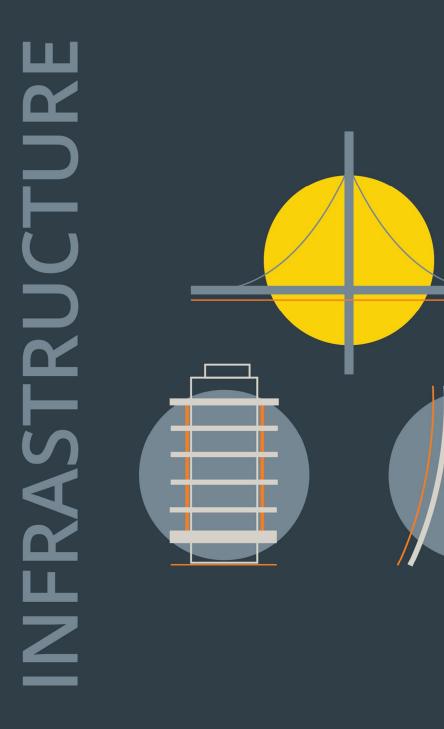
Report Title

Infrastructure Design Report

Clier

Shannon Homes Drogheda





170092-REP-010 October 2019

Job Title: Strategic Housing Development at Colpe West, Drogheda,

Co. Meath

Job Number: 170092

Report Title: Infrastructure Design Report

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1.0 INTRODUCTION

1.1 General

DBFL were commissioned to undertake an infrastructure design report to accompany a planning submission for a proposed residential development in the townland of Colpe West, Drogheda, County Meath. The subject site is within the "Mill Road / Marsh Road Urban Design Framework Plan 2017" extents and is included in lands that have been identified for development in the

"Local Area Plan for the Southern Environs of Drogheda 2009-2015".

The proposed development comprises 357 residential units (169 no. houses, 52 no. duplex units, and 136 no. apartments), a childcare facility and associated infrastructure including a link street and a surface water outfall pipe on a site area of circa 13ha. The application is under consideration through the SHD (Strategic Housing Development) planning process, with An Bord Pleanala. This application also seeks to amend a link street approved under Meath County Council Planning Reference LB180620 (commercial development and link street through the

"Mill Road / Marsh Road Framework Plan lands").

This report addresses the engineering items relevant to DBFL Consulting Engineers included in the An Bord Pleanala "Opinion" following the tripartite meeting and also addresses foul and

surface water drainage strategy and design, water supply and road design.

1.2 Location and Topography and Site Characteristics

The subject site is situated to the southwest of Drogheda Town, to the east of the Dublin-Belfast railway line. It is bounded to the north by greenfield agricultural lands (also within the "Mill Road / Marsh Road Framework Plan Lands") and to the east by an existing primary school,

Gaelscoil, "An Bhradain Feasa" and Mill Road. Refer to Figure 1 below.

The lands are currently predominately greenfield agricultural lands and largely slope from southwest to north-west and north-east. There is an existing ditch system which forms the north eastern boundary of the site and continues in an easterly direction towards Mill Road. There is

also a ditch system in lands immediately west of Colpe Road and continuing in an easterly

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direction where it crosses under the route of the link street and is culverted under Mill Road before continuing eastwards in an open channel arrangement.



Figure 1: Site Location Map

2.0 ACCESS AND ROADS

2.1 General

Vehicular access to the residential development would be from a link street through the "Framework Plan" lands linking the residential lands with Colpe Road to the south east. The link street under consideration comprises modifications to the street granted planning permission by Meath County Council under Planning Reference LB180620. The modifications ensure that the design is in accordance with the "Design Manual for Urban Roads and Streets", (DMURS) and include replacing the most western roundabout with a 4-arm signalised junction and replacing the middle roundabout with priority junction arrangements to adjoining lands. The link street includes a vehicular link to Gaelscoil "An Bhradain Feasa", which is currently accessed from Mill Road and also provides access to the temporary post primary school approved under planning reference LB190739.

The street layout for the proposed development is designed in accordance the Design Manual for Urban Roads and Streets (DMURS) and we refer to the *DMURS Compliance Statement*, which is included under separate cover.

Refer also to DBFL drawing no. 170092-1053 for the "Road Hierarchy Plan" in support of the *DMURS Compliance Statement*.

2.2 Traffic & Transportation

A 'Traffic & Transport Assessment' by DBFL Consulting Engineers is included, as a separate report, with this planning submission.

3.0 GROUND CONDITIONS

Surface water soakaway tests have been carried out in accordance with BRE Digest 365 to determine the permeability of the soil. The results of the soakaway testing are included in the Ground Investigations Ireland report, "Mill Road Marsh Road, Co. Meath, Ground Investigation Report", which is included with the planning application under separate cover.

The results of the soakaway testing indicate that the ground is not suitable for the disposal of surface water to the ground. At soakaway pits SA01; 02; 04; 05 & 06, while the water level dropped, it was too slow to calculate a soil infiltration rate "f", in accordance with BRE Digest 365. At soakaway pit location SA03, groundwater filled the test pit to 500mm below ground level.

Excavation of the soakaway pits confirmed that ground conditions in the area generally comprise firm gravelly sandy clay, overlying firm to stiff gravelly sandy clay. Rock was encountered at circa 0.8m and 1.8m below ground level, in soakaway pits SA01 & SA02, which were carried out in the site of the approved commercial development (LB180620). Rock in the area comprises limestone.

Rock was generally found between 2m and 4m throughout the site.

4.0 SURFACE WATER DRAINAGE

4.1 General

The jurisdiction of Meath County Council forms part of the Greater Dublin Area (GDA) as identified in the *Greater Dublin Strategic Drainage Study* (GDSDS). The GDSDS outlines regional drainage policies to address the drainage needs of the GDA. These policies address surface water management from development sites, from the point of view of water quality, quantity, risk of flooding and compliance with relevant environmental legislation. As outlined in the GDSDS, proposed developments must be drained on separate foul and surface water drainage systems and must incorporate Sustainable Urban Drainage Systems (SuDS) for the management of surface water runoff.

Surface water runoff from the proposed development would therefore be designed in accordance with the principles of the GDSDS and Meath County Council's requirements, and all current guidelines, including CIRIA SuDS Guidelines.

4.2 Compliance with Surface Water Policy

Surface water management for the proposed development is designed to comply with the Greater Dublin Strategic Drainage Study (GDSDS) policies and guidelines and the requirements of South Dublin County Council. The guidelines require the following main 4 main criteria to be provided by the development's surface water design;

- Criterion 1: River Water Quality Protection satisfied by providing interception storage, treatment of run-off within the SUDS features. This is satisfied using green roofs, permeable paving, swales, petrol interceptors and on-line cellular storage attenuation systems.
- Criterion 2: River Regime Protection satisfied by attenuating run-off with flow control devices prior to discharge to the outfall.
- Criterion 3: Level of Service (flooding) for the site satisfied by the Site being outside the 1000 year coastal and fluvial flood levels and extents. Pluvial flood risk addressed by development designed to accommodate surface water runoff from a 100-year period storm (1& AEP) plus climate change (10%) as per the recommendations of the GDSDS. Planned flood routing for storms greater than 100-year return period level considered in design and development run-off contained within site.

• Criterion 4: River flood protection – attenuation provided within the SUDS features i.e. permeable paving, green roofs and on-line attenuation basins.

4.3 Surface Water Management

4.3.1 General

Surface water runoff from the proposed residential development would be attenuated to Qbar in accordance with the recommendations of the GDSDS, with surface water runoff exceeding the allowable outflow rate stored for up to a 1% AEP (Annual Event Probability) rainfall event. Surface water storage would be provided in an underground storage system, such as 'Stormtech' or similar approved systems and in an overground system in the form of shallow detention basins above the 'Stormtech' units.

SuDS features are incorporated into the surface water drainage network, as required in the GDSDS.

There are three surface water outfall points identified for receiving attenuated surface water runoff from the subject site, as follows:

- (i) Outfall "A": The existing 1050mm diameter surface water pipe (existing MH S4) adjacent to the railway line (*Figure 2* below) via the surface water outfall pipe approved under *LB180620*.
- (ii) Outfall "B": The existing ditch system adjacent to the most western section of the link street, which forms the northern boundary of *Gaelscoil An Bhradáin Feasa* before crossing Mill Road and continuing in an easterly direction towards the Stameen River (*Figure 3* below).

This ditch is currently piped under Mill Road and continues in a westerly direction towards the Stameen River, via a surface water pipe through private front gardens. Preliminary investigations indicate that this piped section is sub-standard. It is therefore proposed to construct a new surface water outfall in a westerly direction to the Stameen River via Mill Road. Refer to DBFL drawing no.170092-3058 for details of this surface water outfall.

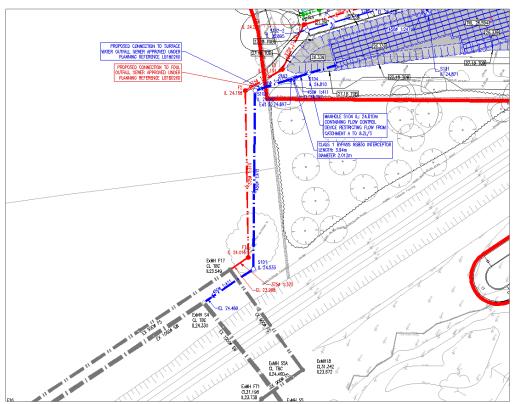


Figure 2: Outfall A; Extract of Site Services Plan indicating the surface water connection point to the existing 1050mm diameter surface water sewer north of railway line

(iii) Outfall "C": The existing ditch along the south-eastern boundary of the commercial development approved under *LB180620* and adjacent to Colpe Road, which crosses Mill Road in a culvert and continues in an easterly direction (*Figure 4* below). This ditch originally drained lands to the south west of the railway line, however following development of these lands the catchment area reduced significantly and runoff to this ditch also reduced, with runoff from the section of Colpe Road between the bridge and Mill Road now being the primary source of runoff.

The proposed works include a new surface water drainage network for this section of road which would discharge attenuated runoff to the ditch between the realigned section of Mill Road and the existing Mill Road, (Outfall "C"). This ditch is currently culverted under Mill Road in a culvert of 0.46m wide x 0.9m high, which has settled resulting in the upstream end of the culvert being lower than the downstream end. It is therefore proposed to remove this culvert and to replace it with a new 900mm diameter surface water pipe. Refer to DBFL drawing no. 170092-3057 for further details.

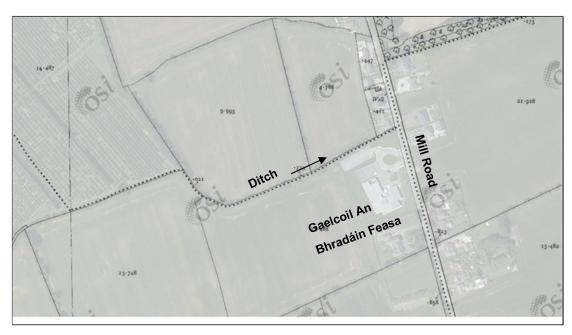


Figure 3: Outfall B; Extract of OSI historic 25-inch map (1888-1913) showing the ditch system which forms the western boundary of "Gaelscoil an Bhradáin Feasa"

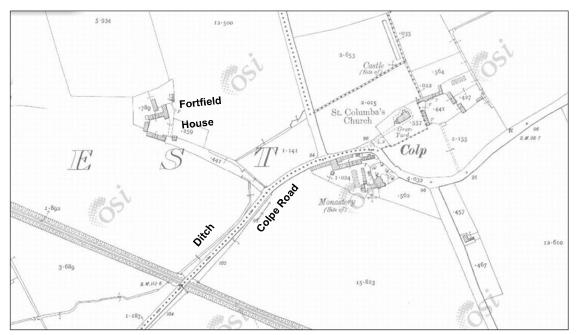


Figure 4: Outfall C; Extract of OSI historic 25 inch map (1888-1913) showing the ditch system crossing the railway and continuing in a north easterly direction

4.3.2 Surface Water Catchments

To manage surface water runoff from the development, it is proposed to separate the development into three surface water catchments ("A", "B", and "C") corresponding to each surface water outfall. Each catchment is divided into smaller sub-catchments with surface water storage for a 1% AEP (Annual Event Probability), or 1 in 100-year return period event storm provided within each catchment and sub-catchment. Refer to *Figure 5* below for the surface water catchments for the subject site.

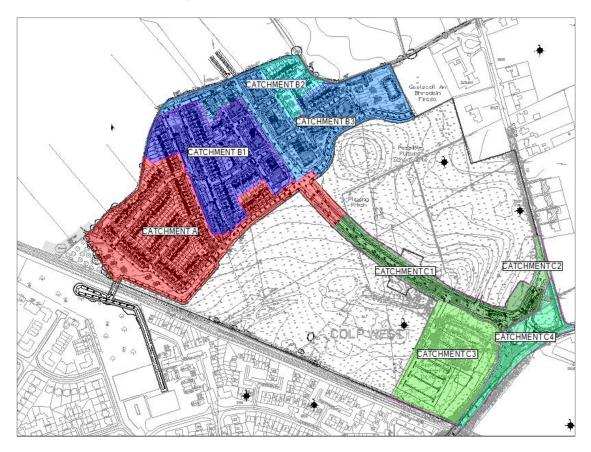


Figure 5: Surface Water Catchment Plan

Catchment "A": Comprises the western portion of the lands and a section of the link street, with attenuated runoff from this catchment discharging to the existing 1050mm diameter surface water sewer, adjacent to the railway line (

2 above). Surface water storage for this catchment is provided in the public open space area.

Catchment "B": Comprises the balance of the residential development and is subdivided in catchments "B1", "B2" and "B3". Attenuated runoff from catchment "B" outfalls to the ditch system to the west of Gaelscoil An Bhradain Feasa (Outfall "B"; Figure 3 above). Surface water

storage for this catchment is provided in open space areas and primarily in the public open space at the eastern end of the site.

Catchment "C": Comprises the balance of the link street and is subdivided into catchments "C1", "C2", "C3" & "C4". Attenuated runoff from catchment "C" outfalls to the existing ditch system adjacent to Colpe Road (Outfall "C"; Figure 4 above). Sub-catchment C3 is not included in the application site but refers to attenuated runoff rate from committed development (commercial development approved under LB180620).

4.3.3 Surface Water Attenuation

The GDSDS recommends limiting outflow to the maximum discharge rate of QBAR or 2l/s/ha, whichever is the greater, for all attenuation storage, where QBAR is estimated using the Flood Studies Report Method (FSR).

Obar is calculated using the *Institute of Hydrology* Qbar equation is as follows:

$$Q_{har}[rural] = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times Soil^{2.17}$$

Where:

- Q_{bar[rural]} is the mean catchment annual flow from a rural catchment in m³/s;
- AREA is the area of the catchment in km². For a catchment area less than 50ha, calculate
 Q_{bar} for 50 ha and pro rata it.
- Area = $50ha \text{ or } 0.5km^2$;
- SAAR is the standard average annual rainfall = 760mm;
- SOIL is the soil index, with 5 soil types used and SPR values (standard percentage runoff)
 applied to each soil type.
- SAAR = 760mm for Colpe Road, Drogheda.
- The SPR values for the 5 soil types are as follows:
 - Soil 1 = 0.1; (well drained; very low ruoff potential)
 - Soil 2 = 0.3; (very permeable soil, sand and gravel, low water table; low runoff potential)
 - Soil 3 = 0.37; (very fine sands, silts, clays; permeable soils; moderate runoff potential)
 - Soil 4 = 0.47; (clay or loamy soils; high runoff potential)
 - Soil 5 = 0.53; (peat, rocky soils; very high runoff potential)

The site investigations included as a standalone report indicate that the soil throughout the site are predominantly clay with no permeability, corresponding to soil type 4. Also, rock was found generally throughout the site between 2m and 4m below ground level. However, while on site testing and conditions indicate the most appropriate soil type as being soil type 4 throughout the site, Qbar is calculated based on a more conservative SPR value of 0.37 (Soil Type 3). Obar calculation is outlined below.

Q
$$_{(bar\, rural)} = 0.00108 \times 0.50^{.89} \times 760^{-1.17} \times 0.37^{-2.17} = 0.158 \text{m} 3/\text{s} = 158 \text{l/s for 50ha}$$
 Q $_{bar} = 3.1 \text{ l/s/ha}$

(A copy of the allowable outflow spreadsheet is included in Appendix A.)

While Obar has been calculated for soil type 3, a more conservative value of 2l/s/ha has been applied for the residential element of the development. This is equivalent to soil type 2. The allowable outflow rate applied for the link street is 3l/s/ha (soil type 3) as approved under LB180620. Therefore, the overall allowable outflow rate for the entire site including the modifications to the link street approved under LB180620 is 2.23l/s/ha. Refer to *Table 1* for details of the allowable outflow rate applied for each catchment.

'Hydrobrake' flow controls will be located on the outfall from each sub-catchment and set at a rate to optimise storage within each upstream catchment. The allowable outflow from each catchment and sub-catchment is included in *Table 1* below.

4.3.4 Surface Water Storage

The surface water storage method proposed for each catchment is determined by the site layout and available space within each catchment and sub-catchment. They all comprise underground 'Stormtech' systems (or similar approved), with some over ground storage in the form of detention basins. The total surface water storage volume required for the subject site comprises circa 2,600m³. Refer to *Table 1* below for a breakdown of the surface water storage requirement for each catchment and sub-catchment.

The volume of surface water storage required for each catchment has been calculated using the "Source Control" module of "Microdrainage" software taking account of design invert levels, ground levels, and depth and type of storage system and allowable outflow rate.

The surface water drainage network and the surface water storage system have also been simulated using the "Network" module of "Microdrainage" for a range of storm events including 1 in 2, 1 in 10, 1 in 30 and 1 in 100-year storm events.

Details of surface water attenuation and storage for each sub-catchment and catchment is included in *Table 1* below.

Refer to Appendix B for Microdrainage surface water storage calculations.

Surface Water Catchment	Area of Catchment (ha)	Allowable Outflow Rate (Qbar) (I/s)	Allowable Outflow Rate/ha (Qbar) (I/s)	Underground Storage 'Stormtech' Volume (m³)	Type of Stormtech Unit	Aboveground Storage "Detention Basin" Volume (m³)	Total Storage Volume (m³) (100-year Return Period / 1% AEP)
А	4.472	8.9	1.99	560	SC-740	215	775
В	6.29	12.7	2.0	1,107	-	278	1,385
B1	2.620	5.3		398	SC-740	60	458
B2	0.620	N/A ¹		88	SC-310	-	88
В3	3.050	7.4		627	SC-740	218	845
С	4.83	14.2	2.9	583.5	-	274	857.5
C1	1.370	4.1		-	-	274	274
C2	0.180	2.0		12.5	SC-310	-	12.5
C3 ²	2.320	6.1		406	SC-740	-	406
C4	0.960	2.0		165	SC-740	-	165
Total	15.590	35.8		2,250.5	-	767	3,065.5
Total for application site, excluding catchment	13.27	29.7	2.23				2,659

Table 1: Details of Surface Water Storage and Attenuation for Each Catchment

¹ Allowable outflow from Catchment B2 = 2I/s; This catchment runs in series to Catchment B3, where $Q_{bar} = 7.4I/s$ (for Catchment B2 + B3 combined);

² Catchment C3 is not included in this application, however the allowable outflow from it is included in the drainage calcs and has been approved for the commercial application under LB180620.

4.4 Surface Water Drainage Design

Surface water drainage for the development is designed using the Modified Rational Method as recommended in the GDSDS, EN752 and BS8301:1985, with the following parameters applied;

• Return period for pipe network 2 years,

o check 30-year 15 minute, no flooding;

check 100-year flooding in designated areas;

• Time of entry 4 minutes

• Pipe Friction (Ks) 0.6 mm

• Minimum Velocity 1.0 m/s

• Standard Average Annual Rainfall 760mm

• M5-60 14.9mm

• Ratio r (M5-60/M5-2D) 0.279

• Storage System Storm Return Event GDSDS Volume 2, p61, Criterion 3

30-year no flooding on site;

 100-year check no internal property flooding. Flood routing plan. FFL + 500mm freeboard above 100-year flood level. No flooding to adjacent areas.

Climate Change
 10% for rainfall intensities.

Factor of Safety for infiltration 2.0

A breakdown of the impermeable areas contributing to the surface water drainage network with runoff coefficients agreed with Meath County Council included in *Table 2* below. Figure 6 includes these surface types colour coded in accordance with the surface types in Table 2.

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Surface Type	Runoff Co- Efficient	Catchment "A" Imp Area (ha)	Catchment "B1" Imp Area (ha)	Catchment "B2" Imp Area (ha)	Catchment "B3" Imp Area (ha)	Total Impermeable Area (ha)
Roof to SuDS features	0.6	0.486	0.180	0.046	0.094	0.806
Roofs to traditional collection system	0.9	-	0.220	-	0.267	0.487
Roads to traditional collection system	1.0	0.753	0.270	0.094	0.473	1.590
Roads to SuDs features	0.5	0.025	0.020	0.005	0.007	0.057
Paths to Traditional Drainage	1.0	0.278	0.200	0.039	0.525	1.042
Cycle Track to Traditional Drainage	1.0	0.038	-	-	0.080	0.118
Car Parking (Permeable Paving)	0.5	0.128	0.110	0.038	0.096	0.372
Public Open Space	0.1	0.089	0.060	0.019	0.121	0.289
Total (ha)		1.797	1.060	0.241	1.663	4.761
Impermeability factor (%)		36%				

Table 2: Breakdown of Impermeable Areas for Proposed Development – refer to Figure 6



Figure 6: Surface Types - Refer to Table 2

Standard drainage details are in accordance with the Greater Dublin Regional "Code of Practice for Drainage Works". The minimum pipe diameter for public surface water sewers is 225mm. Private drains within the proposed development will be 100mm diameter and collector drains will be 150mm diameter. Refer to DBFL drawing numbers 170092-3051 to 170092-3057, for the proposed surface water layout plan.

Surface water sewers have been designed using the "Network" module of "Microdrainage", using the Modified Rational Method. The network is designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

Surface water sewer calculations are included in Appendix C.

4.5 'Sustainable Urban Drainage Systems' (SuDS)

The document 'Sustainable Urban Drainage Systems' (SuDS) published by CIRIA, document No. C521, was utilised for the surface water design strategy for the proposed development. The document encourages the use of a variety of alternative measures in the design of sustainable drainage systems, which take account of quality, quantity and amenity. These measures protect or enhance water quality, are sympathetic to the environment, provide a habitat for wildlife and encourage natural ground water recharge. The following SuDS features are incorporated into the drainage design for the scheme:

Primary SuDS features

Swales, bio-retention areas, permeable paving and 'green roofs' which operate under normal rainfall events. They provide storage that not only attenuates the flow but also permits settlement of coarse silts, with plants in the water to promote settlement. Runoff would also be treated by adsorption of particles by aquatic vegetation or by soil, and by biological activity.

Secondary SuDS features

'Detention Basins' to store runoff between a 1 in 30-year and 1 in 100-year return period event. Therefore, the detention basins are only utilised during extreme rainfall events. Features of the proposed detention basins include retardation of surface water flows, balancing of surface water flows and an increased loss of surface water to natural ground through infiltration. Access would be required to the basin for inspection and to allow for regular cutting of grass, the annual clearance of aquatic vegetation and silt removal if required. The basins should be inspected approximately twice a year, with eroded and damaged areas repaired. Sediment accumulations would be removed when necessary and appropriate measures would be taken to ensure that the extracted material is disposed of properly and safely.

Refer to Appendix D for Operation and Maintenance Manual.

4.6 Interception Storage

To prevent pollutants or sediments discharging into water courses the GDSDS requires "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on 5-10mm of rainfall depth from 80% of the runoff from impermeable areas as defined in GDSDS. The interception volume attributable to each SuDs feature consists of the volume of water that can infiltrate to the ground, what will evaporate into the atmosphere and what can transpirate through plants and vegetation. Additionally, there will be some loses of water due to absorption and wetting of stone and soil media.

Required Interception Storage

The total interception storage required is circa 190.4m³,

Interception Storage Provided

The interception volume provided for the overall site is circa 299m³ in the permeable paving stone layer. This is calculated as follows:

Car Parking (Permeable) = 3,720m²

Stone layer 300mm deep;

Void Ratio = 30%

Storage = 334.8m³

4.7 Treatment Volume

The GDSDS requires that a "treatment volume" (Vt) be provided to prevent any pollutants or sediments entering river systems. Additionally, a 'treatment train' stormwater runoff management system is required. According to CIRIA document C697 the following treatment train approach is necessary:

- Surface Water Runoff from Roofs 1 Treatment Stage
- Surface Water Runoff from Roads 2 Treatment Stages
- Surface Water Runoff from other Paved Areas excluding Roads 1 Treatment Stage

The treatment volume is based on treatment 15mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS.

The total treatment volume required for the site is 571.2m³, and the volume provided for the site is 845.31m³.

• Storage in Permeable Paving: Volume = 334.8m³ (refer to Section 4.6);

• Storage in Stormtech: Area of Stormtech = 2932.9m²

Stone layer 150mm deep;

Void Ratio = 30%

Storage = 440.2m³

Storage in Bio Retention Areas:
 Effective Impermeable Area = 159.2 m²

Filter Bed Depth = 0.9 m

Volume = 5.70m³

Storage in Swales: Total plan area of swales = 323.1 m²

Depth of subgrade treatment = 0.2m

Volume = 64.61 m^3

4.8 Treatment of Ditches & Watercourses

Ditch systems traversing the development site would be accommodated in suitable road crossings where necessary, in the form of culverts or pipes. The existing ditch systems within the subject site comprise surface water outfalls "B" and "C". The proposed treatment of these

ditches within the development site is described below and on DBFL drawing no. 170092-3059.

Outfall "B":

The existing ditch system which forms the western boundary of "Gaelscoil An Bhradain Feasa" will remain as an open channel. This channel is piped under Mill Road and through private front

gardens. It is proposed to intercept this outfall on Mill Road and to re-route it through Mill Road

to the Stameen River. This will ensure a suitably sized and accessible outfall.

Refer to Appendix E for further details and 'Microdrainage' calculations for proposed surface

water outfall.

Outfall "C":

It is proposed to divert the existing ditch (as approved under LB180620) adjacent to Colpe Road

to facilitate the construction of the footpath and cycle path along the western side of Colpe

Road. This ditch would be diverted into an open channel with dimensions matching the existing

ditch. The ditch will be piped under the link street in a 900mm diameter pipe as indicated on

drawing no. 170092-3057. This ditch is currently culverted under Mill Road in a culvert of 0.46m

wide x 9m high, which has settled resulting in the upstream end of the culvert being lower than

the downstream end. It is therefore proposed to remove this culvert and to replace it with a

new surface water culvert / pipe.

Refer to Appendix E for further details and 'Microdrainage' calculations of the proposed 900mm

diameter surface water pipe under the link street.

4.9 Flood Risk

A 'Site Specific flood Risk Assessment' (SSFRA) by DBFL Consulting Engineers, is included under

separate cover.

Strategic Housing Development at Colpe West, Drogheda Infrastructure Design Report

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5.0 Foul Drainage

5.1 General

Foul flows from the development will outfall to the foul outfall sewer approved under LB180620 at the north east corner of the site, before continuing to the existing 900mm diameter foul outfall sewer which crosses the railway and continues in a northerly direction to Drogheda Wastewater Treatment Works adjacent to Marsh Road.

The proposed development is separated into two foul drainage Catchments, "1A" & "1B" as per Figure 7 below. Catchment "1A" comprises the western section of the site (87 no. houses), with foul flows from this catchment discharging by gravity to the existing 900mm diameter foul sewer, at manhole F17, adjacent to the railway line. The balance of the development site is included in Catchment "1B" and comprises 270 residential units and a childcare facility and commercial development approved under LB180620. Foul flows from Catchment "1B" will discharge to a new temporary foul pumping station located to the east of the lands. The foul drainage for this catchment is designed to enable the foul pumping station to be decommissioned in the future and the foul sewer to continue along the link street to the strategic foul pumping station at Marsh Road which will be designed to drain the "Mill Road / Marsh Road Urban Design Framework Plan Lands". The interim foul drainage arrangement for this catchment will be to pump foul flows from the temporary pumping station to the foul sewer on the link street.

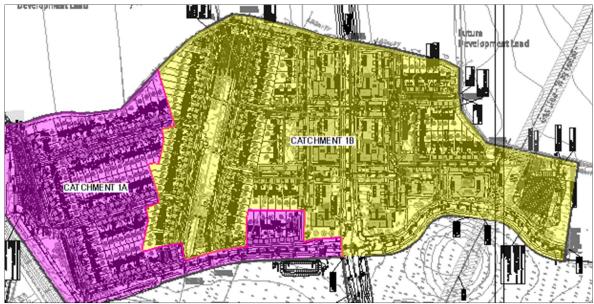


Figure 7: Foul Drainage Catchment Plan

5.2 Design Calculations

The gravity foul sewer network is designed using the "Network" Module of "Microdrainage". Foul sewer network calculations are included in Appendix F.

