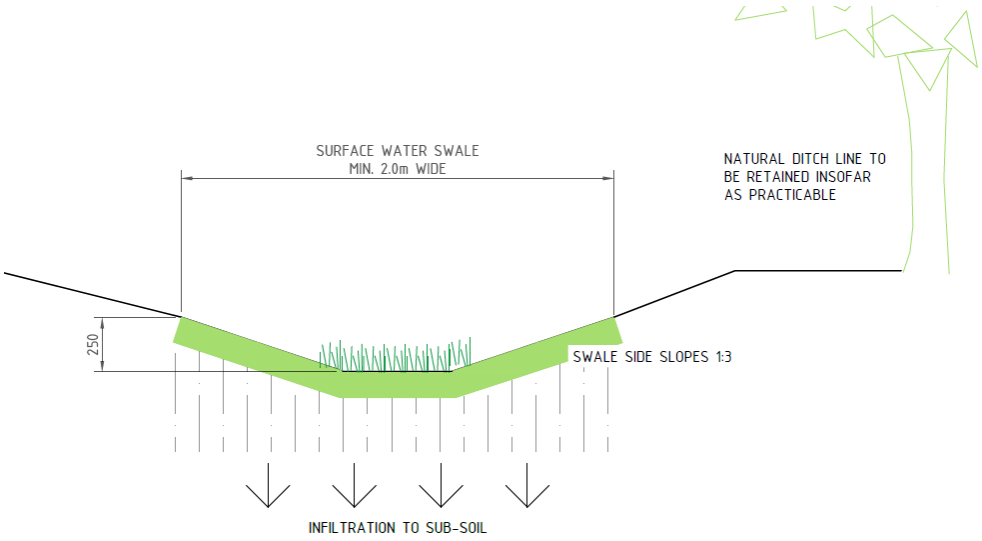
These values are based on estimated outflow rates from typical greenfield sites located in North Dublin, however, the actual discharge for similar sized sites of similar characteristics will vary subject to location in the country and hence the tabulated discharges are of little value outside North Dublin. The table is based on several estimation methods outlined in Dublin Corporation "Storm water Management Policy Technical Guidelines" (SMPTG). In the SMPD (that effectively summarises the SMPTG) it is recommended that the permissible outflow for small and medium sized sites is calculated using the estimation method contained in the Institute of Hydrology Report №124.

6.2 SYSTEM ANALYSIS/APPRAISAL

Attenuation Ponds/Basins-The most suitable location of such a technique would be on a low lying relatively flat plan none of which is available within the site boundaries of the application. As stated in the guidance document of the Irish Suds.ie website the application of ponds/basins is not suitable for high density residential area. Furthermore, the application of ponds/basins was ruled out on health and safety grounds due to the presence of children in a large residential area and the increased risk of a drowning accident. To create any such facility within the site boundaries would require large volumes of excavation and the construction of embankments due to the sloping topography of the site, all of which would contravene SuDS policies.

Private Soakaways/ Permeable Paving (Infiltration Method)-The disposal of surface water via soakaways or pervious asphalt (Infiltration method) was ruled out due to the underlying ground conditions and the likelihood that discharging of surface water to the substrata could cause future subsidence and subsequent damage dwellings and services.

Swales- We have included for a swale where the existing ditch can remain open. This will allow for surface water to be conveyed naturally and discharge to the storm sewer at a reduced rate.



Typical Swale Detail.

Refer to OSL drawing

21059-P-500(02)

Rainwater Harvesting- In relation to rainwater harvesting an option is to provide a water butt with each individual dwelling. This would be located to the rear of each unit. This was ruled out as the benefit is negligible. It would only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants.

Combined Attenuation Tank System & Permeable Paving (Exfiltration System.) In conclusion the primary system that we are proposing is a combination of attenuation tank systems using Reinforced Concrete Units, installed to ensure a robust leak proof system and permeable parking spaces. This system will attenuate the public roads and footpaths within the development. The method for calculating the system is shown below.

The permeable paving system being proposed will be used in various car parking spaces in the development. The system shall consist of 80mm permeable paviours, 50mm laying course on non-woven geotextile on 125 hydraulically bound course graded aggregate (porous no-fine concrete) on 150 course graded aggregate on 150mm capping layer. The permeable stone has been sized for sufficient storage for a 1:5, 1:30 and 1:100-year storm event. Once the surface water has been attenuated it discharges to the main storm sewer via 225mm perforated pipes below the permeable stone subbase. To prevent any surface water from infiltrating the ground below we have an impermeable geotextile installed below the perforated pipe. Calculations of this are shown in 5.2.4 Attenuation Design Criteria.

The surface water attenuation system is also be supplemented using Tree Pits located around the site. These will act as a SuDS element by way of amenity and Biodiverse way of reducing the amount of surface water from entering the system. The tree pits are to be fitted with an overflow pipe which will connect directly to the surface water system.

6.2.1 Runoff Estimation Method

The estimation method contained in the Institute of Hydrology Report №124 and recommended for estimation of the runoff from small and medium sites in the SMPD is as indicated below.

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} (SAAR)^{1.17} (SOIL)^{2.17}$

Q_{BAR} (m^3/s) is the mean annual peak flow

AREA (km^2) is the area of the catchment

SAAR (mm) is the Standard Annual Average Rainfall and

SOIL is a soil index value

The values for SAAR and SOIL are taken from maps and tables prepared by the Institute of Hydrology

The size of the site is determined by physically measuring the site on a suitable scaled map or in this case from physical survey data. The runoff estimation for the lands is indicated in Attenuation Storage

6.2.2 Storage Requirements

Once the discharge is determined for the site the storage volume for the storm water runoff needs to be determined. Due to recent flood events attenuation capacities are being designed for 1 in 100, 1:30 and 1:5 years with a Global Warming Factor being applied of 20%. Therefore, giving a storage volume to be retained within the site.

In order to quantify the rainfall associated with the maximum storm water storage required a series of storm durations for the 1 in 100-year return period are chosen. Although the amount of water discharge is increased (as more storm water runoff is generated on the developed site), the aim is to maintain the Q_{BAR} discharge as the maximum discharge.

Initially the discharge from the storage area will be less than the maximum discharge of Q_{BAR} resulting in a variable discharge becoming constant at Q_{BAR} with respect to time. As the storm duration increases and the discharge approaches a constant value the initial variable discharge has less significance and is essentially ignored. This is considered as a reasonable assumption as the storage area will continue to discharge at a constant rate until the level of water in the storage area returns to the outflow control's minimum active water head and this can be substantially longer than the storm duration. Additionally, most storm events have a variable intensity where the total rainfall is constant, but the intensity is variable throughout the duration of the storm event and the storm water pipe network will move water to the storage area faster than over ground flow.

To determine the volume of storage required the volume of storm water generated on the site is first determined. Considering the constant discharge of Q_{BAR} from the storm water storage area the volume of water discharged from the system over the duration of the storm is estimated. The estimated storage volume required for a storm event is the difference between the storm water volume generated and the discharged volume of storm water. A series of volumes generated and discharges for specific durations are plotted on a graph and the peak volume from the graph is taken as the maximum required storm water storage.

Once the volume of storm water storage is determined the storm water generated from a series of storm durations for the 1 in 100-year return period is estimated using the same numerical system and the results are compared to ensure that there is sufficient storage within the site to retain this additional storm water. In this situation the storm water pipe network is assumed to backup providing additional storage volume and localised flooding of the road network within the site may occur.

The discharge from the attenuated area is controlled via a flow control mechanism as shown in Hydro Brake Detail

6.2.3 Rainfall Intensity

The method used for calculating rainfall intensities for urban drainage design was developed by the British Meteorological Office as a simplified version of a computerised method. The manual method permits the calculation of rainfall intensities for durations between 5 minutes and 48 hours and return period between one year and 100 years. The storms considered for this site is 1 in 100 year's return periods with durations as indicated in the calculations. Figures and tables referred to are published as by Natural Environment Research Council in the U.K. and are described in the Institute of Hydrology publication "Flood Studies Report".

6.2.4 Design & Analysis of Urban Drainage – Wallingford Procedure

Modified Rational Method

The method gives the peak discharge from the equation:

$$Q_p = CiA \quad \ldots\ldots(1)$$

where Q_p is the peak discharge

C is a dimensionless coefficient

i is the average rainfall intensity during the time of concentration

and A is the contributing catchment area.

Additional factors may be necessary to allow for the dimensions used. If Q_p, i and A are expressed in l/s, mm/hr and ha respectively, equation 1 becomes

$$Q_p = \frac{CiA}{0.36} = 2.78\,CiA \quad \ldots\ldots(2)$$

Scope of the Method

The method may be used either to size diameters of pipes for a specified return period of flow in a storm sewer system of given layout and gradients, or to estimate peak discharges in an existing system for given rainfall conditions. It provides only a value of the peak runoff discharge; the hand calculation presented here cannot deal with sewer structures such as storm overflows. A computer version which can deal with storm overflows is available as part of the larger procedure. Networks incorporating more complex features such as storage tanks or pumping stations should be analysed using one of the hydrograph methods available.

Tests have shown[3] that the Modified Rational Method is as accurate for the determination of peak runoff discharge as some more sophisticated urban runoff methods. These tests were limited to urban catchments up to 150ha in area with times of concentration up to about 30 minutes and outfall pipe diameters up to about one metre. The slope and distribution of impervious area in these catchments were reasonably uniform. The accuracy of the method when applied to larger or more irregular catchments is not known, and therefore the method cannot be positively recommended outside these limits.