Foul sewers have been designed in accordance with the Building Regulations and specifically in accordance with the principles and methods set out in the DOE "Recommendations for Site Development Works for Housing Areas", BS8301: 1985, IS EN752 (2008), IS EN12056: Part 2 (2000) and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

The following design parameters have been applied:

Hydraulic Loading : 446l/house/day

Discharge units : 14 units per house (as EN752 7 BS8301:1985) (for the

commercial development, the equivalent number of houses is calculated based on the daily foul loading, refer to Table 4).

Pipe Friction (Ks) : 1.5 mm

Minimum Velocity : 0.7 m/s (self-cleansing velocity)

Maximum Velocity : 3.0 m/s (1:20 maximum pipe gradient used)

Frequency Factor : 0.5 for domestic use

5.3 Temporary Foul Pumping Station

It is proposed to discharge foul flows from Catchment "2" to a temporary foul pumping station located to the east of the lands. The pumping station is designed to pump foul flows from catchment "2" via a 100mm diameter foul rising main to the proposed gravity foul sewer in the link street.

The pumping station is designed in accordance with Irish Waters Code of Practice and includes 12-hour emergency storage in the event of pump breakdown. Duty and standby pumps are proposed. It is proposed to provide an overflow facility from the pumping station to a storage tank capable of holding effluent for 12 hours in the event of pump failure. Therefore, the wet well and storage facility will be capable of storing approximately 60m³.

The foul pumping station would include a kiosk to accommodate the control panel, telemetry equipment, a flow recorder, hose reel and washing facilities.

Pumping station and rising main calculations and details of the proposed pumps are included in Appendix G.

5.4 Irish Water

A copy of the Irish Water "Statement of Design Acceptance" and "Confirmation of Feasibility" for the development is included in Appendix H.

6.0 WATER SUPPLY AND DISTRIBUTION

The development's water-main distribution system is indicated on drawings 170092-3051 to 170092-3057. It is proposed to connect to the existing 200mm diameter watermain on Colpe Road, west of the railway line, with the 200mm diameter main extended along the link street

and the residential development supplied from 150mm and 100mm diameter watermains.

Connections to the public water main will include a bulk meter and sluice valves in accordance

with the Irish Water requirements.

Individual houses will have their own connections to the distribution main via service

connections and boundary boxes. Individual service boundary boxes will be of the type to suit

Irish Water.

6.1 Watermain Standards and Details

The water main layout and details are in accordance with Irish Water Connection and Developer

Services, 'Code of Practice for Water Infrastructure' and 'Water Infrastructure Standard Details'.

6.2 Water Demand & Conservation

The average daily peak demand is approximately 145m³ (assuming an occupancy rate of 2.7

persons per house and a water usage rate of 150l/head/day).

6.3 Irish Water

Irish Water have been provided with a pre-connection enquiry form for the application site.

A copy of the Irish Water Confirmation of Feasibility and Statement of Design Acceptance are

included in Appendix H.

Strategic Housing Development at Colpe West, Drogheda Infrastructure Design Report

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7.0 RESPONSE TO AN BORD PLEANALA OPINION

An Bord Pleanala raised a number of issues following the pre-application planning process for case reference ABP-303309-18, which must be addressed to facilitate an application for strategic housing development. These items are outlined in their opinion document dated 20th February 2019.

The water services are outlined below using the same numbering system as follows:

5. Surface Water Management and Risk of Flooding

Further consideration of documents as they relate to surface and storm water management for the site. This further consideration should have regard to the requirements of the Council in respect of surface water treatment and disposal as set out in section 7.6.2 of the Planning Authority's opinion. Any surface water management proposals should be considered in tandem with any Flood Risk Assessment, which should in turn accord with the requirements of "The Planning system and Flood Risk Management Guidelines" (including the associated 'Technical Appendices'). In this regard, consideration should be given to objective Flood Risk FR POL 3 in the Drogheda Southern Environs Local Area Plan. Further consideration of these issues may require an amendment to the documents and/or design proposals submitted.

We refer you to DBFL "Site Specific Flood Risk Assessment", Rev "A", included under separate cover and to the DBFL "Infrastructure Design Report".

Meath County Council Opinion dated 21st January 2019

7.6.2 Surface Water Treatment & Disposal

The development as proposed does not meet the requirements of Meath County Council Water Services Section with respect to the orderly collection, treatment and disposal of surface water. Meath County Council Water Services Section requires that the following matters be addressed prior to submission of an SHD application;

 Meath County Council Water services consider the proposed attenuation volume to be undersized for the scale of development. The applicant shall provide justification for the use of the runoff factors applied to each of the "Surface Types" detailed in Table 2 of the "Infrastructure Design Report December 2018" which forms part of the applicants submission. The applicant shall also satisfy by means of additional

drawings the areas where each of the "Surface Types" referenced in Table 2 apply within each of the catchments.

Dermot Grogan (DBFL) agreed the runoff coefficients with David O'Reilly (MCC) and Paul Aspell (MCC). Refer to Table 2, Section 4 above for updated runoff coefficients. Refer also to Table 1 for updated attenuation volumes based on these runoff coefficients. Refer to Figure 6 for 'Surface Types' Drawing in Section 4.0

The applicant shall provide justification for the use of a soil Type 2 in their runoff calculations. MCC Water Services believe the soil type at the subject site is a Soil Type 1.

The soil survey maps accompanying the Flood Studies Report indicate soil type 1 for the subject site. The GDSDS states that "it is important to carry out soil tests on soil characteristics to choose an appropriate SOIL category". Site investigations and surface water soakaway testing was carried out by Ground Investigations Ireland and are included under separate cover. The results indicate the predominant soil type in the subject site as being clay with poor permeability. Further site investigations confirm rock at relatively shallow depths of 2 to 4m below ground level. The site conditions indicate the most appropriate soil type as soil type 4. However, a conservative soil type of soil type 2 (2l/s/ha) is used for calculating Obar for the residential element of the development. Obar for the link street is based on soil type 3 (3l/s/la) as approved under LB180620. Refer to Table 1, Section 4 for further details.

3. The applicant shall provide greater detail in relation to the configuration of attenuation systems, in particular where the discharge of one catchment discharges to another. Associated drainage long section should be provided for clarity.

Only surface water Catchments B2 and B3 are in series with the Hydrobrake for Catchment B3 set to accommodate the allowable outflow from Catchment B2 and Catchment B3. i.e. the Hydrobrake set at 7.4l/s from Catchment B3 includes 2l/s from Catchment B2. Refer to Table 1 in Section 4.

The storage requirement for Catchment B3 is calculated using an input (additional hydrograph) of 2l/s to account for the inflow in series from Catchment B2. Refer to Appendix B. Refer to DBFL drawing nos. 170092-3051 and 170092-3052.

4. The applicant shall reconfigure the proposed attenuation systems, the attenuation systems should be configured to achieve partial treatment; the isolator row shall connect the attenuation systems inlet and outlet chambers. The isolator row shall also be linked to adjacent rows by means of a high level 225mm overflow pipe.

We confirm that the surface water drainage has been redesigned, with all surface water storage provided via on-line storage.

The underground "Stormtech" units will be installed and constructed in accordance with the manufacturers instructions. Refer to Appendix D and to DBFL drawing no. 170092-3066.

5. The applicant shall provide details of the winter ground water level for the sites of each of the proposed attenuation systems. Where infiltration systems are to be used, they shall be a minimum depth of 1 metre above the winter water table level. The applicant shall design the attenuation system suitable for the ground conditions and acceptable to MCC Water Services Engineer.

We confirm that the standpipe installed in June 2019 at RC05 indicated a ground water level of circa 3.5m BGL. We confirm that the groundwater level at each surface water storage system will be confirmed prior to construction.

- 6. In order to isolate and carry out maintenance of the flow control devices a penstock valve or similar approved) shall be installed within the flow control chamber, on the upstream end of the manhole.
 - We confirm that a penstock will be provided on the upstream end of the flow control manhole. The details to be agreed with Meath County Council prior to construction.
- 7. Further clarification in relation to Catchment C, in particular how the proposal within this application changes the drainage system for the proposed link street granted permission under Planning Application LB180620.
 - We confirm that the link street is now included in the application boundary and the surface water drainage design has been updated accordingly. We refer you to DBFL drawing nos. 170092-3050 to 3057.
- 8. It is the applicant's intention to discharge Catchments B, C, D & E to the existing ditch system. The applicant shall undertake a detailed assessment of the existing ditch system into which it is proposed to discharge surface water. The assessment

shall prove the existence and capacity of the proposed discharge route. The detailed assessment shall be furnished to MCC Water Services and if required, a remedial works plan agreed with MCC Water Services prior to submission of an SHD application to An Bord Pleanala.

We refer you to Section 4.8 regarding treatment of ditches and specifically relating to surface water outfalls "B" and "C".

It is proposed to construct a new surface water outfall pipe on Mill Road to accommodate the existing drain from catchment B.

It is proposed to remove the existing culvert under Mill Road, which has settled and replace it with a new culvert / pipe at the correct gradient. The culvert accommodates runoff from Catchment "C".

9. Where the provision of permeable paving is welcomed by Meath County Council, it should be limited to privately owned car parking spaces. The provision of storage volume within private property including within sub-surface permeable paving detail is not acceptable. The functionality of such a proposal is unproved and has potential to cause future maintenance issues for the Local Authority. MCC Water Services require that the proposed inlet and outlet distributor boxes within the private driveways be linked by means of a perforated rigid pipe which can be jetted for maintenance purposes.

We refer you to DBFL drawing no. 170092-3067 for details of roof drainage discharging to the stone under the permeable paving, before being piped to the main surface water drainage network.

We confirm that permeable paving is proposed for all driveways in curtilage and for car parking spaces under the control of a management company. The storage within the voids between the stone is not included in the surface water storage calculations but is used to apply an appropriate runoff factor for this surface type as agreed with Meath County Council. Refer to Table 2 Section 4.

....furthermore the following specific information should be submitted with any application for permission.

An Bord Pleanala Specific Further Information:

6. All existing watercourses that traverse the site including any proposal to culvert / reroute existing drains should be clearly identified on a site layout plan.

Refer to DBFL drawing no. 170092-3059.

10. A phasing plan for the proposed development which includes the phasing arrangements for the delivery of the public open spaces, surface water management proposals having regard to sub-catchments within the scheme and Part V provision.

Refer to Figure 8 below.

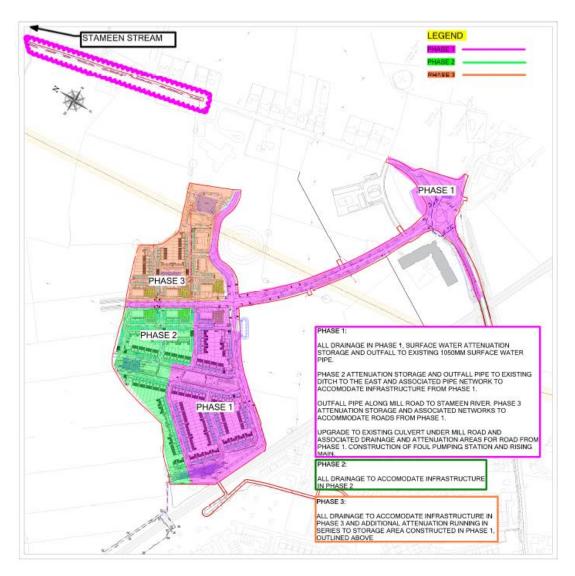
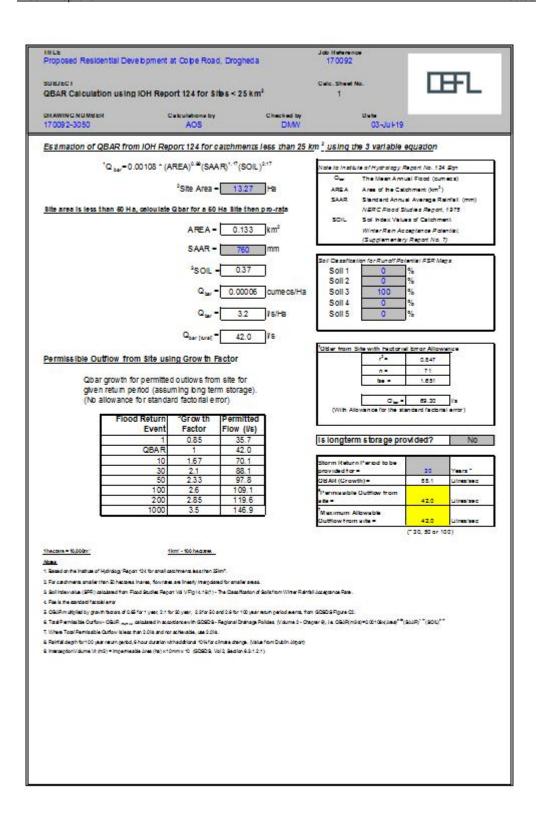


Figure 8 Catchment Phasing

Appendix A

ALLOWABLE OUTFLOW Qbar CALCULATIONS

170092-Rep-010 October 2019



Appendix B

SURFACE WATER STORAGE CALCULATIONS & MET EIREANN RAINFALL DATA

Rainfall Depths for sliding Durations Easting: 311881, Northing: 274674, Met Eireann Return Period Irish Grid:

	200,	N/A ,	N/A ,	N/A,	N/A,	N/A ,	N/A ,	N/A,	N/A ,	N/A,	N/A,	N/A,	N/A,	94.5,	10.6,	23.9,	35.7,	56.3,	74.5,	.91.1,	,90.90	35.2,	,61.5,	392.2,	
														84.8,											
														81.9,											
	150,	14.4,	20.0,	23.6,	28.3,	33.9,	40.7,	45.3,	48.9,	54.4,	60.5,	65.3,	72.6,	78.3,	92.1,	103.6, 1	113.7, 1	131.3, 1	147.0, 1	161.2, 1	174.6, 1	199.2,	221.9,	248.3,	
	100,	12.9,	18.0,	21.2,	25.6,	30.9,	37.4,	41.7,	45.1,	50.4,	56.3,	60.8,	61.9	73.5,	86.6,	97.5,	107.1,	123.8,	138.7,	152.2,	164.9,	188.3,	209.9,	235.1,	
	75,	12.0,	16.7,	19.7,	23.9,	29.0,	35.1,	39.3,	42.6,	47.7,	53.4,	57.9,	64.8,	70.2,	82.9,	93.4,	102.6,	118.8,	133.1,	146.1,	158.3,	180.9,	201.7,	226.0,	
														62.9											
														60.7,											
Years	20,	8.5,	11.8,	13.9,	17.2,	21.3,	26.4,	29.9,	32.7,	37.0,	42.0,	45.9,	52.0,	56.8,	67.5,	76.3,	84.1,	97.7,	109.7,	120.7,	131.0,	150.1,	167.6,	188.2,	
	10,	7.0,	9.7,	11.4,	14.3,	18.0,	22.5,	25.7,	28.2,	32.2,	36.8,	40.4,	46.1,	50.6,	60.3,	68.3,	75.3,	87.7,	98.6,	108.7,	118.0,	135.4,	151.4,	170.2,	
	5,	5.7,	7.9,	9.3,	11.8,	14.9,	19.0,	21.8,	24.1,	27.7,	31.8,	35.1,	40.4,	44.6,	53.4,	60.6,	6.99	78.0,	87.9,	97.0,	105.4,	121.1,	135.6,	152.6,	
	4,	5.3,	7.3,	8.6,	11.0,	14.0,	17.9,	20.6,	22.8,	26.2,	30.2,	33.5,	38.6,	42.7,	51.1,	58.0,	64.1,	74.9,	84.4,	93.1,	101.3,	116.4,	130.4,	146.8,	
	3,	4.7,	6.6,	7.8,	10.0,	12.8,	16.4,	19.0,	21.0,	24.3,	28.1,	31.2,	36.1,	40.0,	48.0,	54.6,	60.4,	70.6,	79.7,	88.0,	95.7,	110.1,	123.4,	139.0,	
	2,	4.0,	5.5,	6.5,	8.4,	10.9,	14.2,	16.5,	18.4,	21.4,	24.9,	27.7,	32.3,	36.0,	43.3,	49.3,	54.6,	63.9,	72.2,	79.8,	86.9,	100.1,	112.3,	126.6,	
11	lyear,	3.4,	4.8,	5.6,	7.4,	9.6	12.6,	14.8,	16.5,	19.3,	22.6,	25.3,	29.5,	33.0,	39.9,	15.5,	50.4,	59.1,	56.8,	73.9,	80.6,	92.9,	104.3,	17.7,	
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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

N/A Data not available

DBFL Consulting Engineers					-1701700	Page 1
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600 min Summer			8.9			
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7200 min Summer	25.369	0.390	8.9	206.7	OK	
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240 min Summer					246	
360 min Summer	7.539	0.0	608	5.7	364	
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600 min Summer				0.6	508	
720 min Summer				1.8	574	
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	7200 8640 10080 10080 120 180 240 360 480 600 720 960 1440	min Winter	Rain (mm/hr r 24.88 r 15.84 r 12.07 r 9.93 r 7.53 r 6.18 r 4.60 r 3.83 r 2.89	0.173 0.146 Floods (m²) 2 0 0 0 8 0 9 0 9 0 9 0 7 0 0 5 0 6 0	8.4 7.8 ed Disch (m ³ .0 3 .0 4 .0 5 .0 5 .0 6 .0 7 .0 7	91. 77. marge ume *) 172.6 174.8 143.3 196.2 178.5 142.6 195.9 142.0	9 O K 6 O K Time-Peal (mins) 60 120 180 240 350 460 560 590 740
	7200 8640 10080 600 120 180 240 360 480 600 720 960 1440 2160	min Winter	Rain (mm/hr r 24.88 r 15.84 r 12.07 r 9.93 r 7.53 r 6.18 r 4.68 r 2.89 r 2.18	0.173 0.146 Floode (m²) 2 0 0 8 0.9 9 0 9 0 9 0 1 0 5 0 6 0 6 0	8.4 7.8 ed Disch (m ³ .0 3 .0 4 .0 5 .0 5 .0 6 .0 7 .0 7 .0 9	91. 77. 3arge ume *) 172.6 174.8 43.3 96.2 78.5 42.6 95.9 42.0 19.5 38.9	9 O K 6 O K Time-Peal (mins) 6 12: 18: 244 35: 46: 566 59 74 105
	7200 8640 10080 120 180 240 360 480 600 720 960 1440 2160 2880	min Winter	Rain (mm/hr x 24.88 x 15.84 x 12.07 x 7.53 x 7.53 x 6.18 x 5.30 x 4.68 x 2.89 x 2.89 x 2.18 x 2.18	Floods Fl	8.4 7.8 ed Disch (m' .0 3 .0 4 .0 5 .0 6 .0 7 .0 7 .0 9 .0 9	91. 77. sarge sume *) 172.6 74.8 43.3 96.2 78.5 42.6 95.2 78.5 42.6 95.8 98.9	9 O K 6 O K Time-Peal (mins) 6 12 18 24 25 46 56 59 74 105 152
	7200 8640 10080 600 120 1800 240 360 4800 600 720 960 1440 2160 2880 4320	min Winte min Wi	Rain (mm/hr 24.88 r 15.84 r 12.07 r 7.53 r 6.18 r 5.30 r 4.68 r 3.83 r 7.53 r 6.18 r 5.30 r 4.68 r 3.83 r 7.53 r 6.18 r 5.30 r 4.68 r 3.83 r 7.53 r 6.18 r 5.30 r 4.68 r 3.83 r 7.53 r 6.18 r 5.30 r 4.68 r 3.83 r 7.53 r 6.18 r 5.30 r 1.34 r 6.80 r 1.79 r 1.34	Floods (m²) 0.146 Floods (m²) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	8.4 7.8 ed Disch (m ² .0 3 .0 4 .0 5 .0 5 .0 6 .0 7 .0 7 .0 8 .0 9 .0 10	91. 77. warge wme *) 172.6 74.8 43.3 96.2 78.5 42.6 95.6 94.3	9 O K 6 O K Time-Peal (mins) 6 12: 18: 24(35: 46: 59: 74: 105: 152: 196-
	7200 8640 10080 600 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760	min Winter	Rain (mm/hr 24.88 r 15.84 r 12.07 r 9.93 r 6.18 r 3.83 r 2.89 r 1.79 r 1.34 r 1.10	Floods (m³) 0.146 Floods (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	8.4 7.8 ed Disch (m ³ .0 3 .0 4 .0 5 .0 5 .0 6 .0 7 .0 7 .0 9 .0 10 .0 11 .0 12	91. 77. 32.6 74.8 43.3 96.2 42.6 95.9 42.6 95.9 42.6 95.9 42.6 95.9 42.6 95.9	9 O K 6 O K Time-Peal (mins) 6 12: 18: 24: 35: 46: 56- 59: 74: 105: 105: 196- 276:
	7200 8640 10080 10080 120 180 240 360 480 960 1440 2160 2880 4320 5760 7200 8640	min Winter	Rain (mm/hr 24.88 r 15.84 r 12.07 r 9.93 r 7.53 r 3.83 r 2.18 r 1.79 r 1.34 r 1.10 r 0.94 r 0.83	0.173 0.146 Floods (m³) 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	8.4 7.8 ed Disch (m' 0 3 .0 4 .0 5 .0 6 .0 7 .0 8 .0 9 .0 10 .0 11 .0 12 .0 14 .0 15 .0 17 .0 18	91. 77. sarge sume *) 172.6 74.8 43.3 96.2 78.5 42.6 95.9 42.0 19.5 38.9 85.6 94.3 62.5 98.2	9 O K 6 O K Time-Peal (mins) 6 12- 18: 24(35: 46: 59: 74: 105: 152: 196: 276: 340:

DBFL Consulting Engineers	·	Page 3
	AT MILL/MARSH ROAD	
The state of the s	REF: 170092	
	MENT A - 30 YR	Mises
	ned by AOS	MILLO
File CATCH A 30 YR- 07.10.20 Check		Drainage
	e Control 2018.1	
75 - 25 - 1 (25) 1 (25)		
Rainfall	<u>Details</u>	
Rainfall Model	FSR Winter Storms	
Return Period (years)	30 Cv (Summer) 0	
Region Scotland and M5-60 (mm)	Ireland Cv (Winter) 0 14.900 Shortest Storm (mins)	
Ratio R	0.279 Longest Storm (mins) 1	
Summer Storms	Yes Climate Change %	
Time Area	a Diagram	
Total Area	(ha) 1.797	
	MANUAL CONTRACTOR OF THE PARTY	
Time (mins) Area From: To: (ha)	Time (mins) Area From: To: (ha)	
	STATE OF STA	
0 4 0.000	4 8 1.797	
@1982-2016	Innovyze	

170092-Rep-010 October 2019

DBFL Consulting Engineers		Page 4
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	Market Co.
Dublin 7	CATCHMENT A - 30 YR	Micco
Date 07/10/2019 16:19	Designed by AOS	Drainage
File CATCH A 30 YR- 07.10.20	Checked by DMW	Dramage
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 26.500

Tank or Pond Structure

Invert Level (m) 24.979

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m) Are	a (m²)	Depth (m)	Area (m²)
0.000	530.0	0.700	530.0	1.400	0.0	2.100	0.0
0.100	530.0	0.800	530.0	1.500	0.0	2.200	0.0
0.200	530.0	0.900	530.0	1.600	0.0	2.300	0.0
0.300	530.0	1.000	530.0	1.700	0.0	2.400	0.0
0.400	530.0	1.100	530.0	1.800	0.0	2.500	0.0
0.500	530.0	1.200	0.0	1.900	0.0		
0.600	530.0	1.300	0.0	2.000	0.0		

Hydro-Brake Optimum Outflow Control

Unit Reference MD-SHE-0137-8900-1060-8900 1.060 Design Head (m) Design Flow (1/s) Flush-Flos Calculated Objective Minimise upstream storage Application Surface Sump Available Diameter (mm) 137 Invert Level (m) 24.979 Minimum Outlet Pipe Diameter (mm) Suggested Manhole Diameter (mm) 150 1200

Points	Head (m)	Flow (1/s	;)
(Calculated)	1.060	8.	9
Flush-Flos	0.316	8.	9
	Points (Calculated) Flush-Flo*	(Calculated) 1.060	(Calculated) 1.060 8.

| Kick-Flo@ 0.697 7.3 | Mean Flow over Head Range - 7.7

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

Depth (m)	Flow (1/s)						
0.100	4.9	1.200	9.4	3.000	14.5	7.000	21.8
0.200	8.6	1.400	10.1	3.500	15.7	7.500	22.6
0.300	8.9	1.600	10.8	4.000	16.7	8.000	23.3
0.400	8.8	1.800	11.4	4.500	17.7	8.500	24.0
0.500	8.6	2.000	12.0	5.000	18.6	9.000	24.6
0.600	8.2	2.200	12.6	5.500	19.4	9.500	25.3
0.800	7.8	2.400	13.1	6.000	20.3		
1.000	8.7	2.600	13.6	6.500	21.1		

DBFL Consulting Engineers		Page 1
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT A - 100 YR	Micco
Date 07/10/2019 16:19 File CATCH A 100 YR - 07.10	Designed by AOS Checked by DMW	Drainage
Innovyze	Source Control 2018.1	
V:	for 100 year Return Period (+10%)	13

	Stor	m	Max	Max	Max	Max	State	15
	Even	t	Level	Depth	Control	Volume		
			(m)	(m)	(1/s)	(m *)		
15	min	Summer	25.363	0.384	8.8	234.4	0	K
30	min	Summer	25.507	0.528	8.9	321.8	0	K
60	min	Summer	25.657	0.678	8.9	413.6	0	K
120	min	Summer	25.809	0.830	8.9	506.1	0	K
180	min	Summer	25.896	0.917	8.9	559.6	0	K
240	min	Summer	25.956	0.977	8.9	595.9	0	K
360	min	Summer	26.032	1.053	8.9	642.1	0	K
480	min	Summer	26.070	1.091	8.9	665.6	0	K
600	min	Summer	26.090	1.111	8.9	676.9	0	K
720	min	Summer	26.098	1.119	8.9	680.6	0	K
960	min	Summer	26.101	1.122	8.9	681.7	0	K
1440	min	Summer	26.080	1.101	8.9	671.7	0	K
2160	min	Summer	26.034	1.055	8.9	643.6	0	K
2880	min	Summer	25.972	0.993	8.9	605.8	0	K
4320	min	Summer	25.823	0.844	8.9	514.9	0	K
5760	min	Summer	25.688	0.709	8.9	432.6	0	K
7200	min	Summer	25.570	0.591	8.9	360.7	0	K
8640	min	Summer	25.472	0.493	8.9	301.0	0	K
10080	min	Summer	25.393	0.414	8.9	252.3	0	K
15	min	Winter	25.410	0.431	8.9	263.0	0	K
30	min	Winter	25.572	0.593	8.9	361.6	0	K

	Stor Even	10			Discharge Volume (m ³)		
1.5	min	Summer	71.340	0.0	232.0	23	
					323.4		
					432.5		
25.00			7.77	0.0	1000	9.70	
					623.0		
					680.6		
					769.4		
					837.7		
					894.0		
					942.2		
960	min	Summer	4.799	0.0	1022.2	812	
					1138.7	1072	
				0.0			
2880	min	Summer	2.195	0.0	1415.8	1908	
				0.0		2684	
5760	min	Summer	1.334	0.0	1724.8	3408	
7200	min	Summer	1.136	0.0	1834.8	4176	
8640	min	Summer	0.995	0.0	1929.0	4840	
0800	min	Summer	0.890	0.0	2010.6	5544	
15	min	Winter	71.340	0.0	260.4	23	
	min	Winter	49.472	0.0	362.6	37	

DBFL Consulting	Engineers					Letter 1
rmond House		LANI	DS AT 1	MILL/M	ARSH R	OAD
Upper Ormond Qua	У	DBFI	L REF:	170092	2	
Dublin 7		CATO	CHMENT	A - 10	00 YR	
ate 07/10/2019	16:19	Desi	igned 1	by AOS	00000000	
ile CATCH A 100	VD - 07 10	57.63 - 100%	cked b			
nnovyze	107.10			ntrol 2	2010 1	
movyze		304.	te co.	IULUI 2	1.010.1	
S	F D 1	F 1	00	D.+	D	//
Summ	ary of Results	TOT I	oo yea	I Retu.	In Per	100 (1
	Storm	Max	Max	Max	Max	Status
	5-3-2-1 C-1-4-1			Control		
	42.50 me			(1/s)		
					8.8.	
	60 min Winter	25.743	0.764	8.9	465.8	O K
	120 min Winter	25.918	0.939	8.9	572.6	OK
	180 min Winter	26.022	1.043	8.9		
	240 min Winter					0 K
	360 min Winter 480 min Winter	26.502	1.523	8.9	727.8	0 10
	600 min Winter 720 min Winter	26.570	1.591	8.9	768.8	OK
	960 min Winter	26.577	1.598	0.9	773.2	0 10
	1440 min Winter	26.000	1.570	0.9	700.2	0 1
	2160 min Winter 2880 min Winter	26.900	1.509	0.9	672 4	0 10
	4320 min Winter	25 004	0.055	0.9	501.7	OK
	5760 min Winter	25 618	0.635	8 0	280 6	0 10
	5760 min Winter 7200 min Winter	25 450	0.471	8 9	287 4	0 10
	8640 min Winter 10080 min Winter	25.247	0.268	8.4	162.3	OK
	Storm	Rain	Floode	d Disch	arge Ti	me-Peal
				e Volu		(mins)
			(m ³)	(m ²)	
				78.00		-
	60 min Winter					66
	120 min Winter	20.489	Û.	0 6	13.3 97.9	124
	180 min Winter				62.2	184
	240 min Winter 360 min Winter	0 500	Ü.	0 7	61.6	242
	480 min Winter				37.9	350
	600 min Winter	6.600	0.	0 10	00.7	470
	720 min Winter				54.4	580
	960 min Winter					872
	1440 min Winter	2 506	0.	0 12	63.0	1100
	2160 min Winter				60.6	1564
	2880 min Winter				85.7	2076
	4320 min Winter				77.1	2900
	5760 min Winter				32.0	3624
	7200 min Winter				55.3	4320
					60.9	4928
	8640 min Winter					