6.2.4.1 Met Eireann Rainfall Depths

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 186896, Northing: 74613,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.1,	4.4,	5.0,	6.0,	6.7,	7.2,	8.9,	10.8,	12.0,	13.8,	15.3,	16.5,	18.4,	19.8,	21.0,	N/A ,
10 mins	4.4,	6.1,	7.0,	8.4,	9.3,	10.0,	12.4,	15.0,	16.8,	19.2,	21.4,	23.1,	25.6,	27.6,	29.3,	N/A ,
15 mins	5.1,	7.2,	8.2,	9.9,	11.0,	11.8,	14.6,	17.7,	19.7,	22.6,	25.1,	27.1,	30.2,	32.5,	34.4,	N/A ,
30 mins	6.8,	9.3,	10.7,	12.7,	14.0,	15.1,	18.5,	22.2,	24.7,	28.1,	31.2,	33.5,	37.1,	39.9,	42.2,	N/A ,
1 hours	8.9,	12.2,	13.9,	16.3,	18.0,	19.3,	23.4,	28.0,	30.9,	35.0,	38.7,	41.5,	45.7,	49.0,	51.7,	N/A ,
2 hours	11.8,	15.9,	18.0,	21.0,	23.1,	24.6,	29.7,	35.2,	38.7,	43.7,	48.0,	51.2,	56.3,	60.1,	63.2,	N/A ,
3 hours	13.9,	18.5,	20.9,	24.4,	26.7,	28.5,	34.1,	40.2,	44.2,	49.6,	54.4,	58.0,	63.5,	67.7,	71.2,	N/A ,
4 hours	15.6,	20.7,	23.3,	27.1,	29.6,	31.5,	37.6,	44.2,	48.5,	54.4,	59.5,	63.4,	69.3,	73.8,	77.4,	N/A ,
6 hours	18.4,	24.2,	27.1,	31.4,	34.2,	36.4,	43.2,	50.6,	55.3,	61.8,	67.4,	71.7,	78.2,	83.2,	87.2,	N/A ,
9 hours	21.7,	28.2,	31.6,	36.4,	39.6,	42.0,	49.6,	57.8,	63.1,	70.3,	76.5,	81.2,	88.3,	93.7,	98.2,	N/A ,
12 hours	24.3,	31.5,	35.2,	40.4,	43.9,	46.5,	54.7,	63.6,	69.3,	77.0,	83.6,	88.7,	96.3,	102.1,	106.8,	N/A ,
18 hours	28.6,	36.8,	41.0,	46.9,	50.7,	53.7,	62.9,	72.7,	79.0,	87.5,	94.9,	100.4,	108.7,	115.1,	120.2,	N/A ,
24 hours	32.2,	41.1,	45.6,	52.1,	56.3,	59.4,	69.4,	80.0,	86.7,	95.9,	103.7,	109.6,	118.5,	125.3,	130.7,	149.3,
2 days	41.2,	51.5,	56.6,	63.9,	68.6,	72.1,	83.0,	94.5,	101.7,	111.4,	119.7,	125.9,	135.1,	142.1,	147.7,	166.7,
3 days	48.7,	60.1,	65.7,	73.6,	78.7,	82.5,	94.2,	106.4,	114.1,	124.3,	133.0,	139.5,	149.1,	156.3,	162.2,	181.7,
4 days	55.3,	67.7,	73.7,	82.2,	87.6,	91.6,	104.0,	116.9,	125.0,	135.7,	144.7,	151.5,	161.5,	169.0,	175.0,	195.1,
6 days	67.2,	81.2,	87.9,	97.3,	103.3,	107.8,	121.4,	135.4,	144.1,	155.6,	165.3,	172.5,	183.2,	191.1,	197.5,	218.7,
8 days	77.9,	93.3,	100.6,	110.8,	117.3,	122.1,	136.7,	151.7,	161.0,	173.2,	183.4,	191.0,	202.2,	210.6,	217.3,	239.4,
10 days	87.9,	104.4,	112.3,	123.3,	130.1,	135.3,	150.8,	166.7,	176.4,	189.2,	200.0,	207.9,	219.6,	228.3,	235.3,	258.3,
12 days	97.3,	114.9,	123.3,	134.9,	142.2,	147.6,	163.9,	180.6,	190.8,	204.2,	215.4,	223.7,	235.8,	244.8,	252.0,	275.8,
16 days	115.0,	134.6,	143.9,	156.7,	164.6,	170.5,	188.3,	206.4,	217.3,	231.7,	243.7,	252.6,	265.5,	275.1,	282.8,	307.9,
20 days	131.7,	153.0,	163.1,	176.9,	185.5,	191.8,	210.9,	230.1,	241.8,	257.1,	269.8,	279.1,	292.8,	302.9,	310.9,	337.2,
25 days	151.5,	174.8,	185.8,	200.7,	210.0,	216.8,	237.3,	257.9,	270.3,	286.6,	300.1,	310.0,	324.4,	335.0,	343.5,	371.1,

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

6.2.4.2 Surface Water Design

Refer to drawing 21059-P-102 for surface water Layout

Manholes		Contributing Area		Pipe			Full		Time (mins)			Rainfall	Total	Prop.	Prop.	Design	Comments
From	To	Area (ha)	Cum. Area (ha)	Dia (mm)	Length (m)	Gradient (1in X)	Velocity (m/s)	Capacity (l/s)	Entry	Flow	Conc.	Intensity (mm/hr)	Runoff (l/s)	Depth	Velocity	Velocity (m/s)	
S1-0	S1-1	0.2837	0.2837	225	62.000	45	1.953	77.669	4.00	0.53	4.53	50	51.264	0.593	1.068	2.087	
S1-1	S1-2	0.1984	0.4821	300	75.814	150	1.280	90.455	4.53	0.99	5.52	50	87.118	0.788	1.139	1.458	
S1-2	S1-3	0.2067	0.6888	375	48.889	150	1.478	163.215	5.52	0.55	6.07	50	124.465	0.654	1.101	1.627	
S1-3	S1-4	0.1735	0.8623	375	58.268	150	1.475	162.944	6.07	0.66	6.73	50	155.824	0.783	1.138	1.680	
S2-0	S1-4	0.1737	0.1737	225	60.233	60	1.690	67.187	4.00	0.59	4.59	50	31.384	0.480	0.983	1.661	
S1-4	S1-5	0.0771	1.1132	450	8.564	150	1.656	263.362	6.73	0.09	6.81	50	201.146	0.654	1.101	1.824	
S1-5	S1-6	0.3803	1.4935	450	12.080	150	1.656	263.362	6.81	0.12	6.93	50	269.870	0.844	1.138	1.885	
S1-6	S1-7	0.0700	1.5635	450	12.080	150	1.656	263.362	6.93	0.12	7.06	50	282.519	0.918	1.116	1.848	Through Attenuation
S1-7	CCC MH	0.1303	0.1673	225	12.080	150	1.063	42.285	7.06	0.19	7.24	50	30.239	0.625	1.087	1.156	VORTEX CONTROL UNIT TO BE INSTALLED AT ATTENUATION OUTLET TO RESTRICT FLOW TO 6.70 l/s
S3-0	S3-1	0.1457	0.1457	225	32.000	22	2.786	110.771	4.00	0.19	4.19	50	26.335	0.332	0.820	2.285	
S3-1	S3-2	0.0588	0.2045	225	13.604	23	2.758	109.658	4.19	0.08	4.27	50	36.955	0.400	0.902	2.488	
S3-2	S3-3	0.1701	0.3746	225	28.107	23	2.762	109.807	4.27	0.17	4.44	50	67.692	0.568	1.052	2.905	Through Attenuation
S3-4	S3-3	0.0682	0.0682	225	32.000	60	1.689	67.165	4.00	0.32	4.32	50	12.320	0.290	0.761	1.286	
S3-3	CCC MH	0.4428		225	32.000	150	1.063	42.285	4.44	0.50	4.94	50	40.658	0.787	1.139	1.211	VORTEX CONTROL UNIT TO BE INSTALLED AT ATTENUATION OUTLET TO RESTRICT FLOW TO 1.75 l/s

Manholes		Contributing Area		Pipe			Full		Time (mins)			Rainfall	Total	Prop.	Prop.	Design	Comments
From	To	Area (ha)	Cum. Area (ha)	Dia (mm)	Length (m)	Gradient (1in X)	Velocity (m/s)	Capacity (l/s)	Entry	Flow	Conc.	Intensity (mm/hr)	Runoff (l/s)	Depth	Velocity	Velocity (m/s)	
S4-0	S4-1	0.1058	0.1058	225	47.576	56	1.747	69.458	4.00	0.45	4.45	50	19.113	0.359	0.854	1.491	
S4-1	S4-2	0.2796	0.3854	225	40.586	56	1.752	69.673	4.45	0.39	4.84	50	69.633	0.819	1.140	1.997	
S5-0	S5-1	0.2078	0.2078	225	63.395	60	1.684	66.975	4.00	0.63	4.63	50	37.555	0.535	1.028	1.732	
S5-1	S4-2	0.0133	0.2212	225	7.879	59	1.707	67.875	4.63	0.08	4.70	50	39.964	0.551	1.040	1.776	
S4-2	S4-3	0.1506	0.1639	300	47.628	159	1.241	87.748	4.63	0.64	5.27	50	29.608	0.000	0.000	0.000	
S4-3	S4-4	0.1400	0.3039	300	47.638	159	1.243	87.887	4.70	0.64	5.34	50	54.906	0.573	1.055	1.312	VORTEX CONTROL UNIT TO BE INSTALLED AT ATTENUATION OUTLET TO RESTRICT FLOW TO 2.4 l/s
S8-0	S8-1	0.1556	0.1556	225	29.780	59	1.705	67.775	4.00	0.29	4.29	50	28.119	0.449	0.953	1.625	
S8-1	S8-2	0.3240	0.4796	300	74.237	151	1.276	90.185	4.29	0.97	5.26	50	86.658	0.787	1.139	1.453	
S9-0	S8-2	0.1556	0.1556	225	29.780	17	3.187	126.732	4.00	0.16	4.16	50	28.119	0.320	0.804	2.563	
MANHOLE S9-0 IS TO BE INSTALLED AS PART OF SCHEME UNDER CONSIDERATION, AND THE AREAS WITHIN THE SITE DEVELOPMENT BOUNDARY SERVING SAME ARE CONSIDERED IN THE CONTRIBUTING AREAS SERVING .																	
SIZING OF SURFACE WATER NETWORK HAS NOT BEEN CARRIED OUT TO CONSIDER ANY ADDITIONAL DEVELOPMENT OF LAND TO THE NORTH OF S9-0.																	
THE EXISTING LAND DRAIN, PICKING UP EXISTING SURFACE WATER RUNOFF IS TO BE DIRECTED INTO AN INDEPENDANT SURAFCE WATER SYSTEM, PASSING THROUGH THE DELOPMENT SITE																	
THIS 600mm dia PIPE IS DESIGNED TO CONSIDER UNDDEVELOPMENT LAND BASED ON CLCULATIONS OF 1% AEP + CC (1 in 100 year + climate change) flow - 0.315 m3/s(PIPE CAPACITY)																	
S8-2	S8-3	0.0851	0.5646	375	30.453	139	1.533	169.296	5.26	0.33	5.59	50	102.027	0.560	1.046	1.604	
S8-3	S8-4	0.1442	0.7088	375	32.631	150	1.473	162.740	5.59	0.37	5.96	50	128.084	0.668	1.108	1.632	Offline Attenuation Tank
																	VORTEX CONTROL UNIT TO BE INSTALLED AT ATTENUATION OUTLET TO RESTRICT FLOW TO 2.8 l/s
S8-4	S4-3	0.0000	0.0155	225	7.836	124	1.169	46.491	5.96	0.11	6.07	50	2.800	0.166	0.550	0.643	
S4-4	S4-5	0.1273	0.4467	300	60.877	156	1.254	88.652	5.34	0.81	6.15	50	80.715	0.749	1.133	1.421	Offline Attenuation Tank
																	VORTEX CONTROL UNIT TO BE INSTALLED AT ATTENUATION OUTLET TO RESTRICT FLOW TO 1.78 l/s

Manholes		Contributing Area		Pipe			Full		Time (mins)			Rainfall	Total	Prop.	Prop.	Design	Comments
From	To	Area (ha)	Cum. Area (ha)	Dia (mm)	Length (m)	Gradient (1in X)	Velocity (m/s)	Capacity (l/s)	Entry	Flow	Conc.	Intensity (mm/hr)	Runoff (l/s)	Depth	Velocity	Velocity (m/s)	
S6-0	S6-1	0.0939	0.0939	225	25.000	60	1.690	67.213	4.00	0.25	4.25	50	16.975	0.343	0.834	1.409	
S7-0	S7-1	0.0273	0.0273	225	16.000	60	1.691	67.228	4.00	0.16	4.16	50	4.933	0.183	0.583	0.986	
S7-1	S6-1	0.0000	0.0273	225	13.080	68	1.589	63.183	4.18	0.14	4.32	50	4.933	0.189	0.594	0.944	
S6-1	S6-2	0.1371	0.2583	225	45.919	58	1.714	68.139	4.29	0.45	4.74	50	46.675	0.608	1.077	1.846	
S6-2	S4-5	0.1012	0.3595	225	47.839	60	1.688	67.130	5.29	0.47	5.76	50	64.965	0.792	1.139	1.923	Through Attenuation
																	VORTEX CONTROL UNIT TO BE INSTALLED AT ATTENUATION OUTLET TO RESTRICT FLOW TO 1.42 l/s
S4.5	CCC smh		0.0177	225	24.040	150	1.063	42.285	4.00	0.38	4.38	50	3.200	0.186	0.589	0.626	FLOW THROUGH LINE ALLOWS FOR ATTENUATED RUNOFF
S10-0	S10-1	0.2100	0.2100	225	75.000	30	2.396	95.255	4.00	0.52	4.52	50	37.947	0.439	0.944	2.260	
S10-1	S10-2	0.0700	0.2800	300	37.959	150	1.280	90.444	4.18	0.49	4.67	50	50.596	0.535	1.028	1.315	
S10-2	S10-3	0.0700	0.3500	300	8.196	149	1.284	90.756	5.18	0.11	5.29	51	64.510	0.622	1.085	1.393	
S10-3	S10-4	0.1177	0.4677	300	18.562	151	1.276	90.179	6.18	0.24	6.42	52	87.901	0.798	1.140	1.454	
S11-0	S10-4	0.1698	0.1698	225	65.000	48	1.896	75.375	6.18	0.57	6.75	52	31.901	0.454	0.958	1.816	
S10-4	S10-5	0.6375	0.6375	375	11.354	150	1.475	162.951	6.75	0.13	6.88	52	119.802	0.637	1.093	1.612	VORTEX CONTROL UNIT TO BE INSTALLED AT MANHOLE OUTLET TO RESTRICT FLOW TO 2.0 l/s
S10-5	S10-6	0.2307	0.2417	225	70.936	159	1.034	41.095	0.00	1.14	1.14	50	43.678	0.895	1.126	1.164	
S12-0	S12-1	0.1325	0.1325	225	30.000	60	1.697	67.457	6.88	0.29	7.17	52	24.902	0.420	0.924	1.568	
S12-1	S12-2	0.2575	0.3900	300	72.371	64	1.973	139.463	1.14	0.61	1.76	53	74.711	0.521	1.017	2.007	
S12-2	S10-6	0.0000	0.3900	300	8.181	149	1.285	90.840	7.17	0.11	7.28	54	76.120	0.701	1.120	1.439	
S10-6	S10-7	0.0886	0.7204	375	42.605	149	1.478	163.224	7.28	0.48	7.76	50	130.174	0.675	1.110	1.641	VORTEX CONTROL UNIT TO BE INSTALLED AT MANHOLE OUTLET TO RESTRICT FLOW TO 6.0 l/s
S13-0	S13-1	0.0530	0.0530	225	15.000	60	1.693	67.321	4.00	0.15	4.15	50	9.575	0.255	0.709	1.200	

Manholes		Contributing Area		Pipe			Full		Time (mins)			Rainfall	Total	Prop.	Prop.	Design	Comments
From	To	Area (ha)	Cum. Area (ha)	Dia (mm)	Length (m)	Gradient (1in X)	Velocity (m/s)	Capacity (l/s)	Entry	Flow	Conc.	Intensity (mm/hr)	Runoff (l/s)	Depth	Velocity	Velocity (m/s)	
S13-1	S13-2	0.0700	0.1230	225	23.364	151	1.061	42.180	4.18	0.37	4.55	50	22.224	0.516	1.013	1.075	
S13-2	S13-3	0.1845	0.3075	300	60.296	154	1.262	89.198	4.55	0.80	5.34	51	56.678	0.579	1.059	1.337	
S13-3	S13-4	0.0784	0.3859	300	18.915	159	1.243	87.843	5.34	0.25	5.60	52	72.523	0.692	1.117	1.388	
S13-4	S13-5	0.0000	0.3859	300	11.405	161	1.236	87.376	5.60	0.15	5.75	53	73.918	0.706	1.122	1.386	VORTEX CONTROL UNIT TO BE INSTALLED AT MANHOLE OUTLET TO RESTRICT FLOW TO 2.0 l/s
S13-5	S10-7	0.1857	0.1968	225	55.653	148	1.071	42.572	5.75	0.87	6.62	54	38.402	0.743	1.132	1.212	VORTEX CONTROL UNIT TO BE INSTALLED AT MANHOLE OUTLET TO RESTRICT FLOW TO 6.0 l/s
S10-7	S10-8	0.0332	0.0332	225	10.583	149	1.067	42.420	4.00	0.17	4.17	50	6.000	0.254	0.707	0.755	
S10-8	S10-9	0.0339	0.0671	225	10.583	149	1.067	42.420	5.00	0.17	5.17	51	12.365	0.370	0.868	0.926	
S10-9	S10-10	0.0000	0.0671	225	10.583	149	1.067	42.420	6.00	0.17	6.17	52	12.607	0.374	0.872	0.931	
S14-0	S14-1	0.1317	0.1317	225	32.000	80	1.461	58.108	4.00	0.36	4.36	50	23.805	0.446	0.950	1.389	
S14-1	S14-2	0.0815	0.2132	225	34.397	80	1.462	58.111	4.18	0.39	4.57	50	38.529	0.595	1.069	1.563	
S14-2	S14-3	0.0634	0.2766	300	35.000	120	1.433	101.308	4.57	0.41	4.98	51	50.989	0.502	1.002	1.436	
S14-3	S10-7	0.1845	0.4612	300	62.348	128	1.388	98.095	4.98	0.75	5.73	52	86.665	0.730	1.129	1.567	
S10-10	Outfall	0.0520	0.0520	225	10.583	392	0.653	25.953	6.00	0.27	6.27	52	9.766	0.425	0.929	0.606	VORTEX CONTROL UNIT TO BE INSTALLED AT S10-10 MANHOLE OUTLET TO RESTRICT FLOW TO 9.39l/s

MANHOLE S10-10 IS TO BE INSTALLED AS PART OF SCHEME UNDER CONSIDERATION.
RUNOFF DISCHARGING FROM THE MANHOLE RESTRICTED TO 9.39l/s DISCHARGING THROUGH HEADWALL TO THE EXISTING LAND DRAIN.
RUNOFF FROM LAND DRAIN TO BE CONVEYED INTO 600mm dia PIPE RUNNING THROUGH THE SOUTH OF UNITS 186-193 (ROAD 16)

6.3 ATTENUATION STORAGE

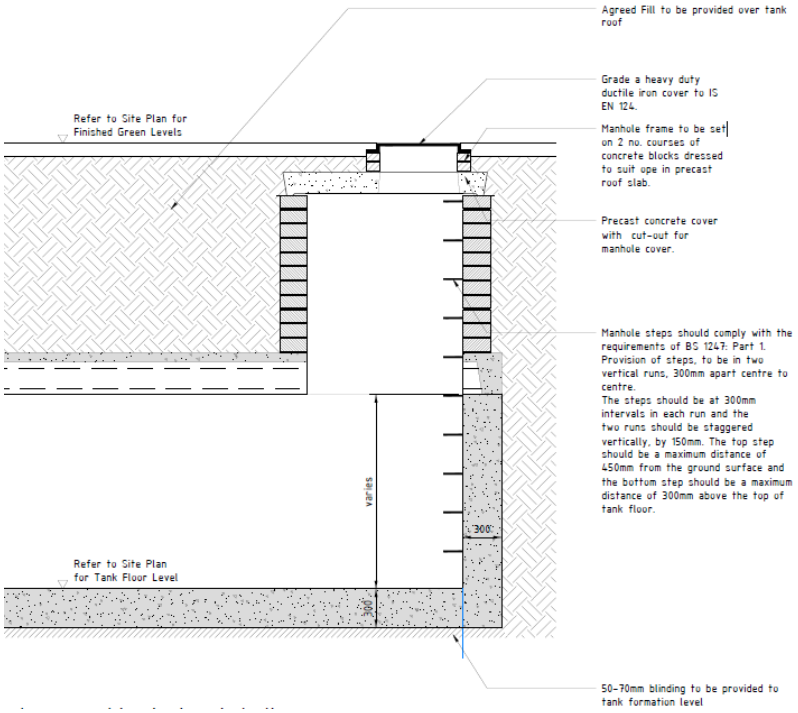
In sizing the Attenuation tanks the site has been subdivided into various zones to allow for attenuation tanks each sized to its specific to each zone.

Due to the Karst Nature of the site that tanks to be installed will all be RC tanks underground attenuation tank situated in open spaces as indicated on the accompanying drawings.

The calculations for the sizing of the tanks can be found below and include for climate change (20% increase).

The outflow will be controlled by hydro breaks, typically situated in the outlet manhole. This manhole will also be fitted with overflow pipe above the hydro break, such that in the event of a blockage the overflow pipe will discharge directly to the main network beyond the attenuation tank.

Suitable access to the tank for maintenance will be provided.