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	The second secon
Dublin 7	CATCHMENT A - 100 YR	
Date 07/10/2019 16:19	Designed by AOS	MICLO
File CATCH A 100 YR - 07.10		Drainage
Innovyze	Source Control 2018.1	
Innovyze	Source Control 2010.1	
<u>R</u>	ainfall Details	
Rainfall Model	FSR Winter Storms	
Return Period (years)	100 Cv (Summer) (and and Ireland Cv (Winter)	
M5-60 (mm)	14.900 Shortest Storm (mins)	
Ratio R	0.279 Longest Storm (mins) .	
Summer Storms	Yes Climate Change &	+10
<u>Ti</u>	ime Area Diagram	
To	tal Area (ha) 1.797	
	s) Area Time (mins) Area	
From: To:	(ha) From: To: (ha)	
0	4 0.000 4 8 1.797	

DDIT COMPATOR	ng Engin	eers	vi toproperter rot		93-040/030 CTPC 345-1		Page 4
Ormond House	AATOMAT .		AT MILL/	MARSH ROA	D		
Jpper Ormond (2uay		DBFL P	EF: 1700			
Dublin 7			CATCHM	ENT A -	100 YR		Micro
Date 07/10/201	19 16:19		Design	ed by AO	S		Design
File CATCH A 1	100 YR -	07.10	Checke	d by DMW			Drainag
Innovyze			Source	Control	2018.1		
			Model D	etails			
		Storage is	Online Con	ver Level	(m) 27.840		
		Ta	nk or Pond	d Structu	ire		
		I	nvert Level	(m) 24.97	19		
Depth (m) A	rea (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	610.0	0.700	610.0			2.100	
0.100				1.500		2.200	
0.200			610.0		610.0		- Co. 10 and
0.300	610.0				2.2	2.400	
0.400	610.0		610.0		1703277	2.500	0.0
	610.0	16/27/27/2007		2.000	90000		
	1	t	ke® Optim Unit Referer Esign Head	nce MD-SHE		<u> </u>	
			ign Flow (1/			8.9	
			Flush-Fl		c	alculated	
			Objecti	ve Minim	ise upstrea	m storage	
			Applicati			Surface	
			Sump Availab			Yes	
			Diameter (n	and the second second		129 24.979	
M	inimum Or		Diameter (n	5.00		150	
			Diameter (n			1200	
		Control	Points	Head (n) Flow (1/:	;)	
	De	sign Point	(Calculate	d) 1.61	.5 8.	9	
				o ^{m.} 0.47			
	W-	an Flow on	Kick-Fl er Head Ran	o © 0.99	4 7.		
	110	TTOM OA	mead wan	www.		· ·	
					803		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated	ptimum as	specified	i. Should a	ed on the lanother type	Head/Discha	ol device	other than a
Hydro-Brake® O Hydro-Brake Op	ptimum as timum® be	s specified utilised	i. Should a	ed on the lanother tylestorage re	Head/Discha pe of contr outing calc	ol device ulations w	other than a
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo	ptimum as timum® be	s specified utilised Depth (m)	i. Should a	ed on the lanother type storage re	Head/Discha pe of controuting calc Flow (1/s)	ol device ulations w Depth (m)	other than a
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200	optimum as otimum® be ow (1/s) I 4.6 7.9	s specified tutilised Depth (m)	i. Should athen these Flow (1/s) 7.7 8.3	ed on the lanother type storage respectively. Depth (m) 3.000 3.500	Head/Discha pe of controuting calc Flow (1/s) 11.9 12.8	Depth (m) 7.000 7.500	Flow (1/s) 17.8 18.4
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300	ptimum as timum® be w (1/s) I 4.6 7.9 8.6	Depth (m)	i. Should : then these Flow (1/s) 7.7 8.3 8.9	ed on the lanother type storage respectively. Depth (m) 3.000 3.500 4.000	Head/Discha pe of controuting calc Flow (1/s) 11.9 12.8 13.7	Depth (m) 7.000 7.500 8.000	Flow (1/s) 17.8 18.4 19.0
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400	ptimum as ttimum2 be mr (1/s) I 4.6 7.9 8.6 8.8	s specified utilised Depth (m) 1.200 1.400 1.600 1.800	i. Should : then these Flow (1/s) 7.7 8.3 8.9 9.4	ed on the lanother type storage respectively. Depth (m) 3.000 3.500 4.000 4.500	Head/Discha pe of controuting calc Flow (1/s) 11.9 12.8 13.7 14.4	Depth (m) 7.000 7.500 8.000 8.500	Flow (1/s) 17.8 18.4 19.0 19.6
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500	ptimum as timum® be w (1/s) I 4.6 7.9 8.6 8.8 8.9	s specified e utilised Depth (m): 1.200 1.400 1.600 1.800 2.000	i. Should : then these Flow (1/s) 7.7 8.3 8.9 9.4 9.8	Depth (m) 3.000 3.500 4.500 5.000	Head/Discha pe of controuting calc Flow (1/s) 11.9 12.8 13.7 14.4 15.2	Depth (m) 7.000 7.500 8.000 9.000	Flow (1/s) 17.8 18.4 19.0 19.6 20.1
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600	ptimum as timum® be mr (1/s) I 4.6 7.9 8.6 8.8 8.9 8.8	Depth (m) 1.200 1.400 1.600 1.800 2.000 2.200	i. Should a then these flow (1/s) 7.7 8.3 8.9 9.4 9.8 10.3	Depth (m) 3.000 3.500 4.500 5.500	Head/Discha pe of controuting calc Flow (1/s) 11.9 12.8 13.7 14.4 15.2 15.9	Depth (m) 7.000 7.500 8.500 9.500	Flow (1/s) 17.8 18.4 19.0 19.6 20.1
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500	ptimum as timum® be w (1/s) I 4.6 7.9 8.6 8.8 8.9	s specified e utilised Depth (m): 1.200 1.400 1.600 1.800 2.000	i. Should : then these Flow (1/s) 7.7 8.3 8.9 9.4 9.8	Depth (m) 3.000 3.500 4.500 5.000	Head/Discha pe of controuting calc Flow (1/s) 11.9 12.8 13.7 14.4 15.2 15.9	Depth (m) 7.000 7.500 8.500 9.500	Flow (1/s) 17.8 18.4 19.0 19.6 20.1

DBFL Consult	ing Engineers						Page 1
Ormond House		LANI	DS AT N	MILL/MA	RSH R	OAD	
Upper Ormond	Quay	DBFI	L REF: 1	170092			
Dublin 7		CATO	CHMENT	B1 - 6	0 YR		Micco
Date 04/10/2	019 08:05	Des	igned k	y AOS	01 85.55		IVIILIU
File CATCH B	1 60 YR - 04.10		cked by				Drainag
Innovyze				ntrol 2	018.1	8	
	Summary of Result	s for 6	0 vear	Retur	n Per:	iod (+10%)
							_
	Storm	Max	Max	Max	Max	Status	
	Event	Level	Depth 0	Control	Volume		
		(m)	(m)	(1/s)	(m2)		
	15 min Summer	23.277	0.317	5.3	122.5	O K	
	30 min Summer					OK	
	60 min Summer	23.515	0.555	5.3	216.6	O K	
	120 min Summer				265.7		
	180 min Summer	23.712	0.752	5.3	293.4		
	240 min Summer	23.757	0.797	5.3		O K	
	360 min Summer 480 min Summer	23.830	0.870	5.3	339.4	OK	
	600 min Summer	23.839	0.879	5.3	342.7	OK	
	720 min Summer	23.843	0.883	5.3	344.5	OK	
	960 min Summer 1440 min Summer 2160 min Summer	23.844	0.884	5.3	344.6	O K	
	1440 min Summer 2160 min Summer	23.828	0.868	5.3	338.4	O K	
			~ - ~				
	2880 min Summer 4320 min Summer	23.616	0.656	5.3	255.9	OK	
	5760 min Summer	23.485	0.525	5.3	204.9	OK	
	5760 min Summer 7200 min Summer	23.382	0.422	5.3	164.5	OK	
	8640 min Summer 10080 min Summer	23.299	0.339	5.3	132.3	OK	
				5.3	107.5	O K	
	15 min Winter 30 min Winter					O K	
	Storm	Rain	Floode	d Discha	arge Ti	ime-Peak	
	Event	(mm/hr)		Volu		(mins)	
			(m ³)	(m³)		
	15 min Summer	63.980	0.	0 12	23.5	23	
	30 min Summer	44.211	0.	0 17	71.5	37	
	60 min Summer	28.972	0.	0 22	28.5	68	
	120 min Summer				90.0	126	
	180 min Summer 240 min Summer	13.965	0.	0 33	30.8 62.1	186 246	
	360 min Summer				10.5	364	
	480 min Summer				48.0	484	
	600 min Summer				79.1	554	
	720 min Summer				05.8	612	
	960 min Summer				50.6	744	
	1440 min Summer				18.9	1014	
	2160 min Summer 2880 min Summer				66.5	1432	
	4320 min Summer				61.9	2684	
	5760 min Summer				38.8	3400	
	7200 min Summer			0 100	00.8	4104	
	8640 min Summer				54.1	4760	
	10080 min Summer				00.5	5448	
	15 min Winter				38.6	22	
	30 min Winter	44 211	0.	0 16	92.3	37	

ublin 7	CATCHMENT B1 - 60 YR	Micco
	CATCHMENT B1 - 60 YR Designed by AOS	Micro Drainage
ublin 7	CATCHMENT B1 - 60 YR	VIDE
	DBFL REF:170092	
	LANDS AT MILL/MARSH ROAD	

Summary of	Results	for 60	year Return	Period	(+10%)
------------	---------	--------	-------------	--------	--------

	Stor	550	Max		Max		A 1 2 2 2 3 3	15	
	Even	t	Level	Depth	Control	Volume			
			(m)	(m)	(1/s)	(m')			
60	min	Winter	23.586	0.626	5.3	244.3	0	K	
120	min	Winter	23.730	0.770	5.3	300.4	0	K	
180	min	Winter	23.811	0.851	5.3	332.0	0	K	
240	min	Winter	23.864	0.904	5.3	352.6	0	K	
360	min	Winter	23.928	0.968	5.3	377.5	0	K	
480	min	Winter	23.960	1.000	5.3	390.1	0	K	
600	min	Winter	23.975	1.015	5.3	395.9	0	K	
720	min	Winter	23.979	1.019	5.3	397.5	0	K	
960	min	Winter	23.975	1.015	5.3	395.7	0	K	
1440	min	Winter	23.949	0.989	5.3	385.7	0	K	
2160	min	Winter	23.880	0.920	5.3	258.9	0	K	
2880	min	Winter	23.798	0.838	5.3	326.9	0	K	
4320	min	Winter	23.593	0.633	5.3	246.9	0	K	
5760	min	Winter	23.394	0.434	5.3	169.3	0	K	
7200	min	Winter	23.257	0.297	5.3	115.8	0	K	
8640	min	Winter	23.169	0.209	5.1	81.6	0	K	
10080	min	Winter	23.116	0.156	4.9	60.9	0	K	

	Stor	m	Rain	Flooded	Discharge	Time-Peak
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m²)	(m ³)	
60	min	Winter	28.972	0.0	256.0	66
120	min	Winter	18.370	0.0	324.9	124
180	min	Winter	13.965	0.0	370.6	184
240	min	Winter	11.463	0.0	405.6	240
360	min	Winter	8.664	0.0	459.8	356
480	min	Winter	7.092	0.0	501.7	468
600	min	Winter	6.068	0.0	536.4	576
720	min	Winter	5.340	0.0	566.3	678
960	min	Winter	4.364	0.0	616.2	774
1440	min	Winter	3.280	0.0	691.1	1086
2160	min	Winter	2.466	0.0	788.9	1556
2880	min	Winter	2.013	0.0	858.5	1996
4320	min	Winter	1.510	0.0	965.7	2860
5760	min	Winter	1.231	0.0	1051.6	3520
7200	min	Winter	1.050	0.0	1121.1	4176
8640	min	Winter	0.922	0.0	1180.8	4760
10080	min	Winter	0.826	0.0	1233.1	5440

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT B1 - 60 YR	Mileson
Date 04/10/2019 08:05	Designed by AOS	MILLIU
File CATCH B1 60 YR - 04.10	The state of the control of the state of the	vrainage
Innovyze	Source Control 2018.1	
	A And Caster And Caster Salverson (A. C. American) A strict	
<u>R</u>	ainfall Details	
Rainfall Model	FSR Winter Storms	
Return Period (years)	60 Cv (Summer)	
M5-60 (mm)	and and Ireland Cv (Winter) 14.900 Shortest Storm (mins)	
Ratio R	0.279 Longest Storm (mins)	
Summer Storms	Yes Climate Change \$	+10
<u>Ti</u>	me Area Diagram	
To	tal Area (ha) 1.060	
	c) Area Time (mins) Area	
	(ha) From: To: (ha)	
0	4 0.000 4 8 1.060	
©19	982-2018 Innovyze	

Occurred II Tours	ng Engin	eers	85				Page 4		
Ormond House				LANDS AT MILL/MARSH ROAD					
Upper Ormond ()uay		DBFL F	EF: 1700	92				
Dublin 7			CATCHM	ENT B1 -	- 60 YR		Mirco		
Date 04/10/201	19 08:05	5	Design	ed by A	OS		Designati		
File CATCH B1	60 YR -	04.10	Checke	d by DM	v .		Diamay		
Innovyze			Source	Control	2018.1		-12		
			Model D	etails					
		Storage is (Online Con	er Level	(m) 24.500				
		<u>Tank</u>	or Pond	d Struct	ure				
		Inv	ert Level	(m) 22.9	60				
Depth (m) A	rea (m²)	Depth (m) A	rea (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)		
0.000	390.0	1507, 127, 157	390.0			1 4 5 7 10 10 10 10			
0.100	390.0	25.00 25.00 5.00	390.0			V4 (400 (410 (410 (410 (410 (410 (410 (41			
0.200	390.0 390.0	C. W. C. C. C. C. C. C.	2	1.600		2000			
0.400	390.0		390.0			24.40 30 40 40 40			
0.500	390.0	N. P. C. C. L. C.			36763				
0.600	390.0	1.300	0.0	2.000	0.0	5			
	200000000000000000000000000000000000000	Sur D: Inve: tlet Pipe D:	Applicati mp Availak iameter (n rt Level iameter (n	.om .ve Minim .on ole .um) (m) um)	(ise upstre	5.3 Calculated am storage Surface Yes 108 22.960 150			
М		d Manhole D:							
М	Suggeste	Control I	Points		m) Flow (1/				
М	Suggeste	Control I	Points	d) 1.0	60 5	.3 .3			
М	Suggeste	Control I	Points Calculate Flush-Fl	d) 1.0	60 5 15 5	. 3			
м	Suggeste De:	Control I	Points Calculate Flush-Fl Kick-Fl	d) 1.0 o= 0.3 o= 0.6	60 5 15 5 73 4	.3			
The hydrologic Hydro-Brake® Op Hydro-Brake Op invalidated	De: Me: al calcul ptimum as	Control I sign Point (an Flow over ations have specified.	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should:	d) 1.0 on 0.3 on 0.6 ge ed on the	60 5 15 5 73 4 - 4 Head/Discha	.3 .3 .6 arge relati	other than a		
The hydrologic Hydro-Brake® O Hydro-Brake Op	De: Me: al calcul ptimum as timum® be	Control I sign Point (an Flow over lations have s specified. s utilised the	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these	d) 1.0 on 0.3 oB 0.6 ge ed on the another ty storage r	60 5 15 5 73 4 - 4 Head/Disch: pe of controuting calc	.3 .3 .6 arge relati col device culations w	other than a		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo	De: Me: al calcul ptimum as timum® be w (1/s) [1 3.7	Control I sign Point (an Flow over lations have specified. utilised to Depth (m) F1	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these ow (1/s) 5.6	d) 1.00 on 0.3 on 0.6 ge ed on the another ty storage r Depth (m) 3.000	60 5 15 5 73 4 - 4 Head/Discharge of contacting calc	.3 .3 .6 arge relation device relations w	other than a ill be Flow (1/s) 12.9		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200	De: Me: al calcul ptimum as timum® be w (1/s) I 3.7 5.1	Control I sign Point (an Flow over ations have specified. utilised to Depth (m) Fl 1.200 1.400	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these ow (1/s) 5.6 6.0	d) 1.00 on 0.3 on 0.6 ge and on the another ty storage r Depth (m) 3.000 3.500	60 5 15 5 73 4 - 4 Head/Dischipe of continuiting cald Flow (1/s) 8.6 9.3	.3 .3 .6 arge relation with the coldevice relations with the coldevice relationship relationsh	other than a ill be Flow (1/s) 12.9 13.3		
The hydrologic Hydro-Brake@O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300	De: Me: al calcul ptimum as timum@ be w (1/s) I 3.7 5.1 5.3	Control I sign Point (an Flow over lations have specified. utilised the control of the control	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these ow (1/s) 5.6 6.0 6.4	d) 1.00 os 0.3 os 0.6 ge ed on the another ty storage r Depth (m) 3.000 4.000	60 5 15 5 73 4 - 4 Head/Disch: pe of cont: outing calc Flow (1/s) 8.6 9.3	.3 .3 .6 arge relation with the coldevice culations with the culation within the culation with the culation with the culation with the cul	other than a ill be Flow (1/s) 12.9 13.3 13.7		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.200 0.400	De: Me: al calcul ptimum as timum@ be w (1/s) [3.7 5.1 5.3 5.2	Control I sign Foint (an Flow over lations have s specified. utilised the control of the contro	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these ow (1/s) 5.6 6.0 6.4 6.8	d) 1.0 on 0.3 on 0.6 ge ed on the unother ty storage r Depth (m) 3.000 4.500 4.500	60 5 15 5 73 4 - 4 Head/Disch: pe of controuting calc Flow (1/s) 8.6 9.3 9.9	Depth (m) 7.000 7.500 8.500	other than a ill be Flow (1/s) 12.9 13.3 13.7 14.2		
The hydrologic Hydro-Brake@O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300	De: Me: al calcul ptimum as timum@ be w (1/s) I 3.7 5.1 5.3	Control I sign Point (an Flow over lations have specified. utilised the control of the control	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these ow (1/s) 5.6 6.0 6.4	d) 1.00 on 0.3 on 0.6 ge ed on the another ty storage r Depth (m) 3.000 4.000 4.500 5.000	60 5 15 5 73 4 - 4 Head/Disch: pe of controuting calc Flow (1/s) 8.6 9.3 9.9 10.4 11.0	Depth (m) 7.000 8.500 9.000	other than a ill be Flow (1/s) 12.9 13.3 13.7 14.2 14.5		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600 0.600 0.800	Der Mer al calcul ptimum as timum® be w (1/s) I 3.7 5.1 5.3 5.2 5.1 4.8 4.6	Control I sign Point (an Flow over lations have sepecified. tutilised to 1.200 1.400 1.600 1.800 2.200 2.400	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should : hen these ow (1/s) 5.6 6.0 6.4 6.8 7.1 7.5 7.8	d) 1.00 0 0.3 0 0.6 ge ed on the another ty storage r Depth (m) 3.000 4.000 4.500 5.500 6.000	60 5 15 5 73 4 - 4 Head/Disch: pe of controuting calc Flow (1/s) 8.6 9.3 9.9 10.4 11.5 12.0	.3 .3 .6 arge relati col device culations w Depth (m) 7.000 7.500 8.000 9.000 9.500	other than a ill be Flow (1/s) 12.9 13.3 13.7 14.2 14.5		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600	De: Me: al calcul ptimum as timum® be w (1/s) I 3.7 5.1 5.3 5.2 5.1 4.8	Control I sign Point (an Flow over lations have specified. utilised to Depth (m) F1 1.200 1.400 1.600 1.800 2.200	Points Calculate Flush-Fl Kick-Fl Head Ran been base Should: hen these ow (1/s) 5.6 6.0 6.4 6.8 7.1 7.5	d) 1.00 0 0.3 0 0.6 ge ed on the another ty storage r Depth (m) 3.000 4.000 4.500 5.500 6.000	60 5 15 5 73 4 - 4 Head/Disch: pe of controuting calc Flow (1/s) 8.6 9.3 9.9 10.4 11.5 12.0	.3 .3 .6 arge relati col device culations w Depth (m) 7.000 7.500 8.000 9.000 9.500	other than a ill be Flow (1/s) 12.9 13.3 13.7 14.2 14.5		

DBFL Consulting Ormond House	g Engin	eer	5	1770	20.25	WITT I	. n.c	03.5
	8800			19195300		MILL/M		GAD
per Ormond Qu	lay			1000000		170092		
blin 7						B1 -10		
te 04/10/2019	08:03			Des	igned	by AOS		
le CATCH B1 -	- 100YR		04.1	. Che	cked b	y DMW		
novyze				Sou	rce Co	ntrol 2	2018.1	30
S		e n.	1	f 1	00	D	D	
Sun	mary o	I Re	SUITS	IOI I	oo yea	ar Retu	In Per	10d (T
		Stor				Max		
		Even	t		0.5	Control		
				(m)	(m)	(1/s)	(m°)	
	15	min	Summer	23.355	0.395	4.9	138.3	ОК
	30	min	Summer	23.503	0.543	5.0	189.9	O K
						5.0		
						5.0		
						5.0		
				23.970			353.6	
	360	min	Summer	24.044	1.084	5.0	3/9.4	OK
	720	min	Summer	24.404	1 444	5.0	298 B	OK
						-3-7	(STATE OF 15 T	
	1440	min	Summer	24.131	1.171	5.0	396.9	O K
	2160	min	Summer	24.055	1.095	5.0	383.1	O K
	2880	min	Summer	24.004	1.044	5.0 5.0	365.5	OK
	4320	min	Summer	23.886	0.926	5.0	324.2	0 K
	5760	min	Summer	23.734	0.774	5.0 5.0	270.8	OK
	10090	min	Summer	23.496	0.536	5.0	187.6	OK
	30	min	Winter	23.570	0.610	5.0 5.0	213.4	O K
	5	tom	43	Rain	Flood	ed Disch	arge Ti	me-Peak
		vent				e Volu	7.1	
	-		100	,	(m*)			N 200 100
						.0 1	38.4	23
				49.472			92.6	37
				32.411			56.0	68
				20.489			23.8	126
				15.541			68.5	186
				12.733			02.5	246
			Summer Summer	9.598			55.0	266
			Summer	7.840 6.698			95.4	484 588
				5.886			28.7 57.3	634
			Summer				04.7	764
			Summer	3.596			72.1	1058
				2.695			69.9	1476
				2.195			35.9	1908
			Summer				36.8	2732
			Summer	1.334			17.7	3464
			Summer	1.136			82.7	4184
	8640		Summer	0.995			38.5	4928
			-	0 000	. 0	.0 11	67.0	5552
	10080 :			0.890				
	10080 :	min	Winter	71.340	0	.0 1	55.2 15.7	23

rmond House pper Ormond (T.ANI	DS AT N	MILL/MAR	SH D	OAD
	Duay	5583		170092		
	Zuay	9360		B1 -100	VD	
ublin 7		43700			IK	
ate 04/10/20		200		by AOS		
ile CATCH Bl	- 100YR - 04.1			State of the same		
nnovyze	111	Sour	rce Cor	trol 20	18.1	à.
<u>St</u>	nmmary of Results		00 yea:			iod (+1
	Event	Level	Depth (Control V	olume	
		(m)	(m)	(1/s)	(m3)	
				0.00		
	60 min Winter 120 min Winter	23.740	0.700			
	180 min Winter	24 025	1 075	5.0	276 2	OK
				5.0	400.4	OK
	240 min Winter 360 min Winter	24.515	1.555	5.1	429.1	OK
	480 min Winter	24.561	1.601	5.2	445.1	OK
	600 min Winter				453.7	OK
	720 min Winter	24.596	1.636	5.3	457.4	OK
	960 min Winter 1440 min Winter	24.594	1.634	5.3	456.6	OK
	2160 min Winter 2880 min Winter	24.511	1.551	5.1	427.8	O K
	4320 min Winter 5760 min Winter	23.929	0.969	5.0	339.3	O K
	7200 min Winter	23.488	0.528	5.0	184.8	OK
	8640 min Winter 10080 min Winter					
			Volume	d Dischar		
				(m3)		
	60 min Winter 120 min Winter	32.411	0.	0 286	. 8	66
	120 min Winter	20.489	0.	0 362	.7	126
	180 min Winter	15.541	0.	0 412		184
	240 min Winter					242
	360 min Winter	9.598	0.	0 509		356
	480 min Winter					470
	600 min Winter					580
	720 min Winter					688
	960 min Winter					868
	1440 min Winter				100	1100
	2160 min Winter 2880 min Winter	2.695				2020
	4320 min Winter					2984
	5760 min Winter					3696
	7200 min Winter					4392
	8640 min Winter					5016
				0 1329		
	10080 min Winter	0.890	0.	1325		5648

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	Tuge 0
Upper Ormond Quay	DBFL REF: 170092	- N 411
Dublin 7	CATCHMENT B1 -100 YR	
Date 04/10/2019 08:03	Designed by AOS	Micro
File CATCH B1 - 100YR - 04.1		Drainage
The state of the s	Source Control 2018.1	-
Innovyze	Source Control 2018.1	
1	Rainfall Details	
Rainfall Model	FSR Winter Storms	Yes
Return Period (years)	100 Cv (Summer)	
Region Scot M5-60 (mm)	land and Ireland Cv (Winter) 14.900 Shortest Storm (mins)	
Ratio R	0.279 Longest Storm (mins)	
Summer Storms	Yes Climate Change &	
	Cime Area Diagram	
Ti	otal Area (ha) 1.060	
	ns) Area Time (mins) Area : (ha) From: To: (ha)	
0	4 0.000 4 8 1.060	
	31	
@1	982-2018 Innovyze	
61	Joz Loro Innovybe	

	g Engin	eers	3				Page 4	
Ormond House				LANDS AT MILL/MARSH ROAD				
Upper Ormond C		REF: 1700	THE PARTY OF THE P					
Dublin 7	market amarka		CATCH	MENT B1 -	-100 YR		Mirro	
Date 04/10/201			2233	ned by AC			Drainag	
File CATCH B1	- 100YR	- 04.1	Check	ed by DMW	1		Drainay	
Innovyze			Source	e Control	2018.1		20	
			Model I	etails				
		Storage is	Online Co	ver Level	(m) 25.700			
		<u>Tan</u>	or Pon	d Structi	ire			
		Inv	ert Level	(m) 22.96	50			
Depth (m) A	rea (m²)	Depth (m) A	rea (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	
0.000	350.0	2021 2021						
0.100	350.0				350.0			
0.200	350.0 350.0		350.0	1.600	350.0 350.0	2.300		
0.400	250.0	1 100	350.0	1.800	0.0	2.500		
0.500	250.0		7,57,77, 67,77,7	Telephone (1997)	56.0000000			
0.600	350.0	1.300			0.0			
	<u>H</u>	ydro-Brake Un			ow Contro.			
		Des	ign Head	(m)		1.660		
		Desig	n Flow (1			5.3		
			Flush-F	THE RESERVE ACCUSATI		alculated		
			Applicat		ise upstrea	Surface		
		Sun	mp Availa			Yes		
		D:	iameter (mum.)		99		
698	1 10 10		rt Level			22.960		
М		tlet Pipe D d Manhole D				150 1200		
		Control 1	Points	Head (r	n) Flow (1/	s)		
	De	sign Point (
				o ^m 0.43		.0		
	Me	an Flow over		.o© 0.88	- 4	.0 .5		
	-1							
	al calcul							
The hydrologic Hydro-Brake® O Hydro-Brake Op	ptimum as							
Hydro-Brake@ 0	ptimum as							
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo	ptimum as timum\$ be	utilised t	nen these	storage r	outing calc	Depth (m)	ill be	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo	ptimum as timum® be w (1/s) I	e utilised t Depth (m) Fl	nen these ow (1/s) 4.6	Depth (m)	Flow (1/s)	Depth (m)	ill be Flow (1/s) 10.4	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200	ptimum as timum® be w (1/s) I 3.2 4.5	e utilised t Depth (m) F1 1.200 1.400	ow (1/s) 4.6 4.9	Depth (m) 3.000 3.500	Flow (1/s) 7.0 7.5	Depth (m) 7.000 7.500	Flow (1/s) 10.4 10.8	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300	ptimum as timum\$ be w (1/s) 3.2 4.5 4.8	Depth (m) F1 1.200 1.400 1.600	nen these now (1/s) 4.6 4.9 5.2	Depth (m) 3.000 3.500 4.000	Flow (1/s) 7.0 7.5	Depth (m) 7.000 7.500 8.000	Flow (1/s) 10.4 10.8 11.1	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200	ptimum as timum® be w (1/s) I 3.2 4.5	e utilised t Depth (m) F1 1.200 1.400	ow (1/s) 4.6 4.9	Depth (m) 3.000 3.500 4.000 4.500	Flow (1/s) 7.0 7.5 8.0 8.5	Depth (m) 7.000 7.500 8.000 8.500	Flow (1/s) 10.4 10.8 11.1 11.5	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400	ptimum as timum® be w (1/s) I 3.2 4.5 4.8 4.9	Depth (m) F1 1.200 1.400 1.600 1.800	ow (1/s) 4.6 4.9 5.2 5.5	Depth (m) 3.000 3.500 4.000 4.500 5.000	Flow (1/s) 7.0 7.5 8.0 8.5	Depth (m) 7.000 7.500 8.000 8.500 9.000	Flow (1/s) 10.4 10.8 11.1 11.5 11.8	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600 0.800	ptimum as timum® be w (1/s) I 3.2 4.5 4.8 4.9 4.9 4.8 4.4	Depth (m) F1 1.200 1.400 1.600 1.800 2.000 2.200 2.400	.ow (1/s) 4.6 4.9 5.2 5.8 6.0 6.3	Depth (m) 3.000 3.500 4.000 5.000 5.500 6.000	Flow (1/s) 7.0 7.5 8.0 8.5 8.9 9.3	Depth (m) 7.000 7.500 8.000 8.500 9.000 9.500	Flow (1/s) 10.4 10.8 11.1 11.5 11.8	
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600	ptimum as timum® be w (1/s) I 3.2 4.5 4.8 4.9 4.9 4.8	Depth (m) F1 1.200 1.400 1.600 1.800 2.000 2.200	.ow (1/s) 4.6 4.9 5.2 5.5 5.8 6.0	Depth (m) 3.000 3.500 4.000 5.000 5.500 6.000	Flow (1/s) 7.0 7.5 8.0 8.5 8.9 9.3	Depth (m) 7.000 7.500 8.000 8.500 9.000 9.500	Flow (1/s) 10.4 10.8 11.1 11.5 11.8	