Typ. RC Attenuation Tank access chamber

6.3.1 Area 1 West Section of Site

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

$SOIL = (0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	24225.492 m^2	=	2.422549
Buildings		4946.275	m^2
Footpath Surrounding Units/Incl Apts		2,729	m^2
Hard standings(Roads Incl Roadside Parking)		6,319	m^3
Gardens/ Public Open Space		10,231	m^2
Entire Site	24225.492 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

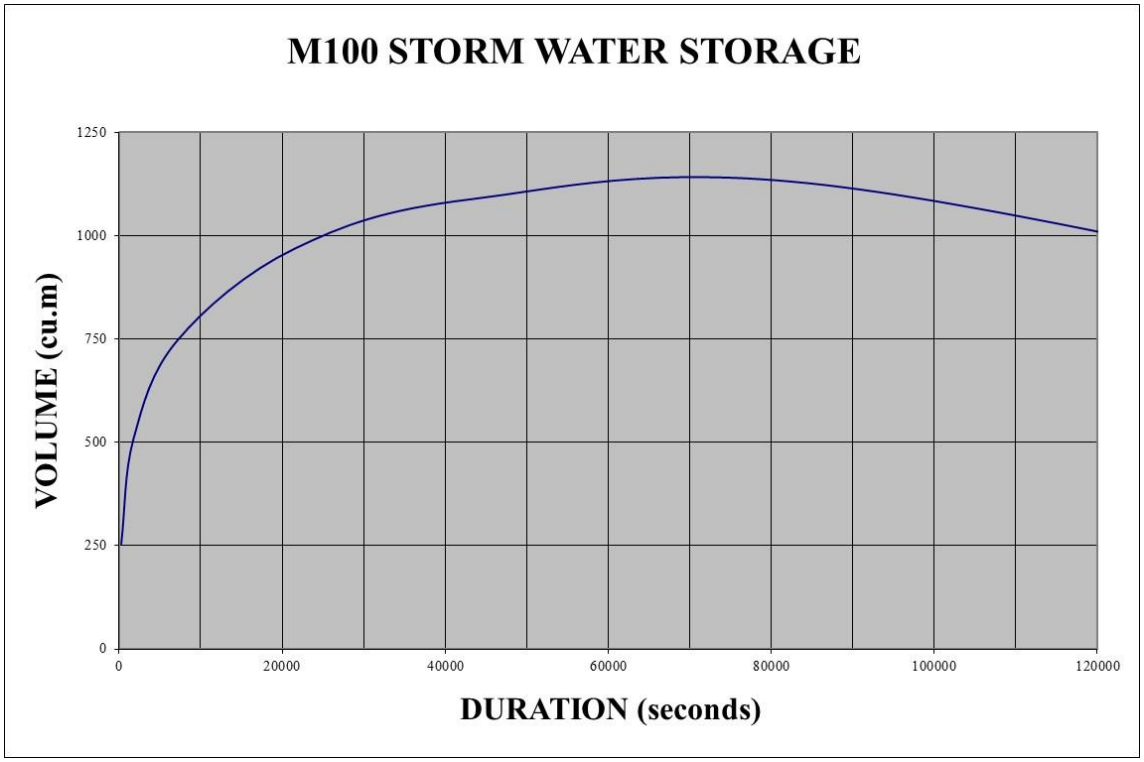
Average Volumetric Runoff Coefficient C_v

$$C_v = \frac{17{,}063.4}{24225.492} = 0.704 \text{ say } 0.70$$

Permitted Runoff (Q_{BAR}) and Storage Volume
Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} =	0.1383 m^3/s	24225.492 m^2	2.42ha Q_{BAR} =	0.006701 m^3/s	6.70 l/s 2.77 l/s/ha



Storage Volume Required = 1123 m^3
100 year storm event.

20% Increase Due to climate change= 1347.411 m^3

Area 1 - West Section of Site				
Permeable Paving	=	0.1741111	ha	1741.111 m²
				1741.111 m²
Total Storage Volume Perm Paving @ 0.3m Depth	=			522.3333 m³
Storage Tank @300m² @2.5m Deep @ 96% VR	=			720 m³
15No. Tree Pits @ 12m² @ 0.6m Depth	=			108 m³
Total Storage Provided	**=**			**1350.333 m³**
Storage Required	**=**	**1347.411**	**m³**	

6.3.2 Area 2 South Section of Site Road 06

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

$SOIL = (0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	6326.314 m^2	=	0.632631
Buildings		1291.684	m^2
Footpath Surrounding Units/Incl Apts		713	m^2
Hard standings(Roads Incl Roadside Parking)		1,650	m^3
Gardens/ Public Open Space		2,672	m^2
Entire Site	6326.314 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

Average Volumetric Runoff Coefficient C_v

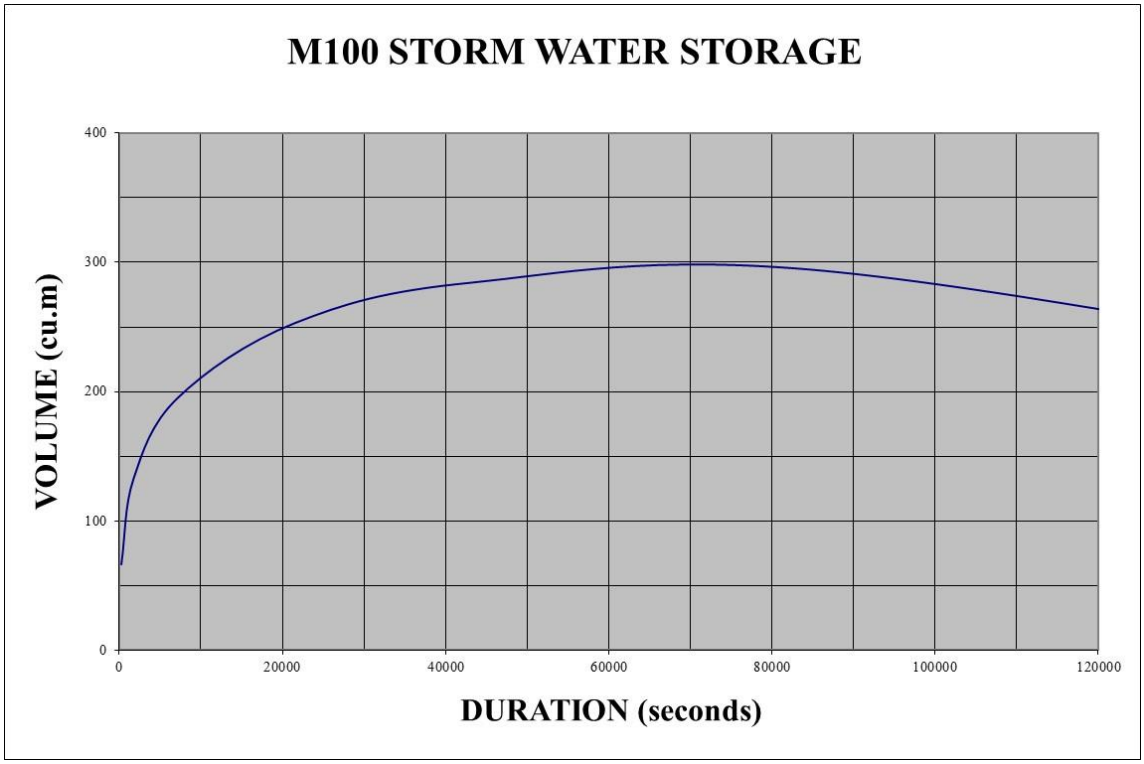
$C_v = \frac{4{,}456.0}{6326.314} = 0.704$ say 0.70

Permitted Runoff (Q_{BAR}) and Storage Volume

Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} =	0.1383 m^3/s	6326.314 m^2	2.42ha Q_{BAR} =	0.00175 m^3/s	1.75 l/s 2.77 l/s/ha



Storage Volume Required = 293 m^3
100 year storm event.

20% Increase Due to climate change= 351.8668 m^3

Area 2 - South Section of Site Road 06				
Permeable Paving	=	0.0484412	ha	484.412 m²
				484.412 m²
Total Storage Volume Perm Paving @ 0.3m Depth	=			145.3236 m³
Storage Tank @ 130m² @ 1.5m Deep @ 96% VR	=			187.2 m³
4 No. Tree Pits @ 12m² @ 0.6m Depth	=			28.8 m³
Total Storage Provided	**=**			**361.3236 m³**
Storage Required	**=**	**351.867**	**m³**	

6.3.3 Area 3 - North Section of Site Roads 01 & 02

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

$SOIL = (0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	10126.294 m^2	=	1.012629
Buildings			2067.551 m^2
Footpath Surrounding Units/Incl Apts			1,141 m^2
Hard standings(Roads Incl Roadside Parking)			2,641 m^3
Gardens/ Public Open Space			4,277 m^2
Entire Site	10126.294 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

Average Volumetric Runoff Coefficient C_v

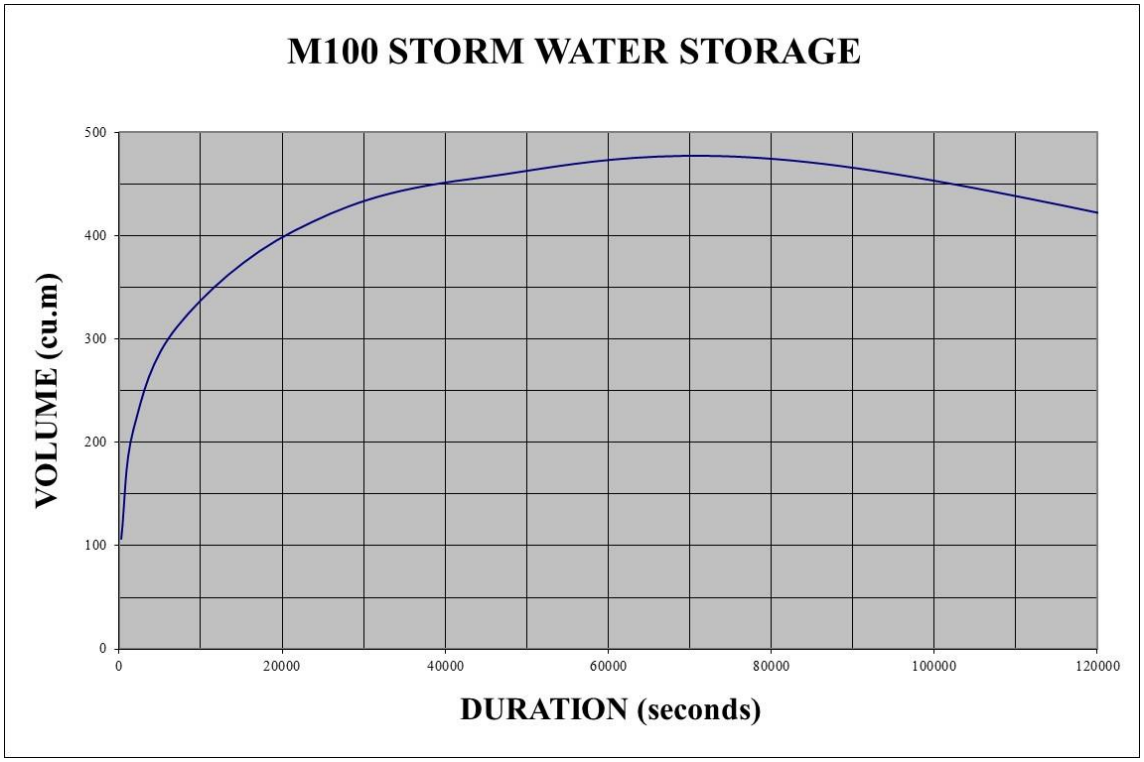
$$C_v = \frac{7{,}132.5}{10126.294} = 0.704 \text{ say } 0.70$$

Permitted Runoff (Q_{BAR}) and Storage Volume

Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} =	0.1383 m^3/s	10126.294 m^2	2.42ha Q_{BAR} =	0.002801 m^3/s	2.80 l/s 2.77 l/s/ha



Storage Volume Required = 469 m^3
100 year storm event.

20% Increase Due to climate change= 563.2199 m^3

Area 3 - North Section of Site Roads 01 & 02					
Permeable Paving South East	=	0.1026115	ha	1026.115	m²
				1026.115	m²
Total Storage Volume Perm Paving @ 0.3m Depth	=			307.8345	m³
Storage Tank @ 150m² @ 1.5m Deep @ 96% VR	=			216	m³
6 No. Tree Pits @ 12m² @ 0.6m Depth	=			43.2	m³
Total Storage Provided	**=**			**567.0345**	**m³**
Storage Required	**=**	**563.219941**	**m³**		

6.3.4 Area 4 - Rock Square

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

$SOIL = (0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	8665.345 m^2	=	0.866535
Buildings		1769.260	m^2
Footpath Surrounding Units/Incl Apts		976	m^2
Hard standings(Roads Incl Roadside Parking)		2,260	m^3
Gardens/ Public Open Space		3,660	m^2
Entire Site	8665.345 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

Average Volumetric Runoff Coefficient C_v

$C_v = \frac{6{,}103.5}{8665.345} = 0.704$ say 0.70

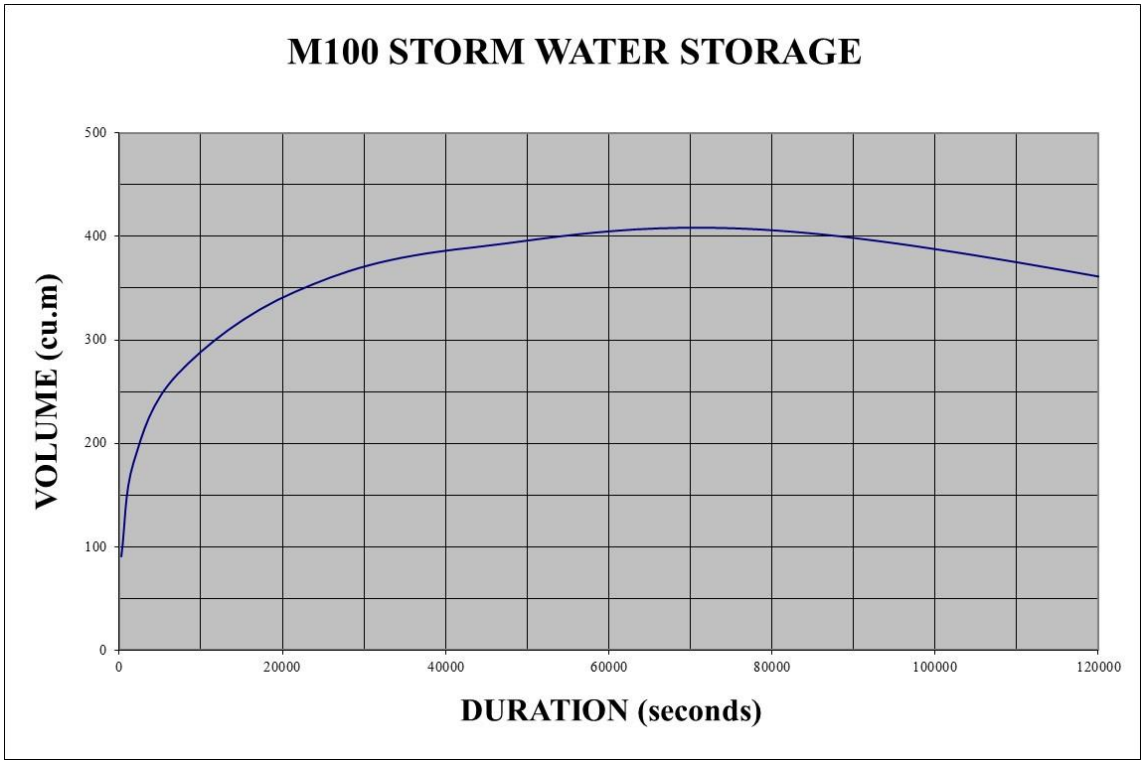
Permitted Runoff (Q_{BAR}) and Storage Volume

Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} = 0.1383 m^3/s 8665.345 m^2 2.42ha Q_{BAR} = 0.002397 m^3/s

2.40 l/s
2.77 l/s/ha



Storage Volume Required = 402 m^3
100 year storm event.

20% Increase Due to climate change= 481.9626 m^3

Area 4 - Rock Square				
Permeable Paving South East	=	0.0459467	ha	459.467 m²
				459.467 m²
Total Storage Volume Perm Paving @ 0.3m Depth	=			137.8401 m³
Storage Tank @ 200m² @ 1.75m Deep @ 96% VR	=			336 m³
3 No. Tree Pits @ 12.5m² @ 0.6m Depth	=			21.6 m³
Total Storage Provided	**=**			**495.4401 m³**
Storage Required	**=**	**481.962612**	**m³**	

6.3.5 Area 5 - Road 5

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

$SOIL = (0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	5136.732 m^2	=	0.513673
Buildings		1048.800	m^2
Footpath Surrounding Units/Incl Apts		579	m^2
Hard standings(Roads Incl Roadside Parking)		1,340	m^3
Gardens/ Public Open Space		2,169	m^2
Entire Site	5136.732 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

Average Volumetric Runoff Coefficient C_v

$C_v = \frac{3{,}618.1}{5136.732} = 0.704$ say 0.70

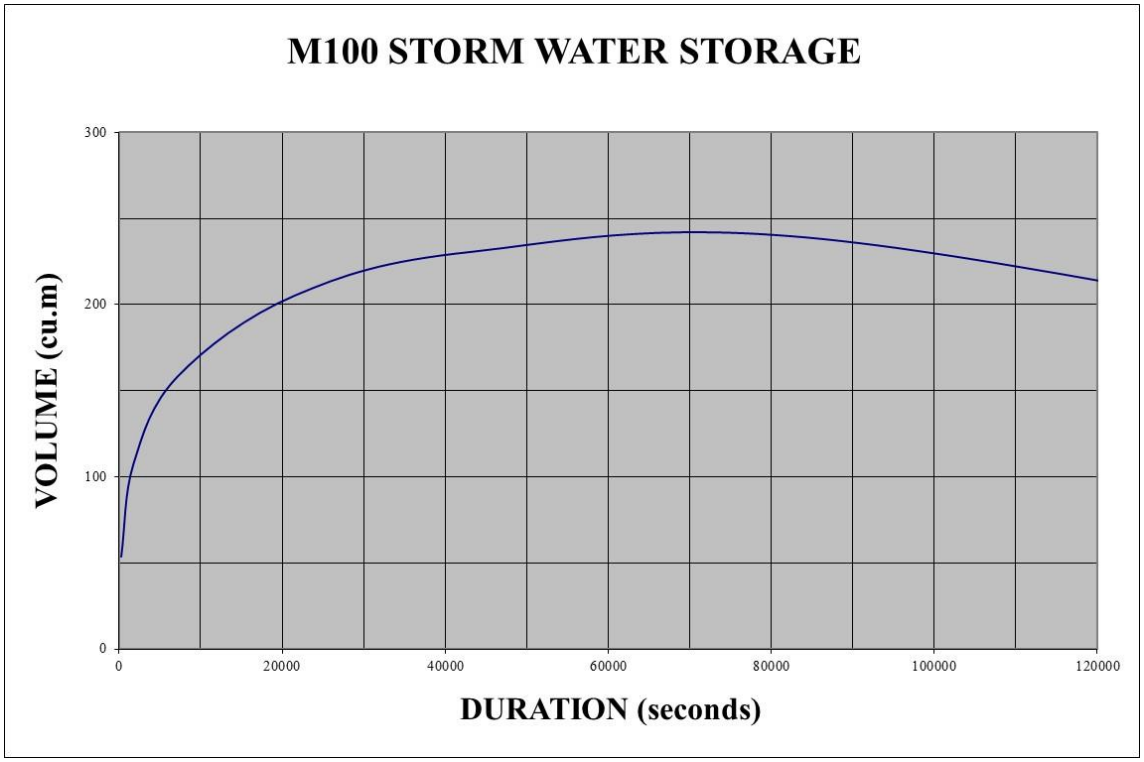
Permitted Runoff (Q_{BAR}) and Storage Volume

Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} = 0.1383 m^3/s 5136.732 m^2 2.42ha Q_{BAR} = 0.001421 m^3/s

1.42 l/s
2.77 l/s/ha



Storage Volume Required = 238 m^3
100 year storm event.

20% Increase Due to climate change= 285.7027 m^3

Area 5 - Road 5					
Permeable Paving South East	=	0.0292983	ha	292.983	m²
				292.983	m²
Total Storage Volume Perm Paving @ 0.3m Depth	=			87.8949	m³
Storage Tank @ 150m² @ 1.2m Deep @ 96% VR	=			172.8	m³
4 No. Tree Pits @ 12.5m² @ 0.6m Depth	=			28.8	m³
Total Storage Provided	**=**			**289.4949**	**m³**
Storage Required	**=**	**285.702735**	**m³**		

6.3.6 Area 6 - Road 4 lower

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

SOIL = $(0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	6447.537 m^2	=	0.644754
Buildings		1316.435	m^2
Footpath Surrounding Units/Incl Apts		726	m^2
Hard standings(Roads Incl Roadside Parking)		1,682	m^3
Gardens/ Public Open Space		2,723	m^2
Entire Site	6447.537 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