DBFL Consulting Engineers						Page 1
Ormond House	LAN	DS AT M	ILL/MA	RSH R	OAD	
Upper Ormond Quay	DBF	L REF: 1	170092			
Dublin 7	120-60	CHMENT E	Vision			
Date 04/10/2019 08:26	- 5	igned by				MilcLO
File CATCH B2 100 YR -04.10						Drainage
Innovyze		rce Cont		018 1		
2						
Summary of Results	for 1	00 year	Retur	n Per	iod (+10%	1
With a series of the series of the series of the series	Enternal Very	100	100	A TABLE	**************************************	201 0
Storm		Max				
Event		Depth Co				
	(m)	(m)	(1/5)	(m,)		
15 min Summer	21.774	0.260	2.0	30.7	OK	
30 min Summer	21.869	0.355	2.0	41.8		
60 min Summer	21.965	0.451	2.0		O K	
120 min Summer 180 min Summer	22.051	0.537	2.0	63.4	O K	
240 min Summer				70.2		
360 min Summer 480 min Summer	22 122	0.608	2.0	71 8	OK	
600 min Summer 720 min Summer	22.114	0.600	2.0	70.7	OK	
960 min Summer	22.097	0.583	2.0	68.8	OK	
960 min Summer 1440 min Summer	22,057	0.543	2.0	64.1	OK	
2160 min Summer	21.988	0.474	2.0	55.9	OK	
2880 min Summer						
4320 min Summer				30.3		
5760 min Summer						
7200 min Summer				14.6		
8640 min Summer 10080 min Summer	21.510	0.096	1.0	9.8	OK	
15 min Winter 30 min Winter	21.914	0.400	2.0	47.2	OK	
550,28840,408.06						
12.	400	127	20 2	_	11218	
Storm		Flooded		0027		
Event	(mm/hr)	Volume (m²)	(m ³		(mins)	
559 60 60		/J-5/20				
15 min Summer				32.0	22	
30 min Summer				14.5	37	
60 min Summer 120 min Summer				58.3 73.7	66 126	
180 min Summer				33.9	186	
240 min Summer	7.75	10.70		91.6	244	
360 min Summer	9.598			3.6	318	
480 min Summer	7.840	0.0		12.8	382	
600 min Summer	6.698	0.0		20.5	448	
720 min Summer				27.1	516	
960 min Summer	4.799			38.2	658	
1440 min Summer				55.3	930	
2160 min Summer 2880 min Summer				74.6	1348	
4320 min Summer				12.7	2424	
5760 min Summer				30.5	3112	
7200 min Summer	1.136			15.3	3752	
8640 min Summer				58.0	4416	
10080 min Summer				59.2	5144	
15 min Winter				35.9	22	
30 min Winter	49.472	0.0		19.8	37	
6.1	992-20	10 Tar-	111100			
(6)	302-20	18 Inno	Jvyze			

BFL Consulting Eng	THEFTS	7 7 7 7 7	00 27 1	MILL/MA	neu -	2020	Page 2
ormond House		1453.750				KUAD	
Jpper Ormond Quay		300000		170092			
Oublin 7	To Alexa	CAT	CHMENT	B2 - 1	00 YI	2	Micro
ate 04/10/2019 08:	26	Des	igned h	y AOS			Drair
Tile CATCH B2 100 Y	R -04.10	. Che	cked by	y DMW			Dian
nnovyze		Sour	rce Cor	trol 2	018.3	D)	
	200000			200		en e	
Summary	of Results	for 1	00 yea	r Retur	n Pe	riod (+10%))
	Storm		Max			Status	
	Event		CONT.	Control		36	
		(m)	(m)	(1/s)	(m,)		
19	60 min Winter	22.024	0.510	2.0	60.2	2 O K	
1:	20 min Winter	22.123	0.609				
	80 min Winter						
2.	40 min Winter	22.197	0.683	2.0	80.6	5 OK	
3	60 min Winter 80 min Winter	22.215	0.701	2.0	82.1	O K	
7.7	00 min Winter	175-T00153-T002	1.00	5.7	Colonia	OK	
	20 min Winter						
	60 min Winter						
14	40 min Winter	22.106	0.592	2.0	69.9	OK	
21	60 min Winter	21.992	0.478	2.0	56.5	0 K	
281	80 min Winter	21.852	0.338	2.0	39.9	OK	
43:	20 min Winter 60 min Winter	21.680	0.166	2.0	19.6	OK	
721	00 min Winter	21.609	0.095	1.6	0 1	OK	
86	00 min Winter 40 min Winter	21.581	0.067	1.4	7.9	OK	
100	80 min Winter	21.574	0.060	1.3	7.1	OK	
			Volume	d Discha Volu	me	ime-Peak (mins)	
			A-330,45	18.0.0			
	0 min Winter					66	
	0 min Winter 0 min Winter				92.6	124	
	0 min Winter			0 10		238	
					6.0	346	
48	0 min Winter 0 min Winter	7.840	0.	0 12		400	
60	0 min Winter	6.698	0.	0 13	35.0	472	
72	0 min Winter	5.886	0.	0 14	12.3	552	
				0. 15	4.7	7.0.6	
	0 min Winter					2014	
144	0 min Winter	3.596	0.	0 17	74.0	1014	
144 216		3.596 2.695	0.	0 17	74.0 95.5	1014 1456 1820	
144 216 288	0 min Winter 0 min Winter	3,596 2,695 2,195	0. 0.	0 17 0 19 0 21	74.0	1456	
144 216 288 432	0 min Winter 0 min Winter 0 min Winter	3.596 2.695 2.195 1.641	0. 0. 0.	0 15 0 19 0 21 0 23	74.0 95.5 12.4	1456 1820	
144 216 288 432 576 720	0 min Winter 0 min Winter 0 min Winter 0 min Winter 0 min Winter 0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136	0. 0. 0. 0.	0 17 0 19 0 21 0 23 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	
144 216 288 432 576 720 864	0 min Winter 0 min Winter 0 min Winter 0 min Winter 0 min Winter 0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	
144 216 288 432 576 720 864	0 min Winter	3.596 2.695 2.195 1.641 1.334 1.136 0.995	0. 0. 0. 0. 0.	0 15 0 21 0 23 0 25 0 25 0 25	74.0 95.5 12.4 38.2 58.2 74.7	1456 1820 2464 3048 3680 4408	

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	The second second
Dublin 7	CATCHMENT B2 - 100 YR	THE REAL PROPERTY.
Date 04/10/2019 08:26	Designed by AOS	Micro
File CATCH B2 100 YR -04.10		Drainage
Innovyze	Source Control 2018.1	
<u> </u>		
1	Rainfall Details	
Rainfall Model	FSR Winter Storm	
Return Period (years)	100 Cv (Summer)	
Region Scot M5-60 (mm)	land and Ireland Cv (Winter) 14.900 Shortest Storm (mins)	
Ratio R	0.279 Longest Storm (mins)	
Summer Storms	Yes Climate Change	
ī	ime Area Diagram	
	otal Area (ha) 0.240	
	s) Area Time (mins) Area : (ha) From: To: (ha)	
0	4 0.000 4 8 0.240	
500	92070 - 19607700 - 1960	
0.1	982-2018 Innovyze	

170092-Rep-010 October 2019

DBFL Consulti	ng Engir	neers	10				Page 4
Ormond House			LANDS	AT MILL	MARSH RO	AD	
Jpper Ormond	Quay		DBFL I	REF: 1700	92		
Oublin 7			CATCH	ENT B2 -	100 YR		Micco
Date 04/10/20	19 08:20	6	Design	ned by A	DS .		Desire
Tile CATCH B2	100 YR	-04.10	Checke	ed by DMV	V .		Drainag
Innovyze	With Page Lines			e Control	Year on the second second	-	
			Model I	etails			
		Storage is	Online Co	ver Level	(m) 23.500		
		Tar	nk or Pon	d Struct	ure		
		I	nvert Level	(m) 21.5	14		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	118.0				450000	513.5.000M	
0.100		5200 - 000000	F 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		11	40.000	
0.200	118.0	5.5 (1.5 (1.5 (1.5 (1.5 (1.5 (1.5 (1.5 (6,97,900		5/7 5 5 5		
0.300	118.0 118.0	500000000000000000000000000000000000000	0.00		17.00		2.713,710
0.500	118.0	1,000,000,000	55,937	6.55	(500)	2.500	0.0
10000000	118.0	0.500.505.505	100000		100000000000000000000000000000000000000		
	/1	Hydro-Bral	rot Ontim	.m On+ #1	on Contro	1	
	-						
			nit Refere sign Head		-0071-2000-	0.705-2000	
		Desi	gn Flow (1	/s)		2.0	
			Flush-F			Calculated	
			The state of the s		ise upstre:	55 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	
			Applicat			Surface	
			ump Availal Diameter (Yes 71	
			ert Level			21.510	
1	Minimum O	utlet Pipe				100	
		ed Manhole				1200	
		Control	Points	Head (n) Flow (1/	(s)	
	De	sign Point	(Calculate	d) 0.7	5 2	.0	
				o th 0.2		.0	
				o® 0.4		. 6	
	Ме	an Flow ove	er Head Ran	ge	- 1	.7	
The hydrologic	cal calcu	lations hav	e been bas	ed on the	Head/Discha	arge relation	onship for t
Hydro-Brake® (Hydro-Brake Op invalidated	Optimum a	s specified	. Should	another ty	pe of cont	col device	other than a
Depth (m) Flo	ow (1/s)	Depth (m) 1	Flow (1/s)	Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)
\$2 BASE	1.8	1.200	2.5	3.000		- F. (600	5.8
0.100	2.0	1.400	2.7	3.500		4.000	
0.100	4 . 4	1.600	2.9	4.000			
0.100 0.200 0.300	2.0		0.000			2710275000110	
0.200	2.0	1.800	3.1	4.500			0.4
0.200	* 2000 1000		3.1	5.000			
0.200 0.300 0.400	1.8	1.800	100000000000000000000000000000000000000		4.9	9.000	
0.200 0.300 0.400 0.500	1.8	1.800	3.2	5.000	4.9 5.2	9.000	6.6

@1982-2018 Innovyze

DBFL Consulting Engineers	Page 1	
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT B3 - 30 YR	Micro
Date 04/10/2019 08:51 File CATCH B3 30YR - 04.10.2	Designed by AOS Checked by DMW	Drainage
Innovyze	Source Control 2018.1	

Summary of Results for 30 year Return Period (+10%)

	Storm Event				Max Control		
	2,00			1000	(1/s)		
15	min	Summer	20.885	0.281	7.4	167.3	OK
30	min	Summer	20.987	0.383	7.4	227.6	OK
60	min	Summer	21.096	0.492	7.4	293.0	OK
120	min	Summer	21.217	0.613	7.4	364.8	OK
180	min	Summer	21.295	0.691	7.4	411.1	OK
240	min	Summer	21.349	0.745	7.4	443.6	OK
360	min	Summer	21.422	0.818	7.4	486.7	OK
480	min	Summer	21.465	0.861	7.4	512.4	OK
600	min	Summer	21.490	0.886	7.4	527.3	OK
720	min	Summer	21.505	0.901	7.4	535.8	OK
960	min	Summer	21.521	0.917	7.4	545.3	OK
1440	min	Summer	21.526	0.922	7.4	548.5	OK
2160	min	Summer	21.453	0.849	7.4	505.4	OK
2880	min	Summer	21.356	0.752	7.4	447.5	OK
4320	min	Summer	21.215	0.611	7.4	363.5	OK
5760	min	Summer	21.107	0.503	7.4	299.4	OK
7200	min	Summer	21.016	0.412	7.4	245.4	OK
8640	min	Summer	20.942	0.338	7.4	201.3	OK
10080	min	Summer	20.884	0.280	7.4	166.6	OK
15	min	Winter	20.920	0.316	7.4	187.7	OK
30	min	Winter	21.034	0.430	7.4	255.8	OK

	Even			Volume	Volume (m³)	
15	min	Summer	55.192	0.0	270.6	23
30	min	Summer	37.956	0.0	335.0	37
60	min	Summer	24.882	0.0	421.3	68
120	min	Summer	15.840	0.0	505.8	126
180	min	Summer	12.078	0.0	562.2	186
240	min	Summer	9.939	0.0	605.6	246
360	min	Summer	7.539	0.0	673.1	366
480	min	Summer	6.189	0.0	725.6	
					769.1	604
720	min	Summer	4.680	0.0	806.7	724
960	min	Summer	3.835	0.0	869.5	862
					963.5	
2160	min	Summer	2.186	0.0	1094.2	1432
					1183.9	
					1322.2	
5760	min	Summer	1.104	0.0	1435.9	3392
					1526.9	
8640	min	Summer	0.831	0.0	1605.2	4760
080	min	Summer	0.746	0.0	1673.3	5448
15	min	Winter	55.192	0.0	291.2	22
30	min	Winter	37.956	0.0	363.3	37

DBFL Consulting E	ngineers					
rmond House		LAN	DS AT	MILL/M	ARSH R	OAD
Jpper Ormond Quay			L REF:	170092	2	
Oublin 7			CHMENT	B3 - :	30 YR	
ate 04/10/2019 0	3:51	Des	ianed	by AOS	100 0000	
ile CATCH B3 30Y	2 - 04 10 2					
nnovyze				ntrol 2	2010 1	8
LANGERS	ry of Result	y 20100000	esara como	0.000.000.000		iod (+1
	Storm	Max	Max	Max	Max	Status
	Event	Level	Depth	Control	Volume	
		(m)	(m)	(1/s)	(m2)	
	40 I W			2.2		
	60 min Winte	r 21.159	0.555	7.5	329.9	0 K
	60 min Winte 120 min Winte 180 min Winte	- 21.297	0.093	7.5	412.3	OK
	240 min Winte	- 21 445	0.701	7.4	500.0	OK
	260 min Winte	r 21 528	0 924	7.4	549 7	OF
	480 min Winte	r 21 580	0.976	7.4	580.7	OK
	360 min Winte 480 min Winte 600 min Winte	r 21.612	1.009	7.4	600.2	OK
	720 min Winte	r 21.633	1.029	7.4	612.3	0 K
	960 min Winte	r 21.657	1.053	7.4	626.4	ОК
	960 min Winte 1440 min Winte 2160 min Winte	r 21.652	1.048	7.4	623.5	O K
	2160 min Winte	r 21.558	0.954	7.4	567.7	O K
	2880 min Winte	r 21 428	0 824	7 4	496 2	OK
	4320 min Winte 5760 min Winte 7200 min Winte	r 21.195	0.591	7.4	351.8	O K
	5760 min Winte	r 21.026	0.422	7.4	251.2	O K
	7200 min Winte	r 20.902	0.298	7.4	177.4	OK
(6)	8640 min Winte 0080 min Winte	r 20.820	0.216	7.2	128.6	OK
1	0080 min <mark>W</mark> inte	r 20.769	0.165	6.9	98.4	O K
	Storm	Rain	Flood	ed Disch	arge Ti	me-Peak
		(mm/hr)				(mins)
		17 (1) (1)	(m²)			
	60 min Winter	24 882	0	n 4	58.4	66
	120 min Winter	15 840	0	.0 5	52 9	126
	120 min Winter 180 min Winter	12.078	0	.0 6	15.9	184
	240 min Winter	9.929	. 0	.0 6	64.5	242
						358
	360 min Winter 480 min Winter 600 min Winter	6.189	0	.0 7	98.5	474
	600 min Winter	5.307	0	.0 8	47.1	586
	720 min Winter	4.680	0	.0 8	88.8	696
	720 min Winter 960 min Winter 440 min Winter 160 min Winter	3.835	0	.0 9	58.1	916
1	440 min Winter	2.896	0	.0 10	56.4	1098
2	160 min Winter	2.186	0	.0 12	11.7	1544
2	880 min Winter 320 min Winter	1.790	0	.0 13		2020
4	320 min Winter	1.349	0	.0 14	67.6	2816
5	760 min Winter 200 min Winter	1.104	0	.0 15	94.5	3520
7	200 min Winter	0.944	0	.0 16	96.5	4184
8	640 min Winter 080 min Winter	0.831	. 0	.0 17	84.4	4832
						5440

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT B3 - 30 YR	Micco
Date 04/10/2019 08:51	Designed by AOS	Desires
File CATCH B3 30YR - 04.10.2	Checked by DMW	uramage
Innovyze	Source Control 2018.1	
<u>R</u>	ainfall Details	
Rainfall Model	FSR Winter Storms	
Return Period (years)	30 Cv (Summer) and and Ireland Cv (Winter)	
M5-60 (mm)	14.900 Shortest Storm (mins)	
Ratio R	0.279 Longest Storm (mins)	10080
Summer Storms	Yes Climate Change *	+10
<u>I</u> :	me Area Diagram	
To	cal Area (ha) 1.663	
	(ha) From: To: (ha)	
0.	4 0.000 4 8 1.663	

170092-Rep-010 October 2019

DBFL Consulting Engineers	Page 4	
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT B3 - 30 YR	Micco
Date 04/10/2019 08:51	Designed by AOS	Desinage
File CATCH B3 30YR - 04.10.2	Checked by DMW	Drainage
Innovyze	Source Control 2018.1	1.0

Model Details

Storage is Online Cover Level (m) 22.500

Tank or Pond Structure

Invert Level (m) 20.604

Depth (m)	Area (m²)						
0.000	595.0	0.700	595.0	1.400	0.0	2.100	0.0
0.100	595.0	0.800	595.0	1.500	0.0	2.200	0.0
0.200	595.0	0.900	595.0	1.600	0.0	2,300	0.0
0.300	595.0	1.000	595.0	1.700	0.0	2.400	0.0
0.400	595.0	1.100	595.0	1.800	0.0	2.500	0.0
0.500	595.0	1.200	0.0	1.900	0.0		
0.600	595.0	1.300	0.0	2.000	0.0	e:	

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0126-7400-1060-7400 Design Head (m) 1.060 Design Flow (1/s) 7.4 Flush-Flor Calculated Objective Minimise upstream storage Application Surface Sump Available Diameter (mm) 126 Invert Level (m) 20.604 Minimum Outlet Pipe Diameter (mm) Suggested Manhole Diameter (mm) 150 1200

Control	Points	Head (m)	Flow (1/s)
Design Point	(Calculated)	1.060	7.4
	Flush-Flos	0.315	7.4
	Kick-Flo®	0.689	6.1
Mean Flow ove	r Head Range	-	6.4

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

Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)
0.100	4.5	1.200	7.8	3.000	12.1	7.000	18.1
0.200	7.1	1.400	8.4	3.500	13.0	7.500	18.7
0.200	7.4	1.600	9.0	4.000	13.9	8.000	19.3
0.400	7.3	1.800	9.5	4.500	14.7	8.500	19.9
0.500	7.1	2.000	10.0	5.000	15.4	9.000	20.4
0.600	6.8	2.200	10.4	5,500	16.1	9.500	21.0
0.800	6.5	2.400	10.9	6.000	16.8	SCHIRETINES	
1.000	7.2	2.600	11.3	6.500	17.5		

DBFL Consu		Engin	eers	9		111				P	age 5
Ormond Hou						AT MI		RSH RO	AD		
Upper Ormo	nd Qua	ay				REF: 1					·
Dublin 7		was a second			CATCH		Micro				
Date 04/10	Date 04/10/2019 08:51 Designed by AOS)rainag
File CATCH	B3 3	OYR -	04.10.	2		ed by					Jian lag
Innovyze				- 3	Source	e Cont	rol 20	018.1		***	
Additional Hydrograph #1											
Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)
2		100		202		202		400		EOD	
4	0.0	102	1.6	202	1.7	302 304	2.0	402	1.9	502 504	1.8
6	0.0	106	1.7	206		306	2.0	406		506	
8	0.0	108	1.7	208		308	2.0	408		508	1.8
10	0.0	110	1.7	210		310	2.0	410		510	1.8
12 14	0.0	112 114	1.8	212		312 314	2.0	412 414		512 514	1.8
16	0.0	116	1.8	214		314	2.0	416		514	
18	0.0	118	1.8	218		318	2.0	418		518	
2.0	0.0	120	1.9	220	1.8	320	2.0	420	1.9	520	1.8
22	0.0	122	1.9	222		322	2.0	422		522	
24	0.0	124	1.9	224		324	2.0	424		524	
26 28	0.1	126 128	1.9	226		32.6 32.8	2.0	426 428		526	
30	0.1	120	1.9	228		330	2.0	430		528 530	1.8
32	0.1	132	1.9	232		332	2.0	432		532	1.8
34	0.2	134	1.9	234		334	2.0	434		534	
36	0.2	136	1.9	236	1.9	336	2.0	436	1.9	536	1.8
38	0.2	138	2.0	238		338	2.0	438		538	1.8
40	0.3	140	2.0	240		340	2.0	440		540	
42 44	0.3	142 144	2.0	242 244		342 344	2.0	442 444		542 544	
46	0.4	146	2.0	246		346	2.0	446		546	1.7
48	0.5	148	2.0	248		348	2.0	448		548	1.7
50	0.5	150	2.0	250		350	2.0	450		550	1.7
52	0.6	152	2.0	252		352	2.0	452		552	1.7
54	0.6	154	2.0	254		354	2.0	454		554	
56 58	0.7	156	2.0	256		356 358	2.0	456		556	
60	0.8	158 160	2.0	258 260		360	2.0	458 460		558 560	
62	0.8	162	2.0	262		362	2.0	462		562	
64	0.9	164	2.0	264		364	2.0	464		564	1.7
66	0.9	166	2.0	266		366	2.0	466		566	
68	0.9	168	2.0	268		368	2.0	468		568	
70 72	1.0	170 172	2.0	270 272	2.0	370 372	2.0	470 472	1.9	570 572	1.7
74	1.1	174	1.9	274	2.0	374	2.0	474	1.8	100000000000000000000000000000000000000	1.7
76	1.1	176		276		376	2.0	476		10-00-00-00	1.7
78	1.1	178	1.9	278	2.0	378	2.0	478	1.8		1.7
80	1.2	180	1.9	280	2.0	380	2.0	480			1.7
82	1.2	182	1.9	282		382	2.0	482	1.8	100000	1.7
84	1.2	184 186	1.9	284 286	2.0	384 386	2.0	484 486	1.8	584 586	1.7
88	1.3	188	1.8	288	2.0	388	2.0	488	1.8	588	1.7
90	1.3	190	1.8	290	2.0	390	2.0	490	1.8	590	1.7
92	1.4	192	1.8	292	2.0	392	2.0	492	1.8	1000	1.7
94	1.4	194	1.7	294	2.0	394	2.0	494	1.8	1000	1.7
96	1.5	196	1.7	296	2.0	396	1.9			24-37-14-37	1.7
98 100	1.5	100 000	1.6	298 300	2.0	398 400	1.9		1.8	100000000000000000000000000000000000000	1.7
	1000	2386				60000	12.75		71000	Car Children	
				©198	2-2018	Inno	yze				

DBFL Consulting Engineers Ormond House LANDS AT MILL/MARSH ROAD								New Do	10	-	age 6
					DBFL I						
Jpper Ormo	na Qua	ay					-				
ublin 7					CATCH		Micro				
ate 04/10				200		ned by					Drainag
Tile CATCH	B3 3	DYR -	04.10.	2			A K ()				Jiumuy
Innovyze Source Control 2018.1											
Additional Hydrograph #1											
Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)		Time (mins)	Flow (1/s)
602	1.7	702	1.8	802	2.0	902	2.0	1002	1.8	1102	0.5
604	1.7	704	1.8	804	2.0	904	2.0	1004		1104	
606	1.7	706	1.9	806	2.0	906	2.0	1006	1.7	1106	0.5
608	1.7	708	1.9	808	2.0	908	2.0	1008		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
610	1.7	710	1.9	810		910	2.0	1010			
612	1.7	712	1.9	812	2.0	912	2.0	1012			
614 616	1.7	714 716	1.9	814 816		914 916	2.0	1014		10000	
618	1.7	716	1.9	818		916	2.0	1018		The second second	
620	1.7	720	1.9	820		920	2.0	1020		1000	
622	1.6	722	1.9	822		922	2.0	1022			
624	1.6	724	1.9	824	2.0	924	2.0	1024	1.5		
626	1.6	726	1.9	826		926	2.0	1026		100000000000000000000000000000000000000	
628	1.6	728	1.9	828		928	2.0	1028			
630	1.6	730	1.9	830		930	2.0	1030			
632	1.6	732	1.9	832		932	2.0	1032			
634 636	1.7	734 736	1.9	834 836		934 936	2.0	1034			
638	1.7	738	1.9	838		938	2.0	1038			
640	1.7	740	1.9	840		940	2.0	1040		1140	
642	1.7	742	1.9	842		942	2.0	1042		1142	
644	1.7	744	1.9	844		944	2.0	1044			
646	1.7	746	1.9	846	2.0	946	2.0	1046	1.1	1146	
648	1.7	748	1.9	848		948	1.9	1048		1148	
650	1.7	750	1.9	850		950	1.9	1050		1150	
652	1.7	752	1.9	852		952	1.9	1052		1152	
654	1.7	754	1.9	854		954	1.9	1054		120000000000000000000000000000000000000	
656 658	1.7	756 758	1.9	856 858		956 958	1.9	1056 1058		1156 1158	
660	1.7	760	1.9	860		960	1.9	1060		11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
662	1.7	762	1.9	862		962	1.9	1062			
664	1.8	764	1.9	864		964	1.9	1064			
666	1.8	766		866		966	1.9	1066			
668	1.8	768	1.9	868		968	1.9				
670	1.8	770	1.9	870		970	1.9			C. C	
672	1.8	24.200.000.000	1.9	872		(2.55 M.S.)	1.9			- Carlot 1940	0.2
674 676	1.8	10.000		100000000000000000000000000000000000000	2.0	1000 110000	5500350		0.8		0.2
678	1.8	1 12 15 20				2500000					
680	1.8	780		0.000		0/25/90/00/	1.9				
682	1.8	782		1,37207		10000					
684	1.8	784		100000		1003740	100		0.7		
686	1.8	400 m e 250		000000	2.0	2000				100	
688	1.8	788		0.0000000			1.8				
690	1.8	34.14.9.00		25500	2.0	0.000	1000			1190	
692	1.8	-		5.72.57		1000000	C-1000				
694 696	1.8	1. 100000000000000000000000000000000000		0.500000		6.900,000	5 3 4 5 5 5			1194	
698	1.8	10000000					1.8	1096		1196	
700				12000		1000		1100			
		2.	1		93			3.			

Ormond House LANDS AT 1 Upper Ormond Quay DBFL REF: Dublin 7 CATCHMENT Date 04/10/2019 08:51 Designed k File CATCH B3 30YR - 04.10.2 Checked by Innovyze Source Cor	170092 B3 - 3 y AOS DMW		AD							
Dublin 7 CATCHMENT Date 04/10/2019 08:51 Designed k File CATCH B3 30YR - 04.10.2 Checked by	B3 - 3 Y AOS DMW) YR			-					
Dublin 7 CATCHMENT Date 04/10/2019 08:51 Designed k File CATCH B3 30YR - 04.10.2 Checked by	B3 - 3 Y AOS DMW) YR			Annual Annual					
Date 04/10/2019 08:51 Designed k File CATCH B3 30YR - 04.10.2 Checked by	y AOS DMW				Micro					
File CATCH B3 30YR - 04.10.2 Checked by	DMW									
C										
Innouve		31								
rimovine con	trol 2	018.1								
ATTEMPT OF THE										
Additional Hydro	raph #	1								
DEC 100 MARCH DEC 1800 DEC 1800		197000	1000 B	A1515.5						
Time Flow Time Flow Time Flow Time				Time	Flow					
(mins) (1/s) (mins) (1/s) (mins) (1/s) (mins) (1/s)	(mins)	(1/5)	(mins)	(1/s)					
1202 0.2 1302 0.1 1402 0.0 150	2 0.0	1602	0.0	1702	0.0					
1204 0.2 1304 0.1 1404 0.0 150	4 0.0	1604	0.0	1704	0.0					
1206 0.2 1306 0.1 1406 0.0 150	6 0.0	1606	0.0	1706	0.0					
1208 0.2 1308 0.1 1408 0.0 150	8. 0.0	1608	0.0	1708	0.0					
1210 0.2 1310 0.1 1410 0.0 151	0.0	1610	0.0	1710	0.0					
1212 0.2 1312 0.1 1412 0.0 151	2 0.0	1612	0.0	1712	0.0					
1214 0.2 1314 0.1 1414 0.0 151		100 100 100		100,000						
1216 0.2 1316 0.1 1416 0.0 151		A. S. A. S. A. S. A.		Contract to						
1218 0.2 1318 0.1 1418 0.0 151		1618		1718						
1220 0.2 1320 0.1 1420 0.0 152		1620								
이 그리고 아니다 아니는 그 아이들에 가장 아니는 그 생각이 되었다. 그리고 아이들에 가장 아니는 그리고 있다면 하는데 그리고 있다.	2 0.0	CO.00. V. CO.		110000000000000000000000000000000000000						
1224 0.2 1324 0.1 1424 0.0 152		100000000000000000000000000000000000000	0.0							
1226 0.2 1326 0.1 1426 0.0 152		200000000000000000000000000000000000000		77.377.300						
1228 0.2 1328 0.1 1428 0.0 152		200000000000000000000000000000000000000		200000000000000000000000000000000000000						
1230 0.1 1330 0.1 1430 0.0 153		912177559		1000						
1232 0.1 1332 0.1 1432 0.0 153		1632		0.000						
		Y 20 Y 11 S 11		1734						
	6 0.0	1636		1736						
		1638		11-11-12						
		0.574		11-27-27						
	0.0	1640		1740						
1242 0.1 1342 0.1 1442 0.0 154		2000		17.19.00						
1244 0.1 1344 0.1 1444 0.0 154 1246 0.1 1346 0.1 1446 0.0 154		2000								
		9122 538		3000 3 0 0 0						
유민이 경영하는 그 경영하다는 - 2012년에는 - 1715년에는 - 2715년에 등 - 2715년에 등 - 2715년에		1000000		0.0000000000000000000000000000000000000						
시작하다면 그 나를 하는 기를 받았다면 그 사람들이 가는 그 사람들이 되었다면 하는 사람들이 되었다.		2.3.7.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.								
1252 0.1 1352 0.1 1452 0.0 155		1652 1654		13-50-00-0						
	4 0.0	10 2770		1754						
1256 0.1 1356 0.1 1456 0.0 155		1656		11-11-11						
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1260 0.1 1360 0.1 1460 0.0 156		11000		120,140,000						
1262 0.1 1362 0.1 1462 0.0 156		7 - 7 - 7 - 7 - 7 - 7		FO 5-4 L-24 L-5						
1264 0.1 1364 0.1 1464 0.0 156		100000000000000000000000000000000000000		30000000000000						
1266 0.1 1366 0.1 1466 0.0 156		100000		0.00						
1268 0.1 1368 0.1 1468 0.0 156		7.500.500.00								
1270 0.1 1370 0.1 1470 0.0 157										
1272 0.1 1372 0.1 1472 0.0 157		100 100 100 100 100 100 100 100 100 100	0.0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						
1274 0.1 1374 0.1 1474 0.0 157		0.57.000.000		1774						
1276 0.1 1376 0.1 1476 0.0 157				1776						
1278 0.1 1378 0.1 1478 0.0 157		200000000000000000000000000000000000000		15,120,151						
1280 0.1 1380 0.1 1480 0.0 158				P. S.						
1282 0.1 1382 0.1 1482 0.0 158		71535 C.C.C.C.L.	0.0	36,357,367						
1284 0.1 1384 0.1 1484 0.0 158			0.0	100, 100, 100, 100, 100, 100, 100, 100,						
1286 0.1 1386 0.1 1486 0.0 158		7.300 (2.70	0.0	The second second second						
1288 0.1 1388 0.1 1488 0.0 158		1 CAL- CAL	0.0	111111111111111111111111111111111111111						
1290 0.1 1390 0.1 1490 0.0 159		1690	0.0	1790						
1292 0.1 1392 0.1 1492 0.0 159		C 200 C 200	0.0	1792						
1294 0.1 1394 0.1 1494 0.0 159		100000000000000000000000000000000000000	0.0	1794						
1296 0.1 1396 0.1 1496 0.0 159		2012/12/02	0.0	17.1 / 27.1						
1298 0.1 1398 0.1 1498 0.0 159			0.0	the state of the s						
1300 0.1 1400 0.0 1500 0.0 160	0.0	1700	0.0	1800	0.0					

			Engine	eers	- 1	TANDO	3 T WT	T /MT.T	OUL DOS		1	age 8		
	d Hou		0.00				AT MI		KSH ROA	7D				
Dubli	Ormo	na Qua	AY		- 1				120			-		
		/2010	08:51		- 1		MENT B					Micro		
					- 1	Designed by AOS Checked by DMW Drainag								
		B3 3	OYR -	34.10.										
Innov	yze					Source	e Cont	ro1 20	1.81					
				A	dditio	nal H	ydrogr	aph #	1					
	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow		
	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)		
	1802	0.0	1902	0.0	2002	0.0	2102	0.0	2202	0.0	2302	0.0		
	1804	0.0	1904	0.0	2004		2104	0.0	2204		2304			
	1806	0.0	1906	0.0	2006		2106	0.0	2206		2306			
	1808	0.0	1908	0.0	2008		2108	0.0	2208		100000000000000000000000000000000000000			
	1810	0.0	1910	0.0	4 - 20-21 2-20	0.0	2110		2210		2310			
	1812 1814	0.0	1912 1914	0.0	2012	0.0	2112 2114	0.0	2212 2214		0.00			
	1816	0.0	1916	0.0	2014		42.4000000	0.0	2214	· · · · · · · · · · · · · · · · · · ·	100000000000000000000000000000000000000			
	1818	0.0	1918	0.0	2018		72.00	1000	2218		3 - 2 3 7 - 20 2 7			
	1820	0.0	1920	0.0	2020		2120		2220		2320			
	1822	0.0	1922	0.0	2022		2122	0.0	2222		3.000			
	1824	0.0	1924	0.0	2024	0.0	2124	0.0	2224	0.0	2324	0.0		
	1826	0.0	1926	0.0	2026	0.0	2126	0.0	2226	0.0	2326	0.0		
	1828	0.0	1928	0.0	2028	0.0	2128	0.0	2228	0.0	2328	0.0		
	1830	0.0	1930	0.0	2030		2130	0.0	2230		0.000			
	1832	0.0	1932	0.0	2032			0.0	2232					
	1834	0.0	1934	0.0	2034		2134	0.0	2234		J 40073 VCN			
	1836	0.0	1936	0.0	2036			0.0	2236					
	1838	0.0	1938	0.0	2038		2138	0.0	2238		7.00			
	1840 1842	0.0	1940 1942	0.0	2040		2140 2142	0.0	2240		2340 2342			
	1844	0.0	1944	0.0	2044		2144	0.00	2244		2344			
	1846	0.0	1946	0.0	2046			0.0	2246		2346			
	1848	0.0	1948	0.0	2048		2148	0.0	2248		U 6.27 (c. 17)			
	1850	0.0	1950	0.0	2050	0.0	2150	0.0	2250	0.0	2350	0.0		
	1852	0.0	1952	0.0	2052	0.0	2152	0.0	2252	0.0	2352	0.0		
	1854	0.0	1954	0.0	2054		2154	0.0	2254		2354	0.0		
	1856	0.0	1956	0.0	2056		2156	0.0	2256		2356			
	1858	400000	1958	0.0	2058		2158	0.0	2258		A STATE OF S	5 15 7-7-7		
	1860	2,000.0	1960	0.0	2060		2160	0.00	2260		2360			
	1862	0.0	1962	0.0	2062		2162	0.0	2262		2362			
	1864 1866	0.0	1964 1966	0.0	4 - 9-20-3-32	0.0	2166	0.0	2264 2266		2364 2366			
	1868	0.0	1968	0.0		0.0	100000000000000000000000000000000000000	0.0						
	1870	100000	1970	0.0	- 10-20-		40.500000	0.0						
		0.0		0.0		0.0			2272			0.0		
		0.0		0.0	10-10-27-1	0.0	100000000000000000000000000000000000000	0.0		0.0				
	1876	0.0	1976	0.0			2176			0.0	2376	0.0		
	1878	0.0		0.0			2178			0.0		0.0		
		0.0		0.0			2180				1000			
		0.0	1982	0.0	4 - 30-36 31-46		2182	1000		0.0				
		0.0		0.0			2184				2384			
		0.0		0.0	C = 13/15/10/10		2186	415		1000	Company of the compan			
		0.0		0.0	177 3 30		2188 2190				2388			
		0.0		0.0			2190			0.0	Contract of the Contract of th			
		0.0					2192							
		0.0		0.0		0.0		0.0			2396			
							2198				2398			
		0.0			2100				2300					
		1000000	WARREST .		0.0000000000000000000000000000000000000		120000	100000			CHARLES			

170092-Rep-010 October 2019

DBFL Consulting Engineers					
LANDS AT MILL/MARSH ROAD					
DBFL REF: 170092					
CATCHMENT B3 - 30 YR	Micro				
Designed by AOS	Desipage				
Checked by DMW	Drainage				
Source Control 2018.1					
	DBFL REF: 170092 CATCHMENT B3 - 30 YR Designed by AOS Checked by DMW				

Additional Hydrograph #1 Flow Time Flow Time Flow Flow Time Flow Time Flow Time Time (mins) (1/s) (mins) (1/s)(mins) (1/s) (mins) (1/s)(mins) (1/s) (mins) (1/s)2482 2562 2642 2722 0.0 2402 0.0 0.0 0.0 0.0 0.0 2802 2404 2484 2564 0.0 2724 2804 0.0 0.0 0.0 2644 0.0 0.0 2406 2726 0.0 2486 0.0 2566 2646 0.0 2806 0.0 0.0 0.0 2408 0.0 2488 0.0 2568 0.0 2648 0.0 2728 0.0 2808 0.0 2410 0.0 2490 0.0 2570 0.0 2650 0.0 2730 0.0 2810 0.0 2412 0.0 2492 0.0 2572 0.0 2652 0.0 2732 0.0 2812 0.0 2414 0.0 2494 0.0 2574 0.0 2654 0.0 2734 0.0 2814 0.0 2416 0.0 2496 0.0 2576 2656 0.0 2736 2816 0.0 0.0 2418 0.0 2498 0.0 2578 2658 0.0 2738 2818 0.0 0.0 2740 2420 0.0 2500 0.0 2580 0.0 2660 0.0 0.0 2820 0.0 2502 2582 2662 0.0 2742 2422 0.0 0.0 0.0 0.0 2822 0.0 2744 0.0 2504 2584 2664 0.0 2824 2424 0.0 0.0 0.0 0.0 2746 2748 2426 0.0 2506 0.0 2586 0.0 2666 0.0 0.0 2826 0.0 0.0 0.0 0.0 2668 2428 2508 2588 0.0 0.0 2828 0.0 2430 0.0 2510 0.0 2590 0.0 2670 0.0 2750 0.0 2830 0.0 2752 2432 0.0 2512 0.0 2592 0.0 2672 0.0 0.0 2832 0.0 2434 0.0 2514 0.0 2594 0.0 2674 0.0 2754 0.0 2834 0.0 2436 0.0 2516 0.0 2596 0.0 2676 0.0 2756 0.0 2836 0.0 0.0 2438 0.0 2518 0.0 2598 2678 0.0 2758 0.0 2838 0.0 2440 2520 0.0 2600 0.0 2680 0.0 2760 2840 0.0 0.0 0.0 2762 2442 0.0 2522 0.0 2602 0.0 2682 0.0 0.0 2842 0.0 2524 2684 2764 2444 0.0 0.0 2604 0.0 0.0 2844 0.0 0.0 2766 2446 0.0 2526 0.0 2606 0.0 2686 0.0 0.0 2846 0.0 0.0 2768 2770 2448 2528 2608 2688 0.0 0.0 0.0 0.0 2848 0.0 2450 0.0 2520 0.0 2610 2690 0.0 0.0 0.0 0.0 2850 2772 2774 2452 0.0 2532 0.0 2612 0.0 2692 0.0 0.0 2852 0.0 2454 0.0 2534 0.0 2614 0.0 2694 0.0 0.0 2854 0.0 2456 0.0 2536 0.0 2616 0.0 2696 0.0 2776 0.0 2856 0.0 0.0 2458 0.0 2538 0.0 2618 2698 0.0 2778 2858 0.0 2460 0.0 2540 0.0 2620 0.0 2700 0.0 2780 0.0 2860 0.0 2542 2622 2702 2782 2462 0.0 0.0 0.0 0.0 0.0 2862 0.0 2544 2624 2704 0.0 2784 2464 0.0 0.0 0.0 0.0 2864 0.0 2466 2546 2626 2706 2866 0.0 0.0 0.0 0.0 2786 0.0 0.0 2708 2788 2468 2548 0.0 2628 0.0 2868 0.0 0.0 0.0 0.0 2470 2550 2630 2710 2790 2870 0.0 0:0 0.0 0.0 0.0 0.0 2472 2712 2792 0.0 2552 0.0 2632 0.0 0.0 0.0 2872 0.0 2634 2474 2554 0.0 2794 0.0 0.0 0.0 2714 0.0 2874 0.0 2476 0.0 2556 0.0 2636 0.0 2716 0.0 2796 0.0 2876 0.0 2478 0.0 2558 0.0 2638 0.0 2718 0.0 2798 0.0 2878 0.0 2480 0.0 2560 0.0 2640 0.0 2720 0.0 2800 0.0 2880 0.0

DBFL Consulting	Engineers					Page 1
Ormond House		LANI	DS AT M	ILL/MARSH	ROAD	
Upper Ormond Qua	ay .	DBFI	L REF:	170092		
Dublin 7		CAT	CHMENT I	YR	Micco	
Date 04/10/2019	09:30	Desi	igned by	y AOS	22.500	Danie
File CATCH B3 10	00 YR - 04.10	Chec	ked by	DMW		Drainag
Innovyze		45		trol 2018	1 1	
Summ	ary of Results	for 1	00 vear	Return	Period (+10%)
-			,			_
	Storm	Max	Max	Max Ma	x Status	
	Event	Level	Depth Co	ontrol Vol	ume	
		(m)	(m)	(1/s) (m	*)	
	15 min Summer	20 919	0.215	7 2 21	7 7 OK	
	30 min Summer	21.038	0.434	7.4 29	9.3 OK	
	60 min Summer			7.4 38	6.6 OK	
	120 min Summer				9.4 OK	
	180 min Summer				7.5 OK	
	240 min Summer					
	360 min Summer 480 min Summer				8.3 OK	
	600 min Summer			7.4 70		
	720 min Summer 960 min Summer	21.692	1.088	7.4 75	1.0 OK	
	1440 min Summer	21.686	1.082	7.4 74	6.9 OK	
	2160 min Summer	21.622	1.018	7.4 70	2.5 OK	
	2880 min Summer	21,526	0.922	7.4 63	6.0 OK	
	4320 min Summer					
	5760 min Summer				6.5 OK	
	7200 min Summer 8640 min Summer				3.6 OK	
	10080 min Summer					
	15 min Winter				4.2 OK	
	30 min Winter	21.091	0.487	7.4 33	6.1 OK	
	Storm	Pain	Flooded	Discharge	Time-Peak	
				Volume		
	1. Feb. 1970. Pro-	,	(m³)		1/8/20 Telegraph 1	
	Man annet	2290500	125	10 10 10 10 10 10 10 10 10 10 10 10 10 1	W 1981	
	15 min Summer	71.340				
	30 min Summer					
	60 min Summer 120 min Summer	20.489	0.0	618.9	128	
	180 min Summer 240 min Summer	12.733	0.0	741.0		
	360 min Summer					
	480 min Summer					
	600 min Summer					
	720 min Summer					
	960 min Summer 1440 min Summer					
	2160 min Summer					
	2880 min Summer					
	4320 min Summer					
	5760 min Summer			1711.4	3464	
	7200 min Summer					
	8640 min Summer					
					5648	
	10080 min Summer					
		71.340	0.0	342.1	23	

BFL Consulting E	ngineers								
mond House		LAN	DS AT	MILL/M	ARSH R	OAD			
per Ormond Quay		DBF	L REF:	170092	2				
ublin 7		CAT	CHMENT	B3 - 1	100 YR				
te 04/10/2019 0	9:30	Des	Designed by AOS						
le CATCH B3 100	YR - 04.10.	Che	cked b	v DMW					
nnovyze		- 3		ntrol 2	2018 1	2			
	rv of Result	Carteria v	1/30/30/WASSE-10W	A CONTROL OF A PROGRAM OF	n resemble	SSOCIETY OF E			
	Storm	Max	Max	Max	Max	Status			
	Event	Level	Depth	Control	Volume				
		(m)	(m)	(1/s)	(m2)				
	60 min Winte	- 21 224	0 600	2.4	424 6	0.17			
	120 min Winte	# 21 287	0.030	7.4	E40 2	0 10			
	180 min Winte	- 21 484	0.703	7 4	607 1	OK			
	240 min Winte	r 21 554	0.950	7.4	655 4	OK			
	120 min Winte 180 min Winte 240 min Winte 360 min Winte	r 21.655	1.051	7.4	725 4	OK			
	480 min Winte	r 21 726	1 122	7.4	771 2	0.8			
	480 min Winte 600 min Winte 720 min Winte	r 22 092	1 488	7.4	700 0	0 10			
	720 min Winte	r 22.121	1.517	7.4	818.8	OK			
	nen min thinks	- 00 150	1 555	7 4	0.4.4 0	(2) 37			
	1440 min Winte	r 22.155	1.551	7.4	842.2	0 K			
	2160 min Winte	r 22.088	1.484	7.4	797.7	0 K			
	2880 min Winte	r 21.668	1.064	7.4	734.2	OK			
	1440 min Winte 2160 min Winte 2880 min Winte 4320 min Winte	r 21.427	0.823	7.4	567.9	ОК			
	5760 min Winte	r 21.257	0.653	7.4	450.3	O K			
	7200 min Winte	r 21.118	0.514	7.4	354.4	O K			
	8640 min Winte	r 21.007	0.403	7.4	278.0	ОК			
1	5760 min Winte 7200 min Winte 8640 min Winte 0080 min Winte	r 20.923	0.319	7.2	219.9	0 K			
	Storm	Rain	Flood	ed Disch	arge Ti	ime-Pea)			
	Event	(mm/hr)	Volum	e Volu	ame	(mins)			
			(m ³)	(m	')				
	60 min Winte 120 min Winte	r 32.41	1 0	.0 5	61.1	66			
	120 min Winte	r 20.48	9 0	.0 6	79.5	126			
	180 min Winte 240 min Winte 360 min Winte 480 min Winte	r 15.54	1 0	.0 7	56.9	184			
	240 min Winte	r 12.73	3 0	.0 8	15.4	244			
	360 min Winte	r 9.59	8 0	.0 9	04.1	362			
	480 min Winte	r 7.840	0 0	.0 9	70.3	478			
	600 min Winte	r 6.69	8 0	.0 10	23.0	590			
	720 min Winte	r 5.88	6 0	.0 10	64.9	704			
	600 min Winte 720 min Winte 960 min Winte 1440 min Winte	r 4.799	9 0	.0 11	13.3	928			
1.33	1440 min Winte	r 3.59	6 0	.0 11	01.2	1142			
3	2160 min Winte 2880 min Winte 4320 min Winte 5760 min Winte	r 2.69	5 0	.0 14	64.8	1604			
	2880 min Winte	r 2.19	5 0	.0 15	79.7	2108			
1.0	4320 min Winte	r 1.64	1 0	.0 17	55.0	2944			
()	5760 min Winte	r 1.33	4 0	.0 19	03.1	3696			
	2000 121	- 1 124	6 0	.0 20	17.0	4464			
	/200 min winte			172 277					
	7200 min Winte 8640 min Winte 0080 min Winte	r 0.99	5 0	.0 21	14.5	5104			

DBFL Consulting Engineers	117	Page 3				
Ormond House	LANDS AT MILL/MARSH ROAD					
Upper Ormond Quay	DBFL REF: 170092					
Dublin 7	CATCHMENT B3 - 100 YR	VIII				
Date 04/10/2019 09:30	Designed by AOS					
File CATCH B3 100 YR - 04.10		Drainage				
Innovyze	Source Control 2018.1					
Ī	ainfall Details					
Rainfall Model	FSR Winter Storms	Yes				
Return Period (years)	100 Cv (Summer) 0					
Region Scot M5-60 (mm)	land and Ireland Cv (Winter) 0. 14.900 Shortest Storm (mins)					
Ratio R	0.279 Longest Storm (mins) 10					
Summer Storms	Yes Climate Change &					
I	ime Area Diagram					
\$60 Dec	tal Area (ha) 1.663					
Time (min	s) Area Time (mins) Area					
From: To	(ha) From: To: (ha)					
0	4 0.000 4 8 1.663					
2.7	D02_2010 Tpp=====					
©1	982-2018 Innovyze					

0.500

0.600

690.0

690.0

170092-Rep-010 October 2019

DBFL Consult	ing Engir	neers					Pag	ge 4		
Ormond House Upper Ormond Dublin 7			DBFL	AT MILL, REF: 1700 MENT B3	92	AD	M			
Date 04/10/2019 09:30 Designed by AOS File CATCH B3 100 YR - 04.10 Checked by DMW								Drainag		
Innovyze				e Control						
		78 —		1 (m) 20.6						
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area	(m²)		
	690.0			1.400				0.0		
	690.0	100000000000000000000000000000000000000	690.0	F. 10 (1) (1)		2.200				
	690.0	A. M. C.		0.000000000000000000000000000000000000		A 22 A 24 A 24 A 25 A 25 A 25 A 25 A 25		0.0		
	690.0	1.75		F-327/43888				0.0		
0.400		100000000000000000000000000000000000000		1.800		200000000000000000000000000000000000000		0.0		

Hydro-Brake® Optimum Outflow Control

1.0 1.0

1.900

2.000

0.0

1.200

1.300

Unit Reference MD-SHE-0118-7400-1570-7400 Design Head (m) 1.570 Design Flow (1/s) Flush-Flos Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm)
Invert Level (m) 118 20.604 Minimum Outlet Pipe Diameter (mm) Suggested Manhole Diameter (mm) 150 1200

Control	Points	Head (m)	Flow (1/s)
Design Point	(Calculated)	1.570	7.4
	Flush-Flow	0.468	7.4
	Kick-Flo®	0.964	5.9
Mean Flow ove	r Head Range	_	6.5

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

Depth (m)	Flow (1/s)						
0.100	4.2	1.200	6.5	3.000	10.0	7.000	15.0
0.200	6.6	1.400	7.0	3.500	10.8	7.500	15.5
0.300	7.1	1.600	7.5	4.000	11.5	8.000	16.0
0.400	7.4	1.800	7.9	4.500	12.2	8.500	16.5
0.500	7.4	2.000	8.3	5.000	12.8	9.000	16.9
0.600	7.3	2.200	8.7	5.500	13.4	9.500	17.4
0.800	6.9	2.400	9.0	6,000	13.9	900000000	
1.000	6.0	2.600	9.4	6.500	14.5		

DBFL Consu		Engin	eers							F	age 5
Ormond Hou	se				LANDS	AT MI	LL/MA	RSH RO	AD	10	
Upper Ormo	nd Qua	ay				REF: 1					
Dublin 7					CATCH	MENT B	3 - 10	00 YR			Micro
Date 04/10	/2019	09:30	8		Desig	ned by	AOS				
File CATCH	B3 1	00 YR	- 04.1	.0	Check	ed by	DMW				Drainage
Innovyze					Source	e Cont	rol 20	18.1			
			<u>A</u>	dditio	onal H	ydrogr	aph ‡	1			
Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow
(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)
2	0.0	102	1.6	202	1.7	302	2.0	402	1.9	502	1.8
4	0.0	104	1.6	204	1.7	304	2.0	404		504	
6	0.0	106	1.7	206	1.7	306	2.0	406	1.9	506	1.8
8	0.0	108	1.7	208		308	2.0	408		508	
10	0.0	110	1.7	210		310	2.0	410		510	
12	0.0	112	1.8	212		312	2.0	412		512	
14	0.0	114	1.8	214		314	2.0	414		514	
16 18	0.0	116 118	1.8	216 218		316 318	2.0	416 418		516 518	
20	0.0	120	1.9	220		320	2.0	420		520	
20	0.0	120	1.9	222		322	2.0	422		520	
24	0.0	124	1.9	224		324	2.0	424		524	
26	0.1	126	1.9	226		326	2.0	426		526	
28	0.1	128	1.9	228	1.8	328	2.0	428	1.9	528	1.8
30	0.1	130	1.9	230	1.9	330	2.0	430	1.9	530	1.8
32	0.1	132	1.9	232		332	2.0	432		532	
34	0.2	134	1.9	234		334	2.0	434		534	
36	0.2	136	1.9	236		336	2.0	436		536	
38	0.2	138	2.0	238		338	2.0	438		538	
40	0.3	140 142	2.0	240 242		340 342	2.0	440 442		540 542	
44	0.4	144	2.0	244		344	2.0	444		544	
46	0.4	146	2.0	246		346	2.0	446		546	
48	0.5	148	2.0	248		348	2.0	448		548	
50	0.5	150	2.0	250	1.9	350	2.0	450	1.9	550	1.7
52	0.6	152	2.0	252		352	2.0	452		552	
54	0.6	154	2.0	254		354	2.0	454		554	
56	0.7	156	2.0	256		356	2.0	456		556	
5.8	0.7	158	2.0	258		358	2.0	458		558	
60	0.8	160	2.0	260		360	2.0	460		560	
62 64	0.8	162 164	2.0	262 264		362 364	2.0	462 464		562 564	
66	0.9	166		266		366	2.0	466		566	
68	0.9	168	2.0	268		368	2.0	468		568	
70	1.0	170	2.0	270		370	2.0	470		570	
72	1.0	172	2.0	272		372	2.0	472	1.8	572	
74	1.1	174	1.9	274	2.0	374	2.0	474	1.8		
76	1.1	176	1.9	276		376	2.0	476		7 4 4 5 7 5 7	
78	1.1	178	1.9	278	2.0	378	2.0	478		578	
80	1.2	180	1.9	280	2.0	380	2.0	480		580	
82	1.2	182	1.9	282	2.0	382	2.0	482	1.8	582	1.7
84 86	1.2	184 186	1.9	284 286	2.0	384 386	2.0	484 486	1.8	584 586	
88	1.3	188	1.8	288	2.0	388	2.0	488	1.8	10 - 5 5 5 5	
90	1.3	190	1.8	290	2.0	390	2.0	490	1.8	590	
92	1.4	192	1.8	292	2.0	392	2.0	492	1.8	2000	
94	1.4	194	1.7	294	2.0	394	2.0	494	1.8	594	
96	1.5	196	1.7	296	2.0	396	1.9	496	1.8	596	1.7
98	1.5	198	1.6	298	2.0	398	1.9	498	1.8		
100	1.5	200	1.7	300	2.0	400	1.9	500	1.8	600	1.7
				©198	2-2018	Inno	rvze				
				XVIVE	23/07/28/75						