Average Volumetric Runoff Coefficient C_v

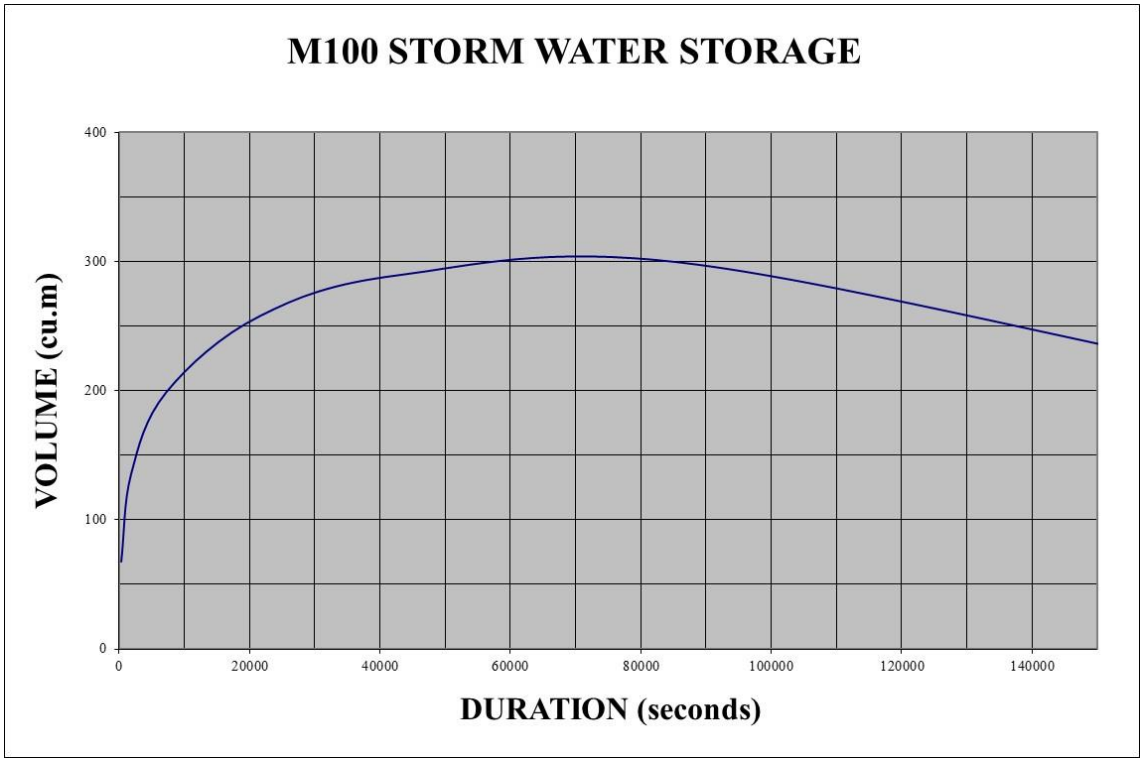
$C_v = \frac{4{,}541.4}{6447.537} = 0.704$ say 0.70

Permitted Runoff (Q_{BAR}) and Storage Volume

Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} = 0.1383 m^3/s 6447.537 m^2 2.42ha Q_{BAR} = 0.001784 m^3/s 1.78 l/s 2.77 l/s/ha



Storage Volume Required = 299 m^3
100 year storm event.

20% Increase Due to climate change= 358.6091 m^3

Area 6 - Road 4 lower					
Permeable Paving South East	=	0.0277504	ha	277.504	m^2
				277.504	m^2
Total Storage Volume Perm Paving @ 0.3m Depth	=			83.2512	m^3
Storage Tank @ 162m^2 @ 1.5m Deep @ 96% VR	=			233.28	m^3
6 No. Tree Pits @ 12.5m^2 @ 0.6m Depth	=			43.2	m^3
Total Storage Provided	**=**			**359.7312**	**m^3**
Storage Required	**=**	**358.609123**	**m^3**		

6.3.7 Area 7 - East of Site

Soil Index SOIL (From FSR)
Fig I 4.18 (I) Winter Rain Acceptance Potential (WRAP) = 2 (low runoff)

$SOIL = (0.15\ S_1 + 0.3\ S_2 + 0.4\ S_3 + 0.45\ S_4 + 0.5\ S_5)/(1 - S_U)$

SOIL = 0.3(1) / (1 - 0.0) =	0.3

S_n = Fraction of site of particular soil type (where n indicates soil type from Fig I 4.18 (I))

General Information
Average Volumetric Runoff Coefficient C_v for the site = 0.70

Area =	33963.034 m^2	=	3.396303
Buildings		6934.452	m^2
Footpath Surrounding Units/Incl Apts		3,826	m^2
Hard standings(Roads Incl Roadside Parking)		8,858	m^3
Gardens/ Public Open Space		14,344	m^2
Entire Site	33963.034 m^2		

Runoff coefficient for surfaces are
Dwellings at 1.0
Hardstanding, roads and footpaths at 1.0
Grass and landscaping at 0.30

Average Volumetric Runoff Coefficient C_v

$$C_v = \frac{23{,}922.2}{33963.034} = 0.704 \quad \text{say} \quad 0.70$$

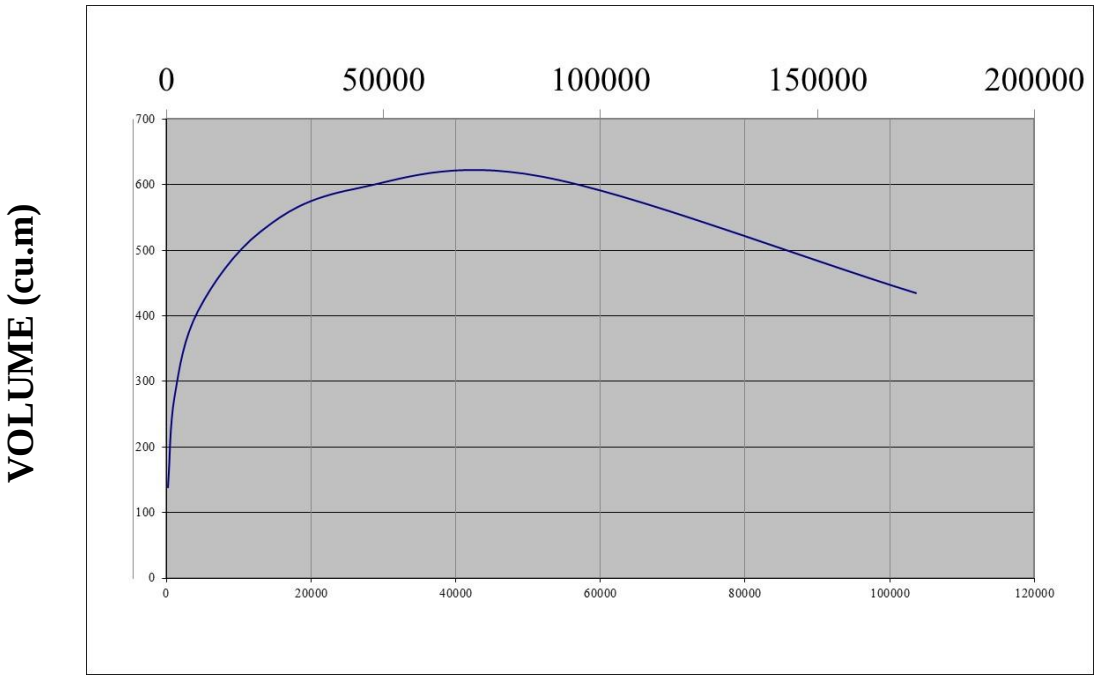
Permitted Runoff (Q_{BAR}) and Storage Volume

Based on guidance from Dublin Corporation's Stormwater Management Policy

$Q_{BAR} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

50 Q_{BAR} =	0.1383 m^3/s	33963.034 m^2	2.42ha Q_{BAR} =	0.009395 m^3/s	9.39 l/s 2.77 l/s/ha

M100 STORM WATER STORAGE

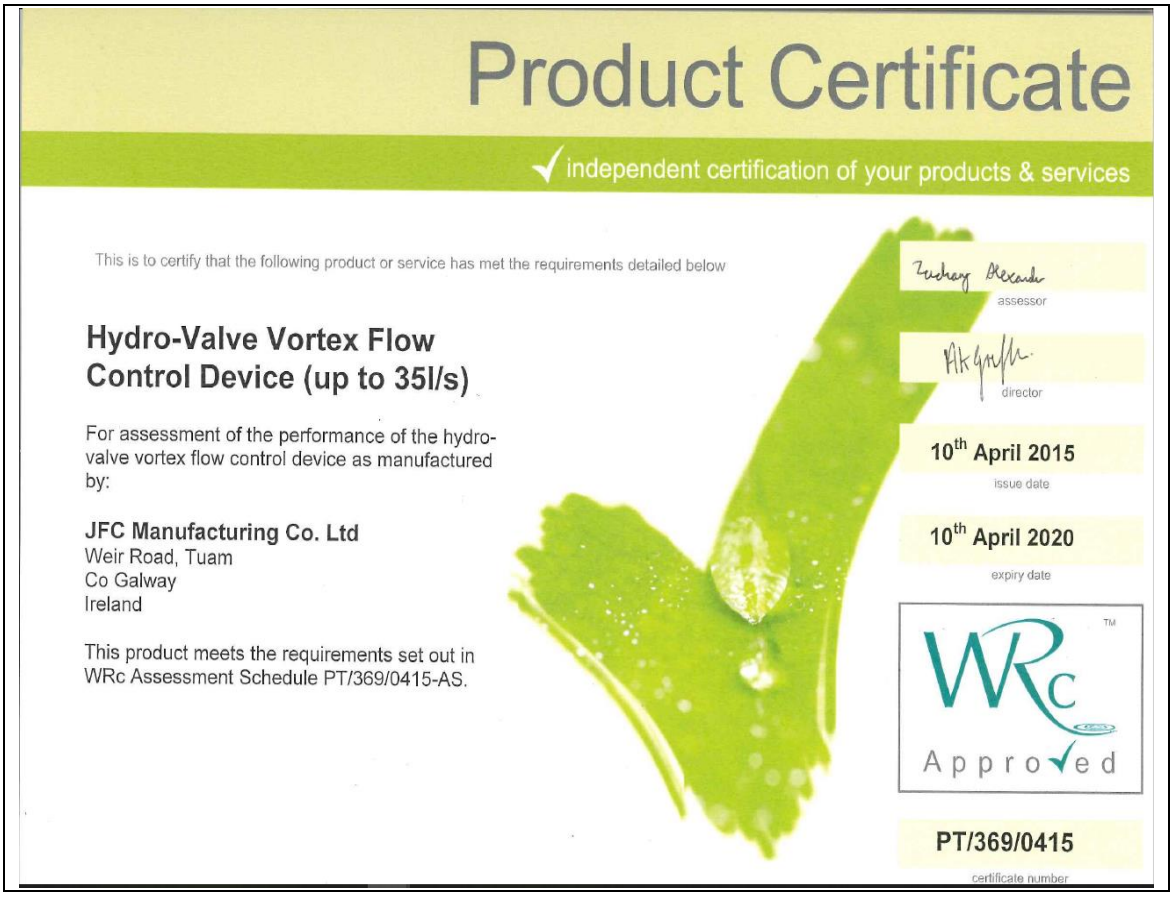


Storage Volume Required = 1574 m^3
100 year storm event.