DBFL Consulting Engineers	Page 6	
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT B3 - 100 YR	Micco
Date 04/10/2019 09:30	Designed by AOS	Designage
File CATCH B3 100 YR - 04.10	Checked by DMW	Drainage
Innovyze	Source Control 2018.1	

Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow
(mins)	77.74	(mins)	- F. H. T. 15	1. 1. C. O. C.		(mins)	93.5	The state of the s	100 May 100 Ma	(mins)	
400000000	2027/03	STATISTICS OF STATIST OF STAT	LONGING STO	100000000	100000000000000000000000000000000000000	26049320	30000000	85 EAST-154	Appropriate	0.0000000000000000000000000000000000000	23-88-009
602	1.7	702		802	2.0	902	2.0	1002		1102	0.
604	1.7	704	1.8	804	2.0	904	2.0	1004	CRY38.0	1104	0
606	1.7	706	1.9	806	700	906	1000000	1006		1106	0.
608	1.7	708	1.9	808		908 910	2.0	1008	1.7	1108	
612	1.7	2011/2012	1.9	812		912	2.0		200	1112	
614	1.7	0.02000	1.9	814		914		10 10 10 11 11 11	1.6		
616	1.7	716		816		916	1000100	1016	27.00		
618	1.7	718		818		918					
620	1.7	720		0119000000	2.0	5057	12000000		1.5		
622	1.6	100000		822		100.000	2.0		1.5		0.
624	1.6		1.9	824		924	1.00	1024	CARL FIRE		
626	1.6	726	1.9	826	2.0	926	2.0	1026	1.4	1126	0.
628	1.6	728	1.9	828	2.0	928	2.0	1028	1.4	1128	0.
630	1.6	730	1.9	830	2.0	930	2.0	1030		1130	0.
632	1.6	11222200	1.9	832		932	2.0	1032			
634		734		834		934					
636	1.7	736		10.000000000000000000000000000000000000		936	12/8/07/20		0.00		
638	1.7	100000000000000000000000000000000000000	1.9	838		938		100	1.3		
640	1.7	740		111111111111111111111111111111111111111	2.0	940	1.00	CO. 10 11 11 11 11 11 11 11 11 11 11 11 11	0.00	1140	
642	1.7	703.1111	1.9	842		942	2.0	2000		1142	
644 646	1.7		1.9	844 846		944 946	100000000000000000000000000000000000000		1.2	1144 1146	
648	1.7		1.9	848		948	1.9	A	1.1	1148	
650	1.7	100000	1.9	850		950	1.9		1.1	1150	
652	1.7	752		C. F. S. S. S. S.		952	1.9	200 200	1.1		
654	1.7	754		854		954	1.9	1054		1154	
656	1.7	756	1.9	856	2.0	956	-313.00	- 1 500	1.0		
658	1.7	758	1.9	858	2.0	958	1.9	1058	1.0	1158	0.:
660	1.7	760	1.9	860	2.0	960	1.9	1060	0.9	1160	0.
662	1.7	762	1.9	862	2.0	962	1.9	1062	0.9	1162	0.
664	1.8	764	1.9	864	2.0	964	1.9	1064	0.9	1164	0.
666	1.8	766	1.9	866		966	1.9		0.9	1166	
668	1.8	768	1.9	868		968	25.00	40.000.000.000	0.9		
670	1.8	770		870		970	1.9		0.8	1170	0.
672	1.8	772		872		972	1.9		0.8		0.
674	1.8	774		874		974	1.9	100000000000000000000000000000000000000	0.8		
676	1.8	776		876		976	-		0.8		
678	1.8	778	1.9	878		978	1.9	(0.7	1178	
680 682	1.8		1.9	880		980 982	1.9		0.7	1180 1182	0.
684	1.8	201000000	1.9	100000000000000000000000000000000000000		120010			0.7	1184	
686	1.8	100/200		0.70		986			0.7	1186	
688	1.8	10.0000		888		988	1.8	0.000	0.6	1188	
690	1.8	790	1.9	890		990	1.8	100000000000000000000000000000000000000	0.6		
692	1.8		2.0	892		992	1.8		0.6		
694	1.8	100000000000000000000000000000000000000	2.0	894		994	1.8		0.6	1194	
696	1.8			896		996			1 1 1 1 1 1 1	1196	
698	1.8	798		898		998	1.8	1098	The second second	1198	0.
700	1.8			900	2.0	1000	1.8		0.6		0.

ime Flovins) (1/s 1302 0. 1304 0. 1306 0. 1308 0. 1310 0. 1311 0. 1312 0. 1314 0. 1316 0. 1312 0. 1312 0. 1312 0. 1313 0. 1313 0. 1314 0.	Additi Time (mins) 1 1402 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420 1 1421	DBFL CATCH Desig Check Source onal H Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	e Cont	70092 3 - 10 AOS DMW rol 20 aph #: Flow (1/s) 0.0 0.0 0.0	00 YR 018.1 Time (mins) 1602 1604 1606	Flow (1/s)	Time (mins)	(1/s) 0.0
ime Flowins) (1/s 1302 0. 1304 0. 1308 0. 1318 0. 1318 0. 1318 0. 1318 0. 1320 0. 1320 0. 1320 0. 1320 0. 1320 0. 1320 0. 1320 0. 1320 0.	Additi Time (mins) 1 1402 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420 1 1421	CATCH Desig Check Sourc onal H Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0	MENT B ned by ed by e Cont. (vdrogr Time (mins) 1502 1504 1506 1508 1510	3 - 10 AOS DMW rol 20 aph #: Flow (1/s) 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	Time (mins)	Flow (1/s)
Ime Flow ins) (1/s 1302 0. 1304 0. 1306 0. 1310 0. 1310 0. 1310 0. 1311 0. 1312 0. 1314 0. 1316 0. 1320 0. 1320 0. 1320 0.	Additi Time (mins) 1 1402 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420 1 1421	Desig Check Source onal H Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	ned by ed by e Cont. Ydrogr Time (mins) 1502 1504 1506 1508 1510	AOS DMW rol 20 aph #. Flow (1/s) 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	Time (mins)	Flow (1/s)
Ime Flow ins) (1/s 1302 0. 1304 0. 1306 0. 1310 0. 1310 0. 1310 0. 1311 0. 1312 0. 1314 0. 1316 0. 1320 0. 1320 0. 1320 0.	Additi Time (mins) 1 1402 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420 1 1421	Check Source onal H Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0	ed by e Cont (vdroqr Time (mins) 1502 1504 1506 1508 1510	DMW rol 20 aph #. Flow (1/s) 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	Time (mins)	Flow (1/s)
ime Flow ins) (1/s 1302 0. 1304 0. 1306 0. 1310 0. 1312 0. 1312 0. 1314 0. 1316 0. 1316 0. 1320 0. 1320 0. 1320 0. 1320 0.	Additi Time (mins) 1 1402 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420 1 1421	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Time (mins) 1502 1504 1506 1508 1510	rol 20 aph #: Flow (1/s) 0.0 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	Time (mins)	Flow (1/s)
ime Flow ins) (1/s 1302 0. 1304 0. 1306 0. 1310 0. 1312 0. 1312 0. 1314 0. 1316 0. 1316 0. 1320 0. 1320 0. 1320 0. 1320 0.	Additi Time (mins) 1 1402 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420 1 1421	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Time (mins) 1502 1504 1506 1508 1510	rol 20 aph #: Flow (1/s) 0.0 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	(mins) 1702 1704	(1/s) 0.0
ins) (1/s 1302 0. 1304 0. 1306 0. 1308 0. 1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1322 0. 1324 0.	Time (mins) 1 1402 1 1404 1 1406 1 1412 1 1414 1 1416 1 1412 1 1414 1 1416 1 1412	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Time (mins) 1502 1504 1506 1508 1510	Flow (1/s) 0.0 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	(mins) 1702 1704	(1/s) 0.0
ins) (1/s 1302 0. 1304 0. 1306 0. 1308 0. 1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1322 0. 1324 0.	Time (mins) 1 1402 1 1404 1 1406 1 1412 1 1414 1 1416 1 1412 1 1414 1 1416 1 1412	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Time (mins) 1502 1504 1506 1508 1510	Flow (1/s) 0.0 0.0 0.0 0.0	Time (mins) 1602 1604 1606	0.0 0.0	(mins) 1702 1704	(1/s) 0.0
ins) (1/s 1302 0. 1304 0. 1306 0. 1308 0. 1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1322 0. 1324 0.	(mins) 1 1402 1 1404 1 1406 1 1408 1 1410 1 1412 1 1416 1 1418 1 1420 1 1422	(1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0	(mins) 1502 1504 1506 1508 1510	0.0 0.0 0.0 0.0	(mins) 1602 1604 1606	0.0 0.0	(mins) 1702 1704	(1/s) 0.0
1304 0. 1306 0. 1308 0. 1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1318 0. 1320 0. 1324 0. 1324 0. 1326 0.	1 1404 1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1420 1 1422	0.0 0.0 0.0 0.0 0.0	1504 1506 1508 1510	0.0	1604 1606	0.0	1704	
1306 0. 1308 0. 1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1324 0. 1324 0.	1 1406 1 1408 1 1410 1 1412 1 1414 1 1416 1 1420 1 1422	0.0 0.0 0.0 0.0	1506 1508 1510	0.0	1606		\$74.933.0V	0.0
1308 0. 1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1408 1 1410 1 1412 1 1414 1 1416 1 1418 1 1420	0.0 0.0 0.0 0.0	1508 1510	0.0		0.0		
1310 0. 1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1410 1 1412 1 1414 1 1416 1 1418 1 1420	0.0 0.0 0.0	1510				1706	0.0
1312 0. 1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1412 1 1414 1 1416 1 1418 1 1420 1 1422	0.0 0.0 0.0	200000000000000000000000000000000000000		1608		100 100 000	
1314 0. 1316 0. 1318 0. 1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1414 1 1416 1 1418 1 1420 1 1422	0.0	1512	0.0	1610		10000000	
1316 0. 1318 0. 1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1416 1 1418 1 1420 1 1422	0.0		0.0	1612		100 A	
1318 0. 1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1418 1 1420 1 1422		100000000000000000000000000000000000000	500	1614			
1320 0. 1322 0. 1324 0. 1326 0. 1328 0.	1 1420 1 1422		120,000,000	0.0	1616 1618		200000000000000000000000000000000000000	
1322 0. 1324 0. 1326 0. 1328 0.	1 1422		1520	0.0	1620		Table 95 (5)	
1324 0. 1326 0. 1328 0.	Co. 10 20 515 00		1522	0.0	1622			
1326 0. 1328 0.	1 1424		1524		1624		1724	
1328 0.	100		1526	C 10 Pr 110	1626		- The section of	
		0.0	1528	0.0	1628	0.0	1728	0.0
1330 0.	1 1430	0.0	1530	0.0	1630	0.0	1730	0.0
1332 0.			100 300 500	0.0	1632		100000000000000000000000000000000000000	
1334 0.	100		1534	0.0	1634		100000000000000000000000000000000000000	
1336 0.	0.5000		1536	200	1636		7.00.00.000	
1338 0.			1538	0.0	1638		100000000000000000000000000000000000000	
1340 0. 1342 0.	C. 10.5100.0		1540 1542	0.0	1640 1642		1740 1742	
1344 0.	100		1544	0.0	1644		100	
1346 0.	111	0.0		0.0	1646		100000000000000000000000000000000000000	
1348 0.			1548	0.0	1648		1000000	
1350 0.			245 6 44 44 4		1650		1750	0.0
1352 0.	1 1452	0.0	1552	0.0	1652	0.0	1752	0.0
1354 0.	1 1454	0.0	1554	0.0	1654	0.0	1754	0.0
1356 0.	-		1556	0.0	1656		100000	
1358 0.	0.0000000000000000000000000000000000000		1558	0.0	1658		10/17/12/2016	
1360 0.	150		1560	C 10 Page 110	1660		1760	
1362 0.	111		1562	0.0	1662		1762	
	S. 1500 S. 1		CONT. A. C. A.	6.7			100000000	
	- D. J D. V		200 200 200	S 50 / 11 / 1				
	CO. 100 CO. 10		100 100 100	400			100000000000000000000000000000000000000	
								0.0
	1-1						10.0000 0.000	0.0
1376 0.	1 1476	0.0	1576	0.0	1676	0.0	1776	0.0
	100		C-10-10-10-10-10-10-10-10-10-10-10-10-10-				B 100 B	0.0
							178 9 310	0.0
			200 2002	C			1000000000	
	- V - V - V - V - V - V - V - V - V - V		2000	G 50 7 1 1 1 1 1 1			100	
	200		100000000000000000000000000000000000000	500			100000000000000000000000000000000000000	
				4 7 7 4 7 7 7 7 7 7			H 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	9-33-5-6		100 100 100 100	-2.00			Table 1 to 100	
							100 mg	
							1757 1703	
							10 10 10 10 10 10 10 10 10 10 10 10 10 1	0.0
	1.65			- 81			15	
	1364 0.1366 0.1368 0.1370 0.1372 0.1374 0.1378 0.1382 0.1384 0.1386 0.1386 0.1389 0.1389 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 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0.1399 0.1399 0.1399 0.1399 0.1399 0.1399 0.13	1364 0.1 1464 1366 0.1 1466 1368 0.1 1468 1370 0.1 1470 1372 0.1 1472 1374 0.1 1476 1378 0.1 1476 1378 0.1 1476 1380 0.1 1488 1380 0.1 1488 1384 0.1 1488 1388 0.1 1488 1388 0.1 1488 1388 0.1 1488 1388 0.1 1498 1390 0.1 1490 1392 0.1 1490 1392 0.1 1490 1393 0.1 1490 1394 0.1 1490 1396 0.1 1496 1398 0.1 1498	1364 0.1 1464 0.0 1366 0.1 1466 0.0 1368 0.1 1460 0.0 1377 0.1 1470 0.0 1372 0.1 1474 0.0 1374 0.1 1476 0.0 1378 0.1 1476 0.0 1382 0.1 1480 0.0 1382 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1480 0.0 1386 0.1 1490 0.0 1390 0.1 1490 0.0 1392 0.1 1490 0.0 1394 0.1 1494 0.0 1396 0.1 1496 0.0 1398 0.1 1498 0.0 1398 0.1 1498 0.0 1398 0.1 1498 0.0 1398 0.1 1498 0.0 1390 0.0 1500 0.0	1364 0.1 1464 0.0 1564 1366 0.1 1466 0.0 1566 1368 0.1 1460 0.0 1568 1370 0.1 1470 0.0 1570 1372 0.1 1472 0.0 1570 1374 0.1 1474 0.0 1574 1376 0.1 1474 0.0 1574 1376 0.1 1478 0.0 1578 1380 0.1 1480 0.0 1580 1382 0.1 1480 0.0 1582 1384 0.1 1486 0.0 1584 1386 0.1 1488 0.0 1586 1388 0.1 1488 0.0 1586 1389 0.1 1490 0.0 1590 1392 0.1 1492 0.0 1592 1394 0.1 1492 0.0 1594 1396 0.1 1496 0.0 1594 1396 0.1 1496 0.0 1594 1396 0.1 1496 0.0 1596 1398 0.1 1498 0.0 1596 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1498 0.0 1598 1398 0.1 1590 0.0 1600	1364 0.1 1464 0.0 1564 0.0 1366 0.1 1466 0.0 1566 0.0 1568 0.0 1568 0.0 1570 0.0 1570 0.0 1572 0.0 1574 0.0 1574 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1576 0.0 1578 0.0 1578 0.1 1478 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A		Engine		- 1	TANDO	37.1/7		2011 201	-	1	age 8
Ormond Hou				- 1		AT MI		RSH ROA	AD.		
Upper Ormo	nd Qu	ay		- 1		REF: 1					-
Dublin 7						MENT B		JO YR			Micro
Date 04/10						ned by					Drainag
File CATCH	B3 1	00 YR -	- 04.1								Ji dili lag
Innovyze				- 22	Source	e Cont	rol 20	018.1		:32-	
			A	dditio	nal H	ydrogr	aph #	<u>l</u>			
Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)	Time (mins)	200	Time (mins)	Flow (1/s)	Time (mins)	Flow (1/s)
1802	0.0	1902	0.0	2002	0.0	2102	0.0	2202	0.0	2302	0.0
1804		1902	0.0	2004		2102	0.0	2204		2304	
1806		1906	0.0	3 (10 (10 (10 (10 (10 (10 (10 (10 (10 (10	0.0	2106	0.0	2206			
1808		1908	0.0	2008		2108	0.0	2208			
1810	0.0	1910	0.0	2010	0.0	2110	0.0	2210	0.0	2310	0.0
1812		1912	0.0	2012		2112	0.0	2212		2312	
1814		1914	0.0	2014	()=5(3)	2114	0.0	2214		2314	
1816		1916	0.0	2016		2116	0.0	2216		2316	
1818		1918	0.0	2018		2118	0.0	2218		2318	
1820		1920	0.0	C - 1 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	0.0	2120	115.6	2220	1000000	2320	
1822		1922	0.0	2022		2122	0.0	2222		2322	
1824 1826		1924	0.0	2024	0.0	2124 2126		2224		2324 2326	
1828		1928	0.0	2028				2228		2 (0.000)	
1830		1930	0.0	2030		2130	0.0	2230		2330	
1832		1932	0.0	2032		2132	0.0	2232		100000000000000000000000000000000000000	
1834		1934	0.0	2034		2134	77-74	2234		2334	
1836	0.0	1936	0.0	2036	0.0	2136	0.0	2236	0.0	2336	0.0
1838	0.0	1938	0.0	2038	0.0	2138	0.0	2238	0.0	2338	0.0
1840		1940	0.0	2040		2140	0.0	2240		2340	0.0
1842		1942	0.0	2042		2142	0.0	2242		2342	
1844		1944	0.0	2044		2144		2244			
1846		1946	0.0	2046		1.000	1000	2246		100000000000000000000000000000000000000	
1848		1948 1950	0.0	2048		2148 2150		2248 2250			
1850 1852		1950	0.0	2050		2150	0.0	2252		2350 2352	
1854		1954	0.0	2054		2154		2254		2354	
1856		1956	0.0	2056		2156	0.0	2256		2356	
1858		1958	0.0	2058		2158	0.0	2258	C 40000	2358	
1860		1960	0.0	2060		2160	0.0	2260		2360	
1862	0.0	1962	0.0	2062	0.0	2162	0.0	2262	0.0	2362	0.0
1864	0.0	1964	0.0	2064	0.0	2164	0.0	2264		2364	0.0
1866		1966	0.0	2066		100000000	0.0	2266		1000	
1868		1968	0.0	2068		2168	71-71			1 1000 1000	
1870		1970	0.0	2070		2170	0.0			2370	
1872		1972	0.0			500000000000000000000000000000000000000	100000000000000000000000000000000000000				0.0
1874		1974	0.0	2074	0.0	2174	0.0	2274	0.0	2374	
1876 1878		1976 1978	0.0	2076	0.0	2176 2178	0.0	2276 2278	0.0	2376 2378	
1880		1980	0.0	2080	0.0	2180	0.0	2280	0.0	2380	
1882		1982	0.0	2082	0.0	2182	0.0	2282	0.0	2382	
1884		1984	0.0	2084	0.0	2184	0.0	2284	0.0	2384	
1886		1986	0.0	2086		2186	0.0	2286		2386	
1888		1988	0.0	2088	0.0	2188	0.0	2288		2388	
1890		1990	0.0	2090	0.0	2190	0.0	2290	0.0	2390	0.0
1892	0.0	1992	0.0	2092	0.0	2192	0.0	2292	0.0	2392	0.0
1894	0.0	1994	0.0	2094	0.0	2194	0.0	2294	0.0	2394	0.0
1896		1996	0.0	2096		2196	0.0	2296	0.0	2396	
1898		1998	0.0	2098	0.0	2198	0.0	2298	0.0	2398	
1900	0.0	2000	0.0	2100	0.0	2200	0.0	2300	0.0	2400	0.0

	Page 9	
LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT B3 - 100 YR	Micco	
Designed by AOS Checked by DMW	Drainag	
Source Control 2018.1		
	DBFL REF: 170092 CATCHMENT B3 - 100 YR Designed by AOS Checked by DMW	

Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow
mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)	(mins)	(1/s)
2402	0.0	2482	0.0	2562	0.0	2642	0.0	2722	0.0	2802	0.0
2404	0.0	2484	0.0	2564	0.0	2644	0.0	2724	0.0	2804	0.0
2406	0.0	2486	0.0	2566	0.0	2646	0.0	2726	0.0	2806	0.0
2408	0.0	2488	0.0	2568	0.0	2648	0.0	2728	0.0	2808	0.0
2410	0.0	2490	0.0	2570	0.0	2650	0.0	2730	0.0	2810	0.0
2412	0.0	2492	0.0	2572	0.0	2652	0.0	2732	0.0	2812	0.0
2414	0.0	2494	0.0	2574	0.0	2654	0.0	2734	0.0	2814	0.0
2416	0.0	2496	0.0	2576	0.0	2656	0.0	2736	0.0	2816	0.0
2418	0.0	2498	0.0	2578	0.0	2658	0.0	2738	0.0	2818	0.0
2420	0.0	2500	0.0	2580	0.0	2660	0.0	2740	0.0	2820	0.0
2422	0.0	2502	0.0	2582	0.0	2662	0.0	2742	0.0	2822	0.0
2424	0.0	2504	0.0	2584	0.0	2664	0.0	2744	0.0	2824	0.0
2426	0.0	2506	0.0	2586	0.0	2666	0.0	2746	0.0	2826	0.0
2428	0.0	2508	0.0	2588	0.0	2668	0.0	2748	0.0	2828	0.0
2430	0.0	2510	0.0	2590	0.0	2670	0.0	2750	0.0	2830	0.0
2432	0.0	2512	0.0	2592		2672	0.0	2752	0.0	2832	0.0
2434	0.0	2514	0.0	2594	0.0	2674	0.0	2754	0.0	2834	0.0
2436	0.0	2516	0.0	2596	0.0	2676	0.0	2756	0.0	2836	0.0
2438	0.0	2518	0.0	2598	0.0	2678	0.0	2758	0.0	2838	0.0
2440	0.0	2520	0.0	2600	0.0	2680	0.0	2760	0.0	2840	
2442	0.0	2522	0.0	2602	0.0	2682	0.0	2762	0.0	2842	0.0
2444	0.0	2524	0.0	2604	0.0	2684	0.0	2764	0.0	2844	
2446	0.0	2526	0.0	2606	0.0	2686	0.0	2766	790000	2846	0.0
2448	0.0	2528	0.0	2608	0.0	2688	0.0	2768	0.0	2848	0.0
2450	0.0	2530	0.0	2610	0.0	2690	0.0	2770	0.0	2850	0.0
2452	0.0	2532	0.0	2612	0.0	2692	0.0	2772	0.0	2852	0.0
2454	0.0	2534	0.0	2614	0.0	2694	0.0	2774	0.0	2854	0.0
2456	0.0	2536	0.0	2616	0.0	2696	0.0	2776	0.0	2856	0.0
2458	0.0	2538	0.0	2618	0.0	2698	0.0	2778	0.0	2858	0.0
2460	0.0	2540	0.0	2620	0.0	2700	0.0	2780	0.0	2860	0.0
2462	0.0	2542	0.0	2622	0.0	2702	0.0	2782	0.0	2862	0.0
2464	0.0	2544	0.0	2624	0.0	2704	0.0	2784	0.0	2864	0.0
2466	0.0	2546	0.0	2626	0.0	2706	0.0	2786	0.0	2866	0.0
2468	0.0	2548	0.0	2628	0.0	2708	0.0	2788	0.0	2868	
2470	0.0	2550	0.0	2630	0.0	2710	0.0	2790	0.0	2870	0.0
2472	0.0	2552	0.0	2632	0.0	2712	0.0	2792	0.0	2872	0.0
2474	0.0	2554	0.0	2634	0.0	2714	0.0	2794	0.0	2874	0.0
2476	0.0	2556	0.0	2636	0.0	2716	0.0	2796	0.0	2876	0.0
2478	0.0	2558	0.0	2638	0.0	2718	0.0	2798	0.0	2878	0.0
2480	0.0	2560	0.0	2640	0.0	2720	0.0	2800	0.0	2880	0.0

DBFL Consulting	Engineers	130					Page 1
Ormond House		LAN	DS AT M	ILL/M	ARSH R	OAD	
Upper Ormond Qua	Ϋ́	DBF	L REF:	170092	2		
Dublin 7	141	CAT	CHMENT	C1- 10	00 YR		Misses
Date 08/10/2019	10:43	N 186 16	igned b				Micco
File C1 BASIN T		334 V2005	The state of the s	- C.			Draina
200000000000000000000000000000000000000	00.10.2015.5KG		rce Con	S. Charles	2010 1		
Innovyze		Sou	rce Con	trol 2	1.8102	1	
Summ	ary of Results	e. 1987. Let		7,000	country	Manual Services	<u>) </u>
	Storm	Max	757775			Status	
	Event		Depth C				
		(m)	(m)	(1/5)	(m-)		
	15 min Summer	24.717	0.213	4.1	91.1	0 K	
	30 min Summer	24.795	0.291	4.1	124.6	O K	
	60 min Summer					OK	
	120 min Summer				192.6		
	180 min Summer				210.4		
	240 min Summer 360 min Summer					OK	
	480 min Summer						
	600 min Summer					OK	
	720 min Summer						
	960 min Summer				232.7		
	1440 min Summer	25.029	0.525			OK	
	2160 min Summer				209.9	O K	
	2880 min Summer					OK	
	4320 min Summer					O K	
	5760 min Summer					OK	
	7200 min Summer 8640 min Summer					OK	
	10080 min Summer						
	15 min Winter					O K	
	30 min Winter						
	Storm	Rain	Flooded	d Disch	arge Ti	me-Peak	
	Event	(mm/hr)	Volume			(mins)	
			(m ³)	(m²)		
	15 min Summer				94.3	19	
	30 min Summer				30.8	33	
	60 min Summer				71.0	64	
	120 min Summer				16.0	122	
	180 min Summer 240 min Summer				45.6 68.2	182 242	
	360 min Summer				03.0	360	
	480 min Summer				29.9	468	
	600 min Summer				52.2	522	
	720 min Summer				71.3	586	
	960 min Summer			0 4	03.5	714	
	1440 min Summer				53.3	994	
	2160 min Summer				09.1	1408	
	2880 min Summer				52.8	1840	
	4320 min Summer				19.6	2596	
	5760 min Summer				71.4 14.0	3336	
	7200 min Summer 8640 min Summer				50.8	4032 4672	
	10080 min Summer				83.3	5344	
	15 min Winter				05.7	18	
	30 min Winter	49.883	0.0	1	46.4	33	

Ormond House Upper Ormond Quay	ers						Page 2
Upper Ormond Quay		LANI	S AT M	ILL/MA	RSH R	OAD	Tio.
		DBFI	REF:	170092			
Dublin 7		CATO	CHMENT	C1- 10	0 YR		Mileson
Date 08/10/2019 10:43		. 3	gned b				MILLI
File Cl BASIN T 08.10.	2019 SECX		47	7			Drainad
Innovyze		177.475	ce Con		018 1		
Summary of	Results :	for 1	00 vear	Retur	n Per	iod (+10%)
***************************************		NAME OF STREET					
			Max				
E	rent		Depth C				
		(m)	(m)	(1/s)	(m [*])		
60 m	in Winter 2	4.924	0.420	4.1	179.7	OK	
120 m	in Winter 2	5.014	0.510	4.1	218.3	OK	
	in Winter 2						
240 m	in Winter 2	5.093	0.589	4.1	252.2	OK	
	in Winter 2						
	in Winter 2			4.1			
	in Winter 2 in Winter 2			4.1			
1440 m	in Winter 2 in Winter 2	5.104	0.600	4.1	257.0	OK	
2880 m	in Winter 2 in Winter 2	4.983	0.479	4.1	205.0	OK	
4320 m	in Winter 2	4.827	0.323	4.1	138.4	OK	
	in Winter 2						
7200 m	in Winter 2	4.626	0.122	4.1	52.2	O K	
8640 m	in Winter 2 in Winter 2	4.582	0.078	3.9	33.3	O K	
			Volume	Volu	ne	ime-Peak (mins)	
			(m ³)	(m ³))		
	in Winter					62	
	in Winter					120	
	in Winter				5.0	178	
	in Winter					236	
360 m:	in Winter in Winter	7 860	0.0		9.4	250 460	
	in Winter				4.5	566	
	in Winter				5.9	664	
	in Winter				1.9	752	
1440 m	in Winter	3.599	0.0	50	7.7	1068	
	in Winter	2.695			0.4	1532	
	***	2.194			8.9	1988	
2880 m:			0.0		4.1	2764	
2880 m: 4320 m:	in Winter	1.640				0.00	
2880 m: 4320 m: 5760 m:	in Winter in Winter	1.332	0.0	75	1.8	3456	
2880 m: 4320 m: 5760 m: 7200 m:	in Winter in Winter in Winter	1.332	0.0	75	9.7	4040	
2880 m: 4320 m: 5760 m: 7200 m: 8640 m:	in Winter in Winter in Winter in Winter	1.332 1.134 0.993	0.0 0.0	75 79	1.8 9.7 0.9	4040 4584	
2880 m: 4320 m: 5760 m: 7200 m: 8640 m:	in Winter in Winter in Winter in Winter	1.332 1.134 0.993	0.0 0.0	75 79	1.8 9.7 0.9	4040 4584	
2880 m: 4320 m: 5760 m: 7200 m: 8640 m:	in Winter in Winter in Winter	1.332 1.134 0.993	0.0 0.0	75 79	9.7	4040	
2880 m: 4320 m: 5760 m: 7200 m: 8640 m:	in Winter in Winter in Winter in Winter	1.332 1.134 0.993	0.0 0.0	75 79	1.8 9.7 0.9	4040 4584	

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT C1- 100 YR	VI STATE OF THE ST
Date 08/10/2019 10:43	Designed by DCG	Micro
File C1 BASIN T 08.10.2019.SRCX		Drainage
Innovyze	Source Control 2016.1	-
Rainfall Model Return Period (years) Region Scotla M5-60 (mm) Ratio R Summer Storms Tin	FSR Winter Storms 100 Cv (Summer) 0 and and Ireland Cv (Winter) 0 15.000 Shortest Storm (mins) 0.281 Longest Storm (mins) 1 Yes Climate Change % me Area Diagram al Area (ha) 0.700 ime (mins) Area com: To: (ha) 0 4 0.700	.750 .840 15
®19:	92-2018 Innovyże	
	NEED 2 90 4775 - 77 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	

DBFL Consulting Engineers	Page 4	
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT C1- 100 YR	Micro
Date 08/10/2019 10:43 File C1 BASIN T 08.10.2019.SRCX	Designed by DCG Checked by DMW	Drainage
Innovyze	Source Control 2018.1	141

Model Details

Storage is Online Cover Level (m) 27.070

Tank or Pond Structure

Invert Level (m) 24.504

Depth (m)	Area (m²)						
0.000	428.0	0.400	428.0	0.800	0.0	1.200	0.0
0.100	428.0				0.0	1.300	0.0
0.200	428.0	0.600	428.0	1.000	0.0	1.400	0.0
0.300	428.0	0.700	428.0	1.100	0.0	1.500	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-3HE-0100-4100-0696-4100 Design Head (m) 0.696 Design Flow (1/s) Flush-Flom Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 100 Invert Level (m) 24.458 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200

Control Points Head (m) Flow (1/s)

Design Point	(Calculated)	0.696	4.1
	Flush-Flos	0.209	4.1
	Kick-Flo®	0.472	3.4
Mean Flow ove	er Head Range	-	3.5

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

Depth (m)	Flow (1/s)	Depth (m) F	low (1/s)	Depth (m) Fl	ow (1/s)	Depth (m)	Flow (1/s)
0.100	3.3	1.200	5.3	3.000	8.1	7.000	12.1
0.200	4.1	1.400	5.7	3.500	8.7	7.500	12.5
0.300	4.0	1.600	6.0	4.000	9.3	8.000	12.9
0.400	3.8	1.800	6.4	4.500	9.8	8.500	13.3
0.500	3.5	2.000	6.7	5.000	10.3	9.000	13.7
0.600	3.8	2.200	7.0	5.500	10.8	9.500	14.1
0.800	4.4	2.400	7.3	6.000	11.3		
1.000	4.8	2.600	7.6	6.500	11.7		

DBFL Consulting Engineers			
LANDS AT MILL/MARSH ROAD			
DBFL REF: 170092			
CATCHMENT C2 - 100 YR	Micco		
Designed by DCG	Designation		
Checked by DMW	Dramage		
Source Control 2018.1	700		
	DBFL REF: 170092 CATCHMENT C2 - 100 YR Designed by DCG Checked by DMW		

Summaru	of	Results	for	100	waar	Deturn	Deriod	(+10%)
CONTRACTOR TO A	~ -	シェンパエクス		100	$v = a \perp$	LOG COLL ST	FETTOU	117001

	Stor	m	Max	Max	Max	Max	Status
	Even	t	Level	Depth	Control	Volume	
			(m)	(m)	(1/s)	(m 2)	
15	min	Summer	24.473	0.303	2.0	7.6	ОК
30	min	Summer	24.557	0.387	2.0	9.7	OK
60	min	Summer	24.595	0.425	2.0	10.6	O K
120	min	Summer	24.598	0.428	2.0	10.7	0 K
180	min	Summer	24.584	0.414	2.0	10.4	O K
240	min	Summer	24.563	0.393	2.0	9.8	O K
260	min	Summer	24.511	0.341	2.0	8.5	OK
480	min	Summer	24.445	0.275	2.0	6.9	0 K
600	min	Summer	24.386	0.216	2.0	5.4	0 K
720	min	Summer	24.336	0.166	2.0	4.1	0 K
960	min	Summer	24.261	0.091	2.0	2.3	OK
1440	min	Summer	24.188	0.018	1.9	0.4	0 K
2160	min	Summer	24.170	0.000	1.5	0.0	OK
2880	min	Summer	24.170	0.000	1.3	0.0	O K
4320	min	Summer	24.170	0.000	0.9	0.0	O K
5760	min	Summer	24.170	0.000	0.8	0.0	OK
7200	min	Summer	24.170	0.000	0.6	0.0	OK
8640	min	Summer	24.170	0.000	0.6	0.0	OK
10080	min	Summer	24.170	0.000	0.5	0.0	OK
15	min	Winter	24.520	0.350	2.0	8.7	OK
30	min	Winter	24.621	0.451	2.0	11.3	OK

	Stor	750			Discharge Volume	Time-Peak (mins)
	FE-81	578		(m°)		
15	min	Summer	72.036	0.0	9.4	17
30	min	Summer	49.883	0.0	13.1	31
60	min	Summer	32.616	0.0	17.2	54
120	min	Summer	20.592	0.0	21.6	88
180	min	Summer	15.607	0.0	24.5	122
240	min	Summer	12.780	0.0	26.9	158
360	min	Summer	9.627	0.0	30.3	228
480	min	Summer	7.860	0.0	33.0	290
600	min	Summer	6.712	0.0	35.3	350
720	min	Summer	5.897	0.0	37.1	410
960	min	Summer	4.806	0.0	40.4	520
			3.599		45.3	738
2160	min	Summer	2.695	0.0	50.9	0
2880	min	Summer	2.194	0.0	55.3	0
4320	min	Summer	1.640	0.0	62.0	0
5760	min	Summer	1.332	0.0	67.1	0
7200	min	Summer	1.134	0.0	71.4	0
8640	min	Summer	0.993	0.0	75.1	0
10080	min	Summer	0.888	0.0	78.3	0
15	min	Winter	72.036	0.0	10.6	17
30	min	Winter	49.883	0.0	14.6	31

Strategic Housing Development at Colpe West, Drogheda Infrastructure Design Report

Ormond House			T 70 3 71	DC AT A	ATT T /347	ancu n	
			250450	DS AT N			OAD
Jpper Ormon	d Quay		500000	L REF:			
Dublin 7			CAT	CHMENT	C2 - 1	100 YR	
Date 08/10/	2019 09:4	6	Des:	igned k	y DCG		
File CATCHM	ENT C2 10	O YEAR O.	Che	cked by	z DMW		
Innovyze	TENTE (NEED)		200	rce Cor		2018 1	7
miovine			004				9
	Summarry	of Results	for 1	00 1700	r Datu	rn Day	riad (+
	Summary	JI RESULUS	101 1	oo yea.	I Recu	III FEI	200 17
		Storm	Max	Max	Max	Max	Status
		Event	Level				
		A-0.4.10		(m)			
		min Winter					
		min Winter					
		min Winter					O K
		min Winter					0 K
						6.7	
		min Winter min Winter				3.8	
		min Winter				A (- 7) - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 -	
		min Winter			1.9	0.4	O K
	507.7	min Winter	A CONTRACTOR OF THE PARTY OF TH				0 K
	2160	min Winter	24.170	0.000	1.1	0.0	O K
		min Winter					0 K
	4220	min Winter					
					0.6	0.0	OK
	57.50		24.170	0.000			
	5760 7200	min Winter min Winter	24.170	0.000	0.5	0.0	O K
	5760 7200 8640		24.170 24.170	0.000	0.5	0.0	0 K
	5760 7200 8640 10080	min Winter min Winter min Winter min Winter Storm	24.170 24.170 24.170	0.000 0.000 0.000	0.5 0.4 0.4	0.0 0.0 0.0	OK OK OK
	5760 7200 8640 10080	min Winter min Winter min Winter min Winter Storm	24.170 24.170 24.170	0.000 0.000 0.000 Floode Volume	0.5 0.4 0.4	0.0 0.0 0.0 me	OK OK OK
	5760 7200 8640 10080	min Winter min Winter min Winter min Winter Storm	24.170 24.170 24.170 Rain (mm/hr)	0.000 0.000 0.000 Floode Volume (m²)	0.5 0.4 0.4 d Disch	0.0 0.0 0.0 arge T:	OK OK OK ime-Peak (mins)
	5760 7200 8640 10080	min Winter min Winter min Winter min Winter Storm Event	24.170 24.170 24.170 Rain (mm/hr)	0.000 0.000 0.000 Floode Volume (m²)	0.5 0.4 0.4 d Disch e Volu (m ²	0.0 0.0 0.0 arge T: ime ')	OKOK OK OK ime-Peak (mins)
	5760 7200 8640 10080	min Winter min Winter min Winter min Winter Storm Event min Winter min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592	0.000 0.000 0.000 Floode Volume (m²)	0.5 0.4 0.4 d Dische Volt (m ²	0.0 0.0 0.0 arge T: ame ')	OKOK OK OK ime-Peak (mins)
	5760 7200 8640 10080	min Winter min Winter min Winter min Winter Storm Event min Winter min Winter min Winter min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607	0.000 0.000 0.000 Floode Volume (m²) 0.	0.5 0.4 0.4 d Disch e Volt (m*	0.0 0.0 0.0 0.0 arge T: ime ') 19.2 24.3 27.5	0 K 0 K 0 K ime-Peak (mins) 56 94
	5760 7200 8640 10080 60 120 180 240	min Winter min Winter min Winter min Winter Storm Event min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780	0.000 0.000 0.000 Floode Volume (m²) 0.00	0.5 0.4 0.4 d Disch w Volt (m'	0.0 0.0 0.0 0.0 arge T: me 1) 19.2 24.3 27.5 30.1	0 K 0 K 0 K ime-Peak (mins) 58 94 132
	5760 7200 8640 10080 120 180 240 360	min Winter min Winter min Winter min Winter Storm Event min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627	0.000 0.000 0.000 Floode Volume (m²) 0. 0.	0.5 0.4 0.4 0.4 d Disch w Volt (m'	0.0 0.0 0.0 0.0 arge T: me ') 19.2 24.3 27.5 30.1 34.0	0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246
	5760 7200 8640 10080 120 180 240 360 480	min Winter min Winter min Winter min Winter Storm Event min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0.	0.5 0.4 0.4 d Disch woli (m'	0.0 0.0 0.0 0.0 arge T: me 1) 19.2 24.3 27.5 30.1	0 K 0 K 0 K ime-Peak (mins) 58 94 132
	5760 7200 8640 10080 120 180 240 360 480	min Winter min Winter min Winter min Winter Storm Event min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0.	0.5 0.4 0.4 d Disch woln (m ²	0.0 0.0 0.0 0.0 arge T: ame ') 19.2 24.3 27.5 30.1 34.0 37.0	0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 308
	5760 7200 8640 10080 120 180 240 360 480 600 720	min Winter min Winter min Winter min Winter Storm Event min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0.	0.5 0.4 0.4 d Disch w (m'	0.0 0.0 0.0 0.0 arge T: ame ') 19.2 24.3 27.5 30.1 34.0 37.0 39.5	0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 208
	5760 7200 8640 10080 120 180 240 360 480 600 720 960	min Winter min Winter min Winter min Winter Storm Event min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0.	0.5 0.4 0.4 d Dische Wolv (m)	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 308 364 416 512
	5760 7200 8640 10080 1200 180 240 360 480 600 720 940 2160	min Winter min Winter min Winter min Winter Storm Event Min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0. 0.	0.5 0.4 0.4 d Dische Wolt (m'	0.0 0.0 0.0 0.0 arge T: 19.2 24.3 27.5 30.1 34.0 37.0 39.5 41.6 45.2 50.8 57.0	0 K 0 K 0 K 0 K ime-Peak (mins) 588 94 132 170 246 308 364 416
	5760 7200 8640 10080 1200 180 240 360 480 600 720 960 1440 2160 2880	min Winter min Winter min Winter min Winter Storm Event Min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.7860 6.712 5.897 4.806 3.599 2.695 2.194	0.000 0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0. 0. 0.	0.5 0.4 0.4 d Disch woli (m'	0.0 0.0 0.0 0.0 arge T: ame ') 19.2 24.3 27.5 30.1 34.0 37.0 39.5 41.6 45.2 50.8 57.0 61.9	0 K 0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 308 364 416
	5760 7200 8640 10080 1200 1800 240 360 480 600 720 960 1440 2160 2800 4320	min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194 1.640	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0. 0. 0.	0.5 0.4 0.4 d Disch Woln (m ²	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 19.2 24.3 27.5 30.1 34.0 37.0 39.5 41.6 45.2 55.2 57.0 61.9 69.4	0 K 0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 208 364 416 512
	5760 7200 8640 10080 120 180 240 360 480 600 720 960 1440 2180 4320 5760	min Winter min Winter min Winter min Winter min Winter Min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter	24.170 24.170 24.170 Rain (mm/hr) 32.616 20.552 15.607 12.780 9.627 7.260 6.712 5.897 4.806 3.599 2.695 2.194 1.640	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0. 0. 0. 0.	0.5 0.4 0.4 d Disch (m)	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 K 0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 208 364 416 512 0
	5760 7200 8640 10080 120 180 240 360 480 600 720 960 1440 2160 2880 4320 5760 7200	min Winter	24.170 24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.698 2.194 1.640 1.332 1.134	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0. 0. 0. 0.	0.5 0.4 0.4 d Disch (m'	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 K 0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 208 364 416 512
	5760 7200 8640 10080 1200 180 240 360 480 600 7200 960 1440 2160 2880 4320 5760 7200 8640	min Winter min Winter min Winter min Winter min Winter Min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter min Winter	24.170 24.170 24.170 24.170 Rain (mm/hr) 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194 1.640 1.332 1.134 0.993	0.000 0.000 0.000 Floode Volume (m²) 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	0.5 0.4 0.4 d Dische Wolv (m'	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 K 0 K 0 K 0 K ime-Peak (mins) 58 94 132 170 246 208 364 416 512 0

Ormond House Upper Ormond Quay Dublin 7 Date 08/10/2019 09:46 File CATCHMENT C2 100 YEAR 0 Checked by DMW LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT C2 - 100 YR Micro Drainage	DBFL Consulting Engineers		Page 3
Dublin 7 Date 08/10/2019 09:46 Date 08/10/2019 09:46 Designed by DGG File CATCHMENT C2 100 YEAR 0 Checked by DMW Innovyre Source Control 2019.1 Rainfall Details Rainfall Model Return Period (years) MS-60 (um) MS-60 (um) Southand and Ireland CV (Winner) 0.940 MS-60 (um) Summer Storms Tes Climate Change \$ +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Ormond House	LANDS AT MILL/MARSH ROAD	
Date 08/10/2019 09:46 File CATCHMENT C2 100 YEAR 0 Rainfall Details Rainfall Model FSR Winter Storms Yes Creaturn Period (years) 100 Cv (Summer) 0.780 Region Scotland and Ireland Cv (Winter) 0.400 MS-60 (mm) 18.000 Shortest Storm (mins) 13 Ratio R 0.281 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Upper Ormond Quay	DBFL REF: 170092	The second second
Date 08/10/2019 09:46 File CATCHMENT C2 100 YEAR 0 Rainfall Details Rainfall Model FSR Winter Storms Yes Creaturn Period (years) 100 Cv (Summer) 0.780 Region Scotland and Ireland Cv (Winter) 0.400 MS-60 (mm) 18.000 Shortest Storm (mins) 13 Ratio R 0.281 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Dublin 7	CATCHMENT C2 - 100 YR	Micro
File CATCHMENT C2 100 YEAR 0 Checked by DMW Innovyze Source Control 2018.1 Rainfall Model FSR Winter Storms Yes Return Feriod (years) 100 Cv (Winter) 0.440 MS-60 (mm) 15.000 Shortest Storm (mins) 13 Ratio R 0.281 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Date 08/10/2019 09:46		MILLO
Rainfall Model Return Period (years) Region Scotland and Ireland M5-60 (mm) Ratio R Summer Storms Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	File CATCHMENT C2 100 YEAR 0		brainage
Rainfall Model FSR Winter Storms Yes Return Period (years) 100 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 18.000 Shortest Storm (mins) 15 Ratio R 0.281 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Innovyze	A CONTRACTOR OF THE PROPERTY O	
Return Period (years) 100 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winner) 0.840 M5-60 (mm) 15.000 Shortest Storm (mins) 15 Ratio R 0.281 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	- 1	Rainfall Details	
Region Scotland and Ireland Cv (Winter) 0.840 MS-80 (zmm) 15.000 Shortest Storm (mins) 15 Ratio R 0.281 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070			
MS-60 (mm) 15.000 Shortest Storm (mins) 15 Ratio R 0.281 Longest Storm (mins) 10080 Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070			
Ratio R Summer Storms Yes Climate Change % +10 Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070			
Time Area Diagram Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Ratio R		
Total Area (ha) 0.070 Time (mins) Area From: To: (ha) 0 4 0.070	Summer Storms	Yes Climate Change %	+10
Time (mins) Area From: To: (ha) 0 4 0,070	I	ime Area Diagram	
From: To: (ha) 0 4 0.070	To	otal Area (ha) 0.070	
From: To: (ha) 0 4 0.070		Time (mins) Area	
		0 4 0 070	
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DBFL Consultin	g Enginee	ers				1	Page 4
Ormond House			LANDS A	T MILL/MAR	SH ROAD		
Upper Ormond Q	uay		DBFL RE	F: 170092			
Dublin 7	16		CATCHME	NT C2 - 10	0 YR		
Date 08/10/201	9 09-46		2	d by DCG			MICCO
		END O					Drainacı
File CATCHMENT	62 100 1	LAK U	11	The second second	10.1		
Innovyze			source	Control 20	18.1		
			Model De	tails			
	St	orage is	Online Cove	r Level (m)	25.705		
		Tan	k or Pond	Structure			
		Inv	vert Level ((m) 24.170			
Depth (m) Ar	ea (m²) De	epth (m) A	Area (m²) De	epth (m) Are	a (m²) De	pth (m) Ar	ea (m²)
0.000	25.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	25.0	0.800	2/3/10	1.500	0.0	2.200	0.0
0.200	25.0	0.900	0.000000	1.600	0.0	2.300	0.0
0.300	25.0	1.000	9.630.0	1.700	0.0	2.400	0.0
0.400	25.0	1.100	52775	1.800	0.0	2.500	0.0
0.500	25.0	1.200	100000	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		
	Hyd	lro-Brak	eð Optimum	Outflow (Control		
				e MD-SHE-00	73-2000-06		
			ign Head (m			0.600	
		Desig	n Flow (1/s Flush-Flo		0.1	culated	
				e Minimise			
			Application			Surface	
		Su	mp Available			Yes	
			iameter (mm			73	
			rt Level (m			24.086	
Mi	nimum Outl	et Pipe D	iameter (mm)		100	
	Suggested	Manhole D	iameter (mm).		1200	
		Control	Points	Head (m) F	low (1/s)		
	Desig	gn Point	(Calculated)		2.0		
				0.177	2.0		
				0.397	1.7		
	Mean	flow over	r Head Range	-	1.7		
The hydrologica Hydro-Brake® Op Hydro-Brake Opt invalidated	timum as s	pecified.	Should an	other type o	of control	device ot	her than a
Depth (m) Flow	(1/s) Dep	oth (m) F	low (1/s) De	epth (m) Flo	w (1/s) D	epth (m) F	low (1/s)
0.100	1.9	1.200	2.7	3.000	4.2	7.000	6.3
0.200	2.0	1.400	2.9	3.500	4.5	7.500	6.5
0.200	1.9	1.600	3.1	4.000	4.8	8.000	6.7
0.400	1.7	1.800	3.3	4.500	5.1	B.500	6.9
0.500	1.8	2.000	3.5	5.000	5.3	9.000	7.1
0.600	2.0	2.200	3.6	5.500	5.6	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.8		
1.000	2.5	2.600	3.9	6.500	6.0		

DBFL Consulting	Engineers						Page 1
Ormond House		LANI	OS AT M	ILL/M	ARSH R	OAD	
Upper Ormond Qua	av	DBFI	REF:	170092	,		
Dublin 7	72	0.000	CHMENT				A STATE OF
Date 07/10/2019	10.17	39229633			LUU IK		- Micro
		5000000	igned b	70.000			Drainan
File CATCH C4 10	00 YR - 07.10	2000	cked by	33.102.0			oran lag
Innovyze		Sour	rce Con	trol 2	2018.1		
Summ	mary of Results	for 1	00 year	Retu:	rn Per	iod (+109	:)

	Storm		Max				
	Event		Depth C				
		(m)	(111)	(1/5/	\m_ /		
	15 min Summer	24.388	0.218	2.0	51.3	OK	
	30 min Summer	24.469	0.299	2.0	70.3	OK	
	60 min Summer						
	120 min Summer				110.5		
	180 min Summer	24.689	0.519	2.0	121.9	OK	
	240 min Summer				129.1		
	360 min Summer 480 min Summer	24.755	0.585	2.0	137.5	O K	
	4dU min Summer	24.772	0.602	2.0	141.4	O K	
	600 min Summer 720 min Summer	24.778	0.608	2.0	142.9	OK	
	720 min Summer	24.781	0.611	2.0	143.5	OK	
	960 min Summer 1440 min Summer	24 770	0.611	2.0	141 1	OK	
	2160 min Summer	24 744	0.500	2.0	134.8		
	2880 min Summer						
	4320 min Summer	24 629	0.469	2.0	110.2	O K	
	5760 min Summer 7200 min Summer	24.478	0.308	2.0	72.5	OK	
	8640 min Summer	24.420	0.250	2.0	58.8	OK	
	8640 min Summer 10080 min Summer	24.374	0.204	2.0	47.9	OK	
	15 min Winter	24.415	0.245	2.0	57.6	OK	
	30 min Winter	24.506	0.336	2.0	79.1	O K	
	Storm	Date:	F12-2	Direk	ma	B	
	SCOIM		Flooded	Disch	2007		
	P	/ /1-1		17-1-			
	Event	(mm/hr)		Volu (m²		(mins)	
	Event	(mm/hr)	(m²)	Volu (m²		(mins)	
	15 min Summer	72.036	(m²)	(m²	51.0	(mins)	
	15 min Summer	72.036	(m²)	(m²	51.0 71.0		
	15 min Summer 30 min Summer 60 min Summer	72.036 49.883 32.616	(m²) 0.0 0.0	(m²	51.0 71.0 94.5	19 33 64	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer	72.036 49.883 32.616 20.592	(m³) 0.0 0.0 0.0	(m²	51.0 71.0 94.5 19.5	19 33 64 122	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer	72.036 49.883 32.616 20.592 15.607	(m²) 0.0 0.0 0.0 0.0	(m²	51.0 71.0 94.5 19.5 35.9	19 33 64 122 182	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer	72.036 49.883 32.616 20.592 15.607 12.780	(m²) 0.0 0.0 0.0 0.0	(m ²	51.0 71.0 94.5 19.5 25.9 48.4	19 33 64 122 182 242	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627	(m²) 0.0 0.0 0.0 0.0 0.0 0.0	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6	19 33 64 122 182 242 362	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860	(m²)	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5	19 33 64 122 182 242 362 480	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 600 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	(m ³	51.0 71.0 94.5 19.5 25.9 48.4 67.6 82.5 94.7	19 33 64 122 182 242 362 480 572	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 240 min Summer 360 min Summer 480 min Summer 600 min Summer 720 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5	19 33 64 122 182 242 362 480 572 624	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 600 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5 94.7	19 33 64 122 182 242 362 480 572	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 480 min Summer 600 min Summer 720 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5 94.7 05.2 22.6	19 33 64 122 182 242 362 480 572 624 754	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 480 min Summer 600 min Summer 720 min Summer 960 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 682.5 94.7 05.2 22.6	19 33 64 122 182 242 362 480 572 624 754	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 480 min Summer 600 min Summer 720 min Summer 740 min Summer 960 min Summer 1440 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5 94.7 05.2 22.6 48.8 83.1	19 33 64 122 182 242 362 480 572 624 754 1022 1448	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 480 min Summer 480 min Summer 720 min Summer 960 min Summer 1440 min Summer 1440 min Summer 2880 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194 1.640	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 71.0 94.5 19.5 25.9 48.4 67.6 82.5 94.7 05.2 648.8 83.1 07.2	19 33 64 122 182 242 362 480 572 624 754 1022 1448 1848	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 600 min Summer 600 min Summer 720 min Summer 720 min Summer 1440 min Summer 2160 min Summer 22800 min Summer 4320 min Summer 5760 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194 1.630 1.332 1.134	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5 94.7 05.2 22.6 48.8 83.1 07.2 44.1	19 33 64 122 182 242 362 480 572 624 754 1022 1448 1848 2684	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 480 min Summer 600 min Summer 720 min Summer 1440 min Summer 1440 min Summer 2480 min Summer 2480 min Summer 5760 min Summer 7200 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194 1.640 1.332 1.134 0.993	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m'	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5 94.7 05.2 22.6 48.8 83.1 07.2 44.1	19 33 64 122 182 242 362 480 572 624 754 1022 1448 1848 2684 3408	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 600 min Summer 720 min Summer 720 min Summer 1440 min Summer 2880 min Summer 2880 min Summer 7200 min Summer 7200 min Summer 7300 min Summer 8640 min Summer 8640 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 2.695 2.194 1.640 1.332 1.134 0.993 0.888	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 94.5 19.5 35.9 48.4 67.6 82.5 94.7 95.2 22.6 48.8 83.1 07.2 44.1 73.8 97.5 17.8 35.4	19 33 64 122 182 242 362 480 572 624 754 1022 1448 1848 2684 3408 4112 4840 5456	
	15 min Summer 30 min Summer 60 min Summer 120 min Summer 180 min Summer 240 min Summer 480 min Summer 600 min Summer 720 min Summer 1440 min Summer 1440 min Summer 2480 min Summer 2480 min Summer 5760 min Summer 7200 min Summer	72.036 49.883 32.616 20.592 15.607 12.780 9.627 7.860 6.712 5.897 4.806 3.599 2.695 2.194 1.640 1.332 1.134 0.888 72.036	(m²) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	(m ³	51.0 71.0 71.0 71.5 19.5 35.9 48.4 67.6 894.7 05.2 22.6 48.8 83.1 07.2 173.8 97.5 17.8	19 33 64 122 182 242 362 480 572 624 754 1022 1448 1848 2684 3408 4112 4840	

DBFL Consulting Engineers		Page 2
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT C4 - 100 YR	Micco
Date 07/10/2019 12:17	Designed by DCG	Desinado
File CATCH C4 100 YR - 07.10	Checked by DMW	Diamage
Innovyze	Source Control 2018.1	

Summary of	Results	for 100	year Return	Period	(+10%)
------------	---------	---------	-------------	--------	--------

	Stor		Max Level	Max Depth	Max Control	Max Volume	Status
			(m)	(m)	(1/s)	(m°)	
60	min	Winter	24.603	0.433	2.0	101.7	ОК
120	min	Winter	24.701	0.531	2.0	124.8	OK
180	min	Winter	24.756	0.586	2.0	137.8	OK
240	min	Winter	24.793	0.623	2.0	146.3	OK
360	min	Winter	24.837	0.667	2.0	156.8	OK
480	min	Winter	24.860	0.690	2.0	162.2	OK
600	min	Winter	24.871	0.701	2.0	164.8	OK
720	min	Winter	24.875	0.705	2.0	165.8	OK
960	min	Winter	24.872	0.702	2.0	164.9	OK
1440	min	Winter	24.856	0.686	2.0	161.2	OK
2160	min	Winter	24.812	0.642	2.0	150.9	OK
2880	min	Winter	24.760	0.590	2.0	138.6	OK
4320	min	Winter	24.641	0.471	2.0	110.7	OK
5760	min	Winter	24.499	0.329	2.0	77.3	OK
7200	min	Winter	24.399	0.229	2.0	53.8	OK
8640	min	Winter	24.331	0.161	2.0	37.9	OK
10080	min	Winter	24.290	0.120	1.9	28.1	O K