20% Increase Due to climate change= 1889.009 m^3

Area 7 - East of Site					
Permeable Paving South East	=	0.5790794	ha	5790.794	m²
				5790.794	m²
Total Storage Volume Perm Paving @ 0.3m Depth	=			1737.2382	m³
No Storage Tank	=			0	m³
22No. Tree Pits @ 12.5m² @ 0.6m Depth	=			158.4	m³
Total Storage Provided	**=**			**1895.638**	**m³**
Storage Required	**=**	**1889.00875**	**m³**		

6.4 HYDRO BRAKE DETAIL



Product Certificate

independent certification of your products & services

This is to certify that the following product or service has met the requirements detailed below

Hydro-Valve Vortex Flow Control Device (up to 35l/s)

For assessment of the performance of the hydro-valve vortex flow control device as manufactured by:

JFC Manufacturing Co. Ltd
Weir Road, Tuam
Co Galway
Ireland

This product meets the requirements set out in WRc Assessment Schedule PT/369/0415-AS.

assessor

director

10th April 2015
issue date

10th April 2020
expiry date

WRc Approved

PT/369/0415
certificate number

Hydro-Valve Technical Specification

3.0 FEATURES

3.1 General

Hydro-Valve vortex flow control devices have patented features such as the unique mounting adaptor which allows the easy installation of the Hydro-Valve onto the curved surface of a 1200mm manhole or the flat surface of a rectangular manhole. This unique mounting adaptor has an integrated bypass facility operated by a wire rope from the top of the manhole in the unusual event of a blockage. Another maintenance feature is a removable service plate on the back of the vortex chamber. (see figure 5.)

A neoprene gasket between the Hydro- Valve and manhole creates a watertight seal.

Outlet pipe sizes are Ø225mm CorriPipe and Ø300mm CorriPipe as standard, other outlet pipe sizes are available upon request.

3.2 Installation Manhole

There are two main types of mounting adaptors available with all Hydro- Valves:

- To suit a Ø1.2m Manhole (plastic or concrete, see fig. 5)
- To suit a rectangular manhole (precast, cast in situ or blocked)
- Customised Manhole adaptors available on request.

See installation drawings on pages 6 & 7 for more details.

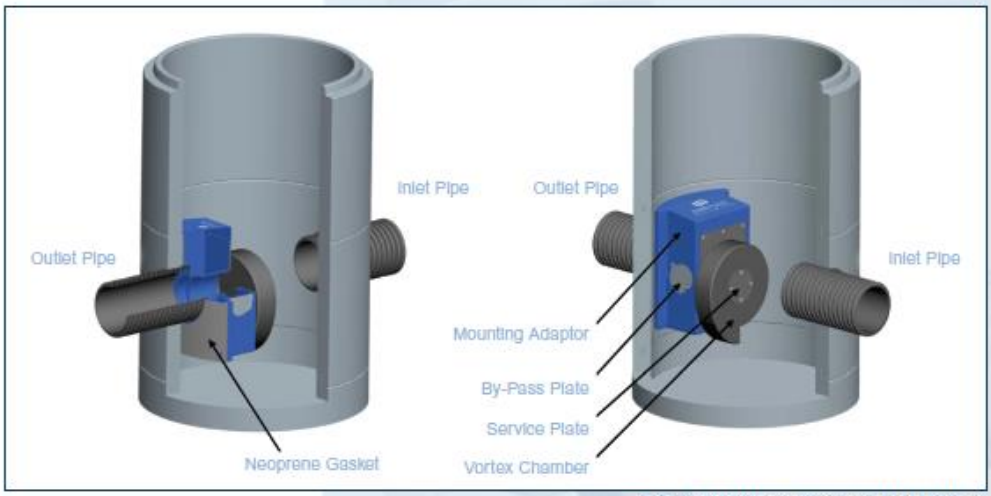


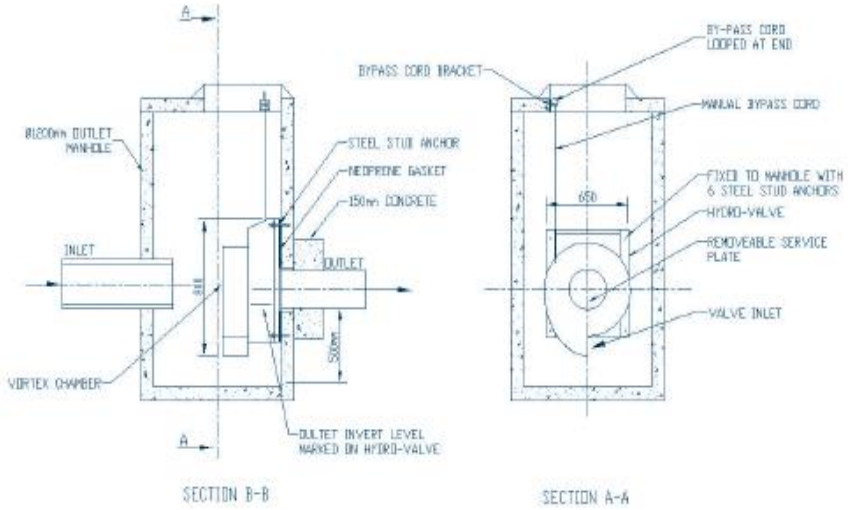
Fig. 5 (Ø1200mm Manhole Installation)

Hydro-Valve Technical Specification

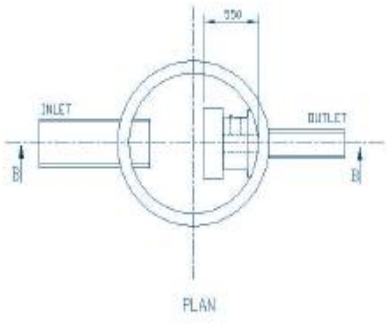
JFC Manufacturing
Weir R.D. Tuam, Co. Galway.
Tel: 093 24066 Fax: 093 24923
Web: www.jfc.ie Email: info@jfc.ie

HYDRO-VALVE

Ø1.2m Manhole Installation Instructions for Large Mounting Box



SECTION B-B SECTION A-A



PLAN

Watertight Seal

- The neoprene gasket seals the Hydro-Valve to the wall of the Manhole preventing any water from entering the outlet pipe without going through the valve.
- The concrete casing prevents any water that leaves the valve from entering the ground around the outlet pipe.

INSTALLATION NOTES

1. Cut out a hole in the Ø1200mm manhole for outlet pipe ensuring it is larger than O.D. of outlet pipe.
2. Mount the Hydro-Valve on inside of Ø1200 manhole so outlet invert is the same level as invert mark on the Hydro-Valve.(moulded in on opposite side to by-pass plate)
3. Mark manhole through 6 holes on Hydro-Valve and drill using 12mm drill bit supplied.
4. Fix Hydro-Valve to Manhole with 6 steel stud anchors supplied.
5. Push the outlet pipe through the manhole until it seats against the Hydro-Valve.
   - A 225 Corrugated Pipe will fit into the reciever with a seal
   - All other pipe sizes will seat aginst front of Hydro-Valve.
6. Case the outlet pipe with 150mm of concrete as shown above.
7. Fix the first by-pass cord bracket to the inside wall of the precast biscut vertically above the by-pass plate.
8. Fix the second bracket to the inside wall of the precast biscut in a position that leaves easy access to the by-pass cord handle.
9. Adjust the length of the by-pass cord using the u-clamp on the by-pass plate to leave easy access to the handle
10. Ensure the cord operates freely.

6.5 BYPASS OIL SEPARATOR

PREMIER TECH AQUA

CE

Technical Specification for Premier Tech Aqua CNSB 20S/21 By-Pass Oil Separator.

Type	:	By-Pass Separator
Catergory	:	Class 1
Nominal Flow	:	20 Lit/sec
Max. Flow	:	200 Lit/sec
Area	:	11111m2
Oil Storage Capacity	:	300Lit
Silt Storage Capacity	:	2000Lit
Installation	:	UTG9502 Concrete Surround

This product conforms fully with both the Environment Agency latest PPG guidelines and the European Standard BSEN-858-1-2.

Under test conditions Premier Tech Aqua By-Pass oil separators performed to less than 1mg/Lit.

The product has been subject to Type Testing (TT) by the manufacturer,

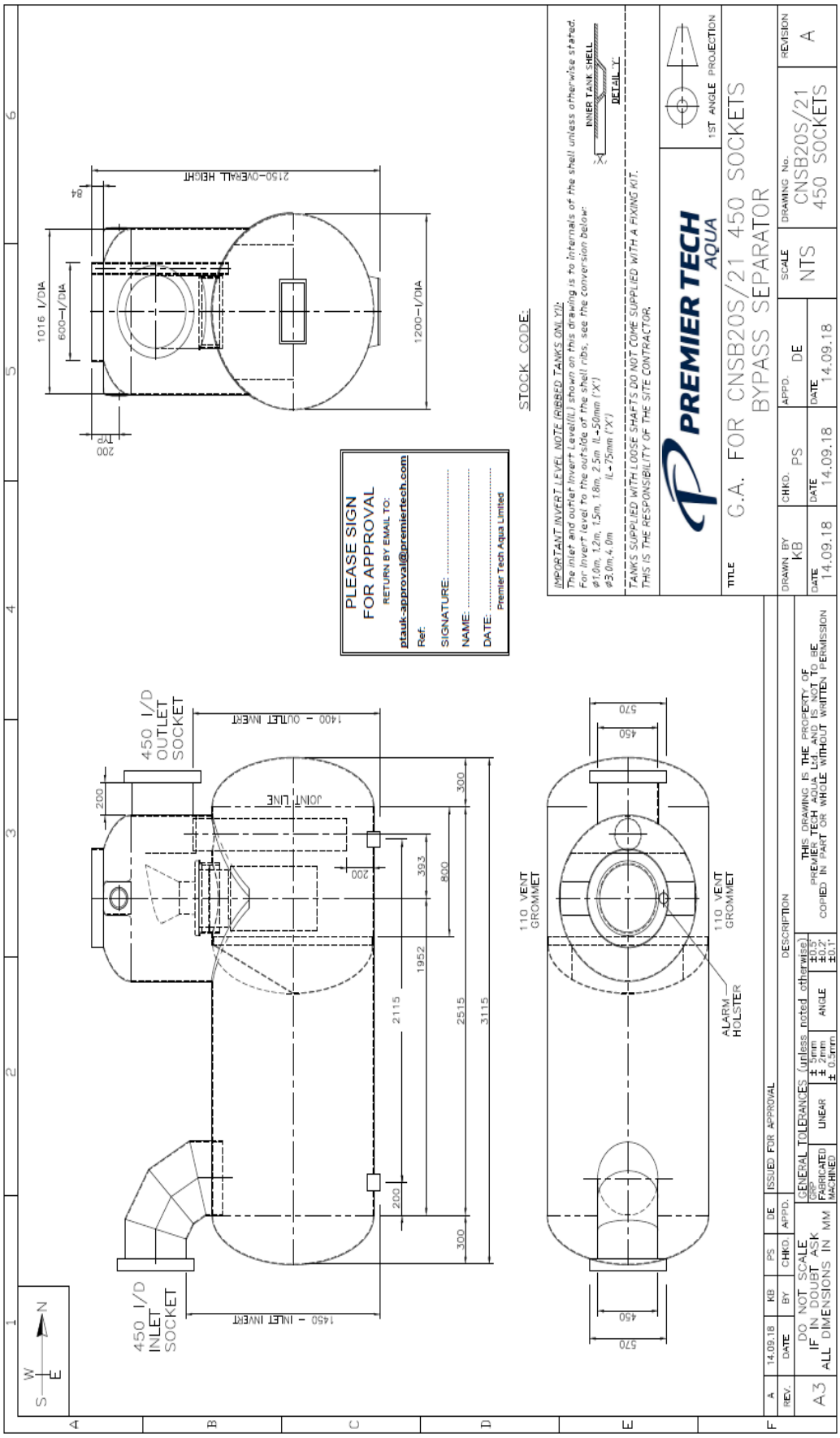
Premier Tech Aqua (formally Conder Environmental Solutions) as defined by EN-858 Part 1: 2002 Table ZA.-1

- Liquid Tightness
- Effectiveness
- Load Bearing Capacity
- Durability

PREMIER TECH AQUA LIMITED, 2 Whitehouse Way, South West Industrial Estate, Peterlee,
Co. Durham, SR8 2RA, UNITED KINGDOM +44 (0) 870 264 0004 +44 (0) 870 264 0005
ptauk-sales@premiertech.com WWW.PREMIERTECHAQUA.CO.UK Registered in England and Wales No: 06698049

Certificate No. FM 81587 ISO 9001:2000

Page 1 of 1


PLEASE SIGN
FOR APPROVAL
RETURN BY EMAIL TO:
ptauk-approval@premiertech.com
Ref:
SIGNATURE:
NAME:
DATE:
Premier Tech Aqua Limited
STOCK CODE:
IMPORTANT INVERT LEVEL NOTE (RIBBED TANKS ONLY):
The inlet and outlet Invert Level(IL) shown on this drawing is to internals of the shell unless otherwise stated.
For Invert level to the outside of the shell ribs, see the conversion below:
ø1.0m, 1.2m, 1.5m, 1.8m, 2.5m IL+50mm (X)
ø3.0m, 4.0m IL+75mm (X)
INNER TANK SHELL
DETAIL 'X'
TANKS SUPPLIED WITH LOOSE SHAFTS DO NOT COME SUPPLIED WITH A FIXING KIT.
THIS IS THE RESPONSIBILITY OF THE SITE CONTRACTOR.
PREMIER TECH AQUA
1ST ANGLE PROJECTION
TITLE G.A. FOR CNSB20S/21 450 SOCKETS BYPASS SEPARATOR
DRAWN BY KB
CHKD. PS
APPD. DE
SCALE NTS
DRAWING No. CNSB20S/21 450 SOCKETS
REVISION A
DATE 14.09.18
DATE 14.09.18
DATE 14.09.18
2150-OVERALL HEIGHT
1016 I/DIA
600-I/DIA
1200-I/DIA
84
200 TYP
450 I/D OUTLET SOCKET
1400 - OUTLET INVERT
JOINT LINE
200
300
393
800
1952
2115
2515
3115
450 I/D INLET SOCKET
1450 - INLET INVERT
110 VENT GROMMET
570
450
ALARM HOLSTER
DESCRIPTION
ISSUED FOR APPROVAL
GENERAL TOLERANCES (unless noted otherwise)
FABRICATED ± 1mm
MACHINED ± 0.5mm
LINEAR ± 1mm ± 0.5mm
ANGLE ± 0.1°
THIS DRAWING IS THE PROPERTY OF PREMIER TECH AQUA Ltd AND IS NOT TO BE COPIED IN PART OR WHOLE WITHOUT WRITTEN PERMISSION
A3
DO NOT SCALE
IF IN DOUBT ASK
ALL DIMENSIONS IN MM
REV. A
DATE 14.09.18
BY KB
CHKD PS
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7.0 UTILITIES

A description of the capacity of existing or planned infrastructure to serve the proposed development, of the impact of the proposed development on existing /planned infrastructure and of any proposals to provide for other services infrastructure (including cabling such as broadband provision) and any phasing proposal

7.1 Existing Utilities

A request for existing utility records from all major utility providers in Ireland has been made for the purpose of application. The following information is based on record information to hand, at the time of preparing the report.

7.1.1 ESB

ESB records indicate that there are existing Low/Medium Voltage ESB infrastructure within the vicinity of the proposed development.

The overhead line running through the site will be replaced with underground services. Ducting will be provided to allow for these to be brought underground, in full consultation with the service provider.

7.1.2 EIR

EIR records indicate that there is telecom infrastructure located to the south of the site within Nordic Enterprise Park.

7.1.3 Virgin Media

According to Virgin Media records, there is existing infrastructure located to the east of the proposed development along the R626.

7.1.4 Gas Networks Ireland

Gas Networks Ireland records indicate that there is existing infrastructure to the south of the site within Nordic Enterprise Park.

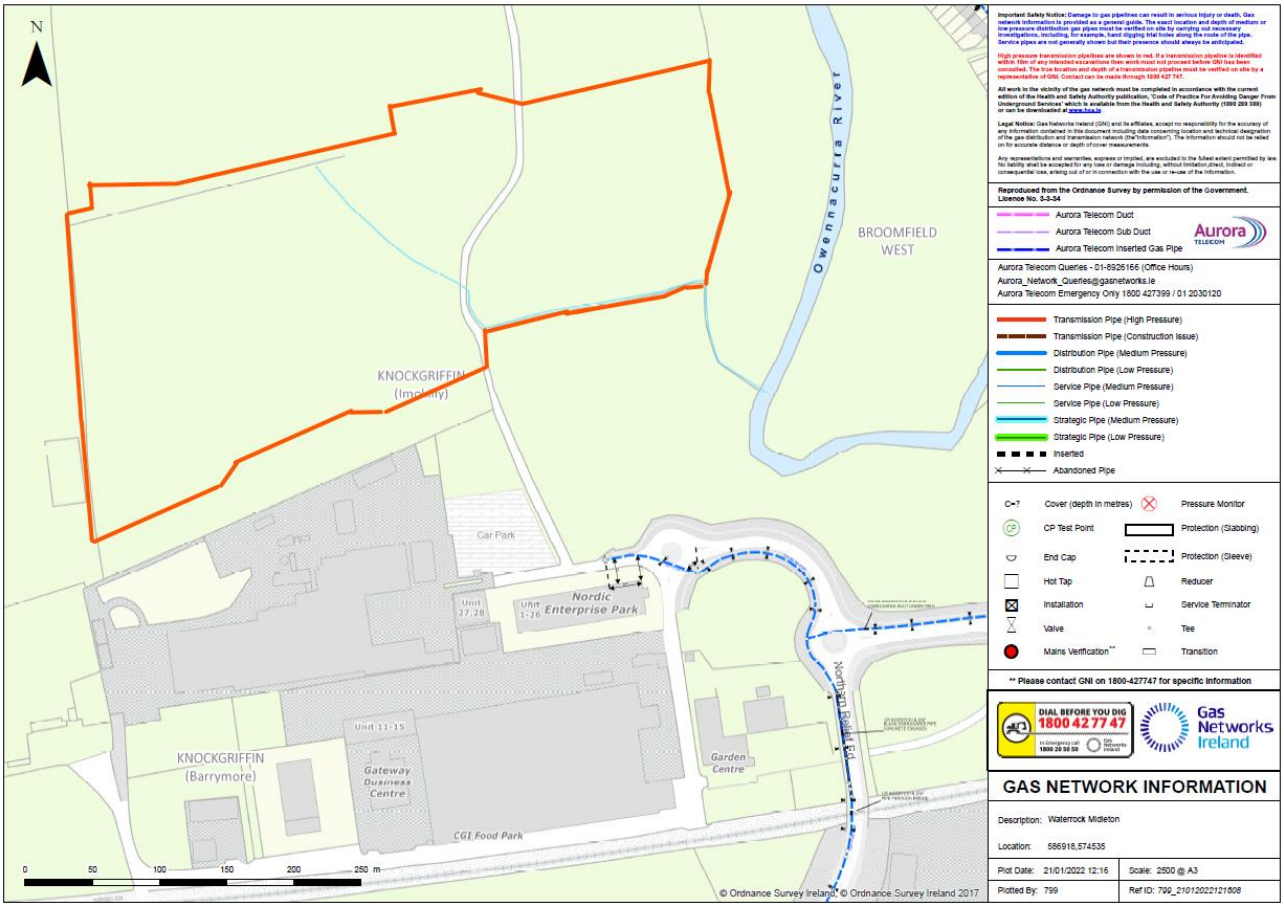

Figure 2 Gas Networks Information: Site Outlined Red

7.1.5 ENET

ENET records indicate that there is existing ENET infrastructure located to the south of the site within Nordic Enterprise Park.

7.2 Proposed Utilities

As part of the scheme, utility infrastructure will be provided to serve the development.

Connections to serve the development will be provided as part of the new LIHAF funded road scheme to be constructed by Cork County Council. Consultations at detailed design stage will be undertaken with the relevant utility providers.

8.0 SUMMARY

This report has outlined the engineering proposals associated with Haven Falls Limited application for a proposed mixed use (primarily residential) development at Water Rock, Midleton, County Cork on a circa 9.5-hectare site.

The findings are summarised as follows:

• Irish Water is providing new trunk watermain and foul sewer infrastructure to serve the Water Rock Framework Plan lands, including the subject site sites.

• Cork County Council are currently in the process of delivering new road infrastructure within the vicinity of the lands in order to facilitate the development along with other future development in the surrounding area. This LIHAF funded road scheme includes for the provision of services to serve future development.

• The proposed development will be served by a new water supply network. The water supply network to serve the development will be constructed in accordance with Irish Water standards.

• The proposed development will be served by new foul infrastructure. The foul network to serve the development will be constructed in accordance with Irish Water standards.

• The surface water management regime will be based on SuDS principles.

Surface water from the site will be collected and attenuated on site, with a peak discharge rate of 2l/s/ha for the 1 in 100 Year rainfall event (including an allowance for climate change). As part of the development, a number of different SuDS measures will be provided to minimise the impact on water quality and water quantity of the runoff and maximise the amenity and biodiversity opportunities within the site.

• There are a number of utility providers with infrastructure within the vicinity of the development.

• IE Consulting has undertaken a Site-Specific Flood Risk Assessment for the development. This SSFRA has been undertaken in consideration of the relevant Cork County Council development plan and in accordance with the DOEHLG guidelines *'The Planning System and Flood Risk Management Guidelines'*. Summary Details of this can be found in 5.0 Site Specific Flood Risk Assessment - Summary

The full IE Consulting Report accompanies the application.