	Stor	THE STATE OF THE S	Rain	Flooded	Discharge	Time-Peak
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m°)	(m ²)	
60	min	Winter	32.616	0.0	105.9	62
120	min	Winter	20.592	0.0	133.9	120
180	min	Winter	15.607	0.0	152.2	180
240	min	Winter	12.780	0.0	166.2	238
3.60	min	Winter	9.627	0.0	187.7	352
480	min	Winter	7.860	0.0	204.3	464
600	min	Winter	6.712	0.0	218.0	574
720	min	Winter	5.897	0.0	229.6	680
960	min	Winter	4.806	0.0	249.0	788
1440	min	Winter	3.599	0.0	276.9	1094
2160	min	Winter	2.695	0.0	317.1	1556
2880	min	Winter	2.194	0.0	344.1	2016
4320	min	Winter	1.640	0.0	385.4	2900
5760	min	Winter	1.332	0.0	418.7	3584
7200	min	Winter	1.134	0.0	445.3	4248
8640	min	Winter	0.993	0.0	468.0	4848
10080	min	Winter	0.888	0.0	487.9	5448

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	THE RESIDENCE OF
Dublin 7	CATCHMENT C4 - 100 YR	Miner
Date 07/10/2019 12:17	Designed by DCG	MICCO
File CATCH C4 100 YR - 07.10		Drainage
Innovyze	Source Control 2018.1	
77		
<u>R</u>	ainfall Details	
Rainfall Model	FSR Winter Storms	
Return Period (years)	and and Ireland Cv (Winter)	
M5-60 (mm)	15.000 Shortest Storm (mins)	
Ratio R	0.281 Longest Storm (mins) .	10080
Summer Storms	Yes Climate Change %	+10
<u>Ti</u>	ime Area Diagram	
Tot	tal Area (ha) 0.390	
4	Fime (mins) Area	
	rom: To: (ha)	
	0 4 0.390	
Ø1.0	982-2018 Innovyze	
Ø13	or-role innovyze	

DBFL Consulting Engineers		Page 4
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT C4 - 100 YR	Micco
Date 07/10/2019 12:17	Designed by DCG	Drainage
File CATCH C4 100 YR - 07.10	Checked by DMW	Drainage
Innovyze	Source Control 2018.1	20)

Model Details

Storage is Online Cover Level (m) 25.250

Tank or Pond Structure

Invert Level (m) 24.170

Depth (m)	Area (m²)						
0.000	235.0	0.400	235.0	0.800	235.0	1.200	0.0
0.100	235.0				0.0		0.0
0.200	235.0	0.600		1.000		1.400	0.0
0.300	235.0	0.700	235.0	1.100	0.0	1.500	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0071-2000-0705-2000 Design Head (m) Design Flow (1/s) Flush-Flom Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 71 Invert Level (m) 24.170 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200

Control Points Head (m) Flow (1/s)

Design	Point	(Calculated)	0.705	2.0	
		Flush-Flos	0.208	2.0	
		Kick-Flo®	0.451	1.6	
Mean Fl	low ove	r Head Range	-	1.7	

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

Depth (m)	Flow (1/s)	Depth (m) B	Flow (1/s)	Depth (m) I	low (1/s)	Depth (m)	Flow (1/s)
0.100	1.8	1.200	2.5	3.000	3.9	7.000	5.8
0.200	2.0	1.400	2.7	3.500	4.2	7.500	6.0
0.200	2.0	1.600	2.9	4.000	4.4	8.000	6.2
0.400	1.8	1.800	3.1	4.500	4.7	8.500	6.4
0.500	1.7	2.000	3.2	5.000	4.9	9.000	6.6
0.600	1.9	2.200	3.4	5.500	5.2	9.500	6.7
0.800	2.1	2.400	3.5	6.000	5.4		
1.000	2.3	2.600	3.6	6.500	5.6		

Appendix C

SURFACE WATER SEWER NETWORK CALCULATIONS-MICRODRAINAGE

Ormond Ho	ulting	Engine	reis							Pag	e 1
	3000			15000	NDS AT MII		RSH I	ROAD			
Jpper Orm	ond Qu	ay		DBI	FL REF: 17	70092					-
Dublin 7				8	TWORK A					Mi	m
Date 09/1	0/2019	10:50		Des	signed by	DCG				n.	nin ac
File CATC	HMENT :	A 09.10	0.2019.m	dx Che	Checked by DMW						
Innovyze				Net	twork 2018	1.1					
	STO		Desi	gn Cri	the Modif: teria for ND Manhole S	Stor	m		ethod	1	
	Re	F	SR Rainfa riod (yea M5-60 (11 Mode rs) mm) 14.	1 - Scotlan 2 900	d and	Irelan	nd Clim	ate Ch		1
Maximum T:	ime of C	Concentra Coul Sewa	fall (mm/) ation (mi age (1/s/) unoff Coe	ns) ha) 0. ff. 0.	100 30 Min Des 000 Min 750 Mi	Max ign De Vel fo n Slop	imum l pth for Auto e for	Backd or Op Des	rop He timisa ign on	tion (r	a) 3.00 a) 1.20 s) 1.0
			5.487.5	197602 00	ith Level S gn Table :	88 1180					
		2000			Base Flow (1/s)					on Type	Auto Desig
\$1,000 40 \$1,001 60										Conduit	
32.000 14	.800 0.3	302 49.	0 0.007	5.00	0.0	0.600	0	225	Pipe/	Conduit	* *
31.002 37						0.600		300	Pipe/	Conduit	
31.003 46										Conduit	•
31.004 34 31.005 34										Conduit	_
31.005 25										Conduit	
33.000 19	.200 0.1	147 130.	6 0.039	5.00	0.0	0.600	0	225	Pipe/	Conduit	-
			Ne	twork	Results T	able					
PN	Rain				E Base					7 (D) (C) (D) (C)	
PN		T.C.			Σ Base Flow (1/s)					Cap (1/s)	
PN 31.000	(mm/hr)	(mins)		(ha)	Flow (1/s)		(1/	's)	(m/s)	7 (D) (C) (D) (C)	
	(mm/hr) 43.01	(mins) 5.67	(m)	(ha)	Flow (1/s)	(1/s)	(1/	(s) 0.8	(m/s)	(1/s)	(1/s) 8.6
\$1.000	(mm/hr) 43.01 40.28	(mins) 5.67	(m) 26.915 26.677	(ha) 0.067	Flow (1/s) 0.0 0.0	(1/s) 0.0	(1/	0.8 1.4	(m/s) 1.00 1.00	(1/s) 39.8	(1/s) 8.6
\$1.000 \$1.001 \$2.000	(mm/hr) 43.01 40.28 44.69	(mins) 5.67 6.68 5.13	(m) 26.915 26.677 26.530	(ha) 0.067 0.127 0.007	Flow (1/s) 0.0 0.0	0.0 0.0 0.0	(1/	0.8 1.4 0.1	(m/s) 1.00 1.00 1.87	(1/s) 39.8 39.8 74.5	8.6 15.2 0.9
\$1.000 \$1.001 \$2.000 \$1.002	(mm/hx) 43.01 40.28 44.69 38.88	(mins) 5.67 6.68 5.13 7.26	(m) 26.915 26.677 26.530 26.088	(ha) 0.067 0.127 0.007	Flow (1/s) 0.0 0.0 0.0	0.0 0.0 0.0	(1/	0.8 1.4 0.1 2.5	(m/s) 1.00 1.00 1.87 1.07	(1/s) 39.8 39.8 74.5	8.6 15.2 0.9
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003	(mm/hx) 43.01 40.28 44.69 38.88 37.19	(mins) 5.67 6.68 5.13 7.26 8.03	(m) 26.915 26.677 26.530	(ha) 0.067 0.127 0.007	Flow (1/s) 0.0 0.0 0.0 0.0	0.0 0.0 0.0	(1/	0.8 1.4 0.1 2.5 2.9	(m/s) 1.00 1.00 1.87 1.07 1.00	(1/s) 39.8 39.8 74.5	8.6 15.2 0.9 27.8 31.5
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$1.005	(mm/hr) 43.01 40.28 44.69 38.88 37.19 36.06 35.02	(mins) 5.67 6.68 5.13 7.26 8.03 8.60 9.17	(m) 26.915 26.677 26.530 26.088 25.914 25.724 25.641	(ha) 0.067 0.127 0.007 0.240 0.284 0.336 0.382	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0	(1/	0.8 1.4 0.1 2.5 2.9 3.3 3.6	1.00 1.00 1.87 1.07 1.00 1.00	(1/s) 39.8 39.8 74.5 75.7 70.4 158.5 158.7	8.6 15.2 0.9 27.8 31.5 36.1 39.8
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004	(mm/hr) 43.01 40.28 44.69 38.88 37.19 36.06 35.02	(mins) 5.67 6.68 5.13 7.26 8.03 8.60	(m) 26.915 26.677 26.530 26.088 25.914 25.724 25.641	(ha) 0.067 0.127 0.007 0.240 0.284 0.336	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0	(1/	0.8 1.4 0.1 2.5 2.9 3.3 3.6	1.00 1.00 1.87 1.07 1.00 1.00	(1/s) 39.8 39.8 74.5 75.7 70.4 158.5	8.6 15.2 0.9 27.8 31.5 36.1 39.8

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nnovyz	e				Ne	twork 2018	1.1					
				Networ	k Desi	qn Table i	for St	torm				
PN	Length	Fall	Slope	I.Area	T.E.	Base	k	HYD	DIA	Secti	on Type	Auto
						Flow (1/s)						Design
34.000	15.500	0.091	170.2	0.039	5.00	0.0				100		1750
				0.079		0.0		۰	225	Pipe/	Conduit	
33.002	34.300	0.210	163.0	0.065	0.00	0.0	0.600	۰	225	Pipe/	Conduit	4
31.007	60.400	0.147	411.0	0.035	0.00	0.0	0.600		450	Pipe	Conduit	
				0.103		0.0	0.600	0	450	Pipe/	Conduit	
				0.039		0.0	0.600	0	450	Pipe/	Conduit	
31.010	67.400	0.164	411.0	0.098	0.00	0.0	0.600	٥	450	Pipe/	Conduit	4
35.000	23.700	0.139	170.5	0.068	5.00	0.0	0.600		225	Pipe	Conduit	* *
				0.068							Conduit	3
31.011	25.700	0.063	411.0	0.062	0.00	0.0	0.600		450	Pipe	Conduit	
				0.062	335.77633						Conduit	
36.000	20.000	0.176	170.5	0.091	5.00	0.0	0.600	0	225	Pipe/	Conduit	3
37,000	26.300	0.155	169.7	0.026	5.00	0.0	0.600	0	225	Pipe/	Conduit	3
36.001	28.200	0.166	169.9	0.048	0.00	0.0	0.600	0	225	Pipe/	Conduit	-
36.002	55.700	0.328	169.8	0.099	0.00						Conduit	
				Ne	twork	Results T	able					
PN	Ra	in 1	r.c.	US/IL E	I.Area	Σ Base	Foul	Add 1	Flow	Vel	Cap	Flow
		hr) (n				Flow (1/s)					(1/s)	
54.00	00 44	.28	5.26	26.155	0.039	0.0	0.0		0.5	1.00	39.7	5.1
53.00	01 42	.56	5.83	26.064	0.157	0.0	0.0		1.8	1.00	39.8	19.9
				25.870	0.222		0.0		2.5	1.02	40.6	27.1
31.00	07 32	.67	10.62	25.495	0.662		0.0		5.9	1.00	158.5	64.4
31.00				25.248	0.765				6.6	1.00	158.5	72.3
31.00	09 31	.56 1	11.39	25.251	0.804	0.0	0.0		6.9	1.00	158.5	75.6
31.01	10 30	.11 1	12.52	25.235	0.902	0,0	0.0		7.4	1.00	158.5	80.9
35 D	10 49	85	5 40	26.025	0.068	0.0	0.0		0.8	1 00	39.7	8 6
				25.886			0.0				39.8	
				05.05	1						150.5	07.0
				25.071 25.008			0.0				158.5	
36.00	00 43	.53	5.50	26.025	0.091	0.0	0.0		1.1	1.00	39.7	11.8
37.00	00 43	.72	5.44	26.325	0.026	0.0	0.0		0.3	1.00	39.8	3.4
86.00	01 42 02 39	.15	5.97	25.849	0.165		0.0		1.9		39.8	

DBFL Co	nsul	ing	En	gine	ers								Pag	e 3
Ormond						1000	NDS AT			RSH	ROAD			
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File CA	TCHM	INT	A C	9.10	.2019.m	dx Ch	ecked	by D	WM				Die	ainag
Innovyz	e			200.101122		Ne	twork	2018	1.1					
					Networ	k Desi	gn Tal	ble f	for St	orm				
PN					e I.Area) (ha)								on Type	Auto Design
36.003	37.60	0 0.	152	247.	4 0.076	0.00		0.0	0.600		300	Pipe/	Conduit	.
36.004	53.30	0 0.	216	246.	8 0.099	0.00							Conduit	-
36.005	10.30	0 0.	042	245.	2 0.014	0.00		0.0	0.600	0	300	Pipe/	Conduit	•
38.000	35.90	0 0.	211	170.	1 0.060	5.00								100
39.000	54.00	0 0.	318	169.	8 0.099	5.00		0.0	0.600	0	225	Pipe/	Conduit	
36.006	6.20	0 0.	025	247.	0.023	0.00		0.0	0.600	0	300	Pipe/	Conduit	***
31.013	1.00	0 0.	004	250.	0.000	0.00		0.0	0.600	0	450	Pipe/	Conduit	
					Ne	etwork	Resul	ts T	able					
PN					US/IL E								(1/s)	
36.0	03 :	8.27		7.53	25.280	0.340		0.0	0.0		3.5	1.00	70.3	38.8
					25.128	0.439			0.0				70.4	
36.0	05	86.08		8.59	24.912	0.453		0.0	0.0		4.4	1.00	70.7	48.7
88.0	00	3.23		5.60	25.895	0.060		0.0	0.0		0.7	1.00	39.7	7.7
59.0	00	2.35	R) 8	5.90	26.095	0.099		0.0	0.0		1.1	1.00	39.8	12.5
36.0	06 ;	35.89	01 3	8.70	24.870	0.635		0.0	0.0		6.2	1.00	70.4	67.9
\$1.0	13	9.42	1	3.11	24.979	1.797		0.0	0.0		14.3	1.28	203.8	157.5
					(D1982-2	2018 I	nnov	yze					

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Description			ng En	gineers	TANDS	AT MI	TT / MARCH	מגסמ	- 1	rage 4		
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Tanovyse Newbork 2016.1 Newbork 20	377 7 TO 10		10.10				500			Micro		
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Manhole Schedules for Storm	and the second second		T A O	9.10.2019.md	CAN - CONT CONT.		100			oran lage		
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Name CL (m) Depth (m) Connection (m) Diam. L=W (ms) Evel (m) Diameter (ms) Dia				Manhol	e Schedi	ales fo	or Storm					
Size 28.340 1.425 Open Manhole 1200 31.000 26.915 225 225 225 27.970 1.825 Open Manhole 1200 31.001 26.677 225 31.000 26.677 225 225 27.970 1.825 Open Manhole 1200 31.002 26.530 225 225 27.970 1.825 Open Manhole 1200 31.002 26.530 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225 225	MH	ME	MH	МЕ	MH	Î	Pipe Out		Î	Pipes In		
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S122-1 27.470 0.940 Open Manhole 1200 S2.000 26.580 225 32.000 26.224 225 1.	53333	The Section of	200	35.00					81.000	26.677	225	
Size 27.970 1.882 Open Manhole 1200 Si.002 26.088 300 Si.001 26.224 225 225 32.000 26.228 225 32.000 26.228 225 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.228 325 32.000 26.028 32.022 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 26.024 325 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000 32.000	100 m 100 m		100000						2000	0.500.500	67,7670	
Size	S. S. S. S. S. S. S. S. S.		100000000000000000000000000000000000000						31 001	26 224	225	16
Sit 27.360 1.446 Open Manhole 1200 31.003 25.914 300 31.002 25.914 300 31.003 25.726 300 31.102 25.914 300 31.003 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 300 31.103 25.726 31.103 25.641 450 31.103 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.558 450 31.005 25.705 225 32.000 26.004 225 32.000 26.004 225 32.000 26.004 225 32.000 26.004 225 32.000 26.004 225 32.000 26.004 225 32.000 26.004 225 32.000 25.660 225 32.000 25.660 225 32.005 25.660 225 32.005 25.660 225 32.005 25.660 225 32.005 25.660 225 32.005 25.660 225 32.005 25.660 225 32.005 25.660 225 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.005 32.0	1000			open namoze			20.000				84 To 100	
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Sil4 27,900 2.25 Open Manhole 1380 31.005 25.641 480 31.004 25.641 480 31.2 27.000 1.472 Open Manhole 1200 33.000 26.220 228 228 27.160 1.096 Open Manhole 1200 34.000 26.185 226 228 228 27.160 1.096 Open Manhole 1200 34.000 26.185 228 228 228 27.200 1.420 Open Manhole 1200 34.000 26.185 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228 228	ı			27								
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S135 26.970 1.690 Open Manhole 1200 36.003 25.280 300 36.002 25.355 225 314 27.100 1.972 Open Manhole 1200 36.004 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.003 25.128 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.004 24.912 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 24.870 300 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005 36.005									37,000	26.170	225	3:
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S132-1 27.320 1.425 Open Manhole 1200 38.000 25.895 225	3134	27.100	1.972	Open Manhole	1200	36.004	25.128	300	36.002	25.128	300	
S132-1 27.320 1.425 Open Manhole 1200 38.000 25.895 225	3133	27.100	2.188	Open Manhole	1200	36.005	24.912	300	36.004	24.912	300	
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@1982-2018 Innovyze	524	27.500	2.633					930	31.012	24.907	400	
				©1	982-2018	Innov	/yze]	

DDLL	Const	lting	Engineers					Pa	ge 5
Ormo	nd Hou	se		L	ANDS AT MI	LL/ MAR	SH ROAD		
Jppe	r Ormo	nd Qu	ay	Di	BFL REF: 1	70092			
Dubl	in 7			N	ETWORK A			1.0	
Date	09/10	/2019	10:50	De	esigned by	DCG		M	icio
	3.5	39	A 09.10.201		95			Di	ainage
	vyze	LIENT	A 07.10.201		etwork 201				
LIIIIO	vyze			144	PLWOIR ZUI	0.1			
			Ma	anhole So	hedules f	or Storm	<u>n</u>		
MH	МН	MH	МН	MH	Pipe 0	***	Ť	Pipes In	1
	A 2 TO 10 TO	S. 100 S.	Connection	1.80	Control of the control		ter PN	-	Diameter
a construction		(m)	STORY STANSON NO.	(mm)	Level		20000	Level (m)	
-8		200		1000	4000000		8		,
-							25 005	24.845	200
				92				25.000	2555
3	26.000	1.025	Open Manhole	0	OUTER	ALL	31.013	24.975	450
			Civ	mulation	Criteria	for Stor	CTD.		7.5
			metric Runoff						
		Area	al Reduction I Hot Start		00 MA		* 10m³/ha Inlet Coef		
		Ho	ot Start Leve:	l (mm)	0 Flow per	Person p	er Day (1/	per/day) 0	.000
	Manhol	e Head	loss Coeff (G	lobal) 0.5	00	ACTOR CONTRACTOR	Run Tim	e (mins)	60
	Foul	Sewage	e per hectare	(1/s) 0.0	00	Outp	ut Interva	l (mins)	1
			ber of Input umber of Onli						
			mber of Offli						
			S	ynthetic	Rainfall	Details	89		
		D.	ainfall Model		FSR		Profile T	me Summer	
	Re	W. C. C. C. C. C. C. C.	eriod (years)		2			er) 0.750	
			Region	Scotland	and Ireland		Cv (Wint		
			M5-60 (mm)				ration (mi	ns) 30)
			Ratio R		0.279				
				01000	2018 Inno				

DBFL Consulting Engineers	H11 - H11 -	Page 6
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/ MARSH ROAD DBFL REF: 170092 NETWORK A	Micco
Date 09/10/2019 10:50	Designed by DCG	Desipose
File CATCHMENT A 09.10.2019.mdx	Checked by DMW	Drainage
Innovyze	Network 2018.1	

Online Controls for Storm

Hydro-Brakes Optimum Manhole: S24, DS/PN: S1.013, Volume (m3): 5.1

Unit Reference MD-SHE-0129-8900-1615-8900 Design Head (m) Design Flow (1/s) 1.615 8.9 Flush-Flow Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) Invert Level (m) 24.979 Minimum Outlet Pipe Diameter (mm) Suggested Manhole Diameter (mm) 1200

Control Points Head (m) Flow (1/s)

Design Point (Calculated) 1.615 8.9
Flush-Flo* 0.477 8.9
Kick-Flo* 0.994 7.1

Mean Flow over Head Range - 7.8

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

Depth (m)	Flow (1/s)						
0.100	4.6	1,200	7.7	3.000	11.9	7.000	17.8
0.200	7.9	1.400	8.3	3.500	12.8	7.500	18.4
0.300	8.6	1.600	8.9	4.000	13.7	8.000	19.0
0.400	8.8	1.800	9.4	4.500	14.4	8.500	19.6
0.500	8.9	2.000	9.8	5.000	15.2	9.000	20.1
0.600	8.8	2.200	10.3	5.500	15.9	9.500	20.7
0.800	8.4	2.400	10.7	6.000	16.6		
1.000	7.1	2.600	11.1	6.500	17.2		

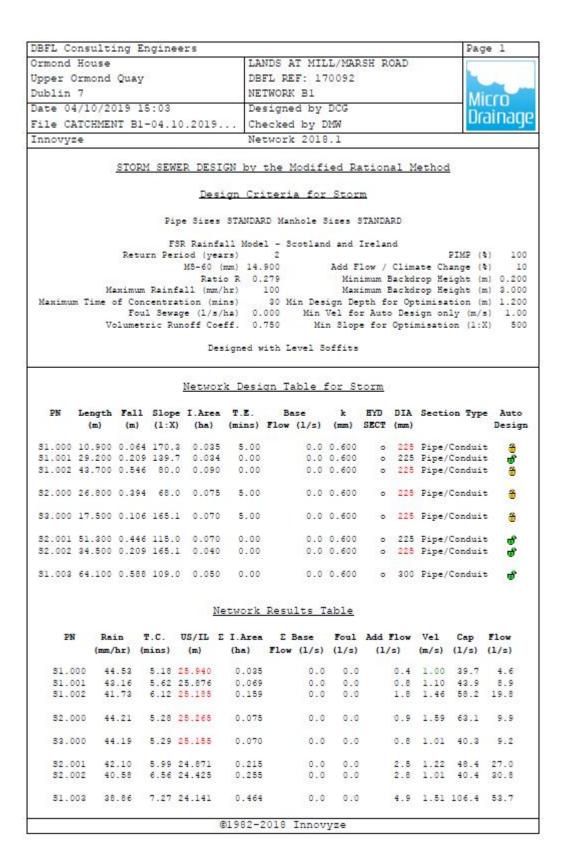
	nsulting	Engineer	s				- 3	Page 7
Ormond :	House			LANDS	AT MILL/ MA	RSH ROAD		No.
Upper O	rmond Qu	ay		DBFL	REF: 170092			land.
Dublin				NETWO	ORK A			
	/10/2019	10:50		2,435	ned by DCG		- 2	MILLO
			010	2500	-			Drainage
		A 09.10.2	UL9.max	3. 73	ced by DMW			STATE OF LABOR.
Innovyz	e			Netwo	ork 2018.1			
Man	Are H hole Head oul Sewag Num N No	al Reduction Hot Start Let loss Coeff e per hecta wher of Inpu Sumber of Off Rainfall M Re MS-60	n Factor t (mins) vel (mm) re (1/s) t Hydro cline Cos line Cos Synt odel gion Sco (mm) od Risk Analy	Simulation 1.000 0 0.500 F 0.000 graphs 0 ntrols 1 ntrols 0 hetic Ra otland an	Flow per Person Number of Stor Number of Time Number of Real infall Details	ow - % of ? or * 10m³/? Inlet Coe per Day (! age Struct /Area Diag Time Cont Ratio R 0.: Summer) 0.: Winter) 0.: DVD Stat ertia Stat	Fotal Flor ha Storage efficcien: l/per/day ures 1 rams 0 rols 0 279 750 340 us OFF us OFF	# 0.000 e 2.000 b 0.800) 0.000
				15, 3	0, 60, 120, 180	, 240, 360	and Wint , 480, 60 , 960, 14 1, 30, 1	0, 40
		limate Chang					10, 10,	
	US/MH		Return	Climate	First (X)	First (Y)	First (S) Overflow
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.
31.000	3124							0.000
		15 Winter	100	+10%				
	3123	15 Winter 15 Winter		+10% +10%				
31.001 32.000	3122-1	15 Winter 15 Winter	100	+10% +10%				
\$1.001 \$2.000 \$1.002	3122-1 3122	15 Winter 15 Winter 15 Winter	100 100 100	+10% +10% +10%	100/15 Summer			
\$1.001 \$2.000 \$1.002 \$1.003	\$122-1 \$122 \$121	15 Winter 15 Winter 15 Winter 960 Winter	100 100 100 100	+10% +10% +10% +10%	100/15 Summer 100/15 Summer			
\$1.001 \$2.000 \$1.002 \$1.003 \$1.004	\$122-1 \$122 \$121 \$115	15 Winter 15 Winter 15 Winter 960 Winter 960 Winter	100 100 100 100 100	+10% +10% +10% +10% +10%	100/15 Summer 100/15 Summer 100/15 Winter			
\$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$1.005	\$122-1 \$122 \$121 \$115 \$114	15 Winter 15 Winter 15 Winter 960 Winter 960 Winter 960 Winter	100 100 100 100 100	+10% +10% +10% +10% +10% +10%	100/15 Summer 100/15 Summer 100/15 Winter 100/15 Winter			
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\$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$1.005 \$1.006 \$3.000	\$122-1 \$122 \$121 \$115 \$114 \$112 \$112-3	15 Winter 15 Winter 15 Winter 960 Winter 960 Winter 960 Winter 960 Winter 15 Winter	100 100 100 100 100 100 100	+10% +10% +10% +10% +10% +10% +10%	100/15 Summer 100/15 Summer 100/15 Winter 100/15 Winter 100/15 Winter 100/15 Summer			
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\$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$1.005 \$1.006 \$3.000 \$4.000 \$3.002 \$1.007 \$1.008 \$1.009 \$1.010 \$5.000 \$5.000 \$1.011 \$1.011	\$122-1 \$122 \$121 \$115 \$114 \$113 \$112-2 \$112-2-1 \$112-2 \$112-1 \$111 \$110 \$109 \$108-2 \$108-1 \$108 \$107	15 Winter 15 Winter 960 Winter 960 Winter 960 Winter 15 Winter 15 Winter 15 Winter 160 Winter 960 Winter	100 100 100 100 100 100 100 100 100 100	+10% +10% +10% +10% +10% +10% +10% +10%	100/15 Summer 100/15 Summer 100/15 Winter 100/15 Winter 100/15 Summer 100/15 Summer 30/15 Summer 30/15 Summer 30/15 Summer 30/15 Summer 30/30 Winter 30/30 Winter 100/720 Winter 100/720 Winter 100/15 Summer 30/15 Summer 30/30 Winter			
\$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$1.005 \$1.006 \$3.000 \$4.000 \$3.002 \$1.007 \$1.008 \$1.009 \$1.010 \$5.000 \$5.000 \$1.011 \$1.011	\$122-1 \$122 \$121 \$115 \$114 \$113 \$112-2 \$112-2-1 \$112-2 \$112-1 \$111 \$110 \$109 \$108-2 \$108-1 \$108 \$107	15 Winter 15 Winter 15 Winter 960 Winter 960 Winter 960 Winter 15 Winter 15 Winter 960 Winter	100 100 100 100 100 100 100 100 100 100	+10% +10% +10% +10% +10% +10% +10% +10%	100/15 Summer 100/15 Summer 100/15 Winter 100/15 Winter 100/15 Summer 100/15 Summer 30/15 Summer 30/15 Summer 30/15 Winter 30/20 Winter 30/20 Winter 100/720 Winter 100/720 Winter 100/75 Summer 30/30 Winter			

DBFL Consulting Engineers	III.	Page 8
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/ MARSH ROAD DBFL REF: 170092 NETWORK A	Mirco
Date 09/10/2019 10:50	Designed by DCG	Designate
File CATCHMENT A 09.10.2019.mdx	Checked by DMW	Drainage
Innovyze	Network 2018.1	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

	US/MH		Surcharged Depth			Overflow	Pipe Flow		Level
PN	Name	(m)	(m)	(m ²)	Cap.	(1/s)	(1/s)	Status	Exceeded
31.000	3124	27.044	-0.096	0.000	0.56		21.3		
31.001	3123	26.893	-0.009	0.000	1.00		38.4	OK	
32.000	5122-1	26.557	-0.198	0.000	0.03		2.2	OK	
31.002	3122	26.473	0.085	0.000	0.94		65.9	SURCHARGED	
31.003	3121	26.414	0.200	0.000	0.12		8.0	SURCHARGED	
31.004	3115	26.416	0.242	0.000	0.07		9.4	SURCHARGED	
31.005	3114	26.416	0.325	0.000	0.08		10.6	SURCHARGED	
31.006	3113	26.414	0.405	0.000	0.08		11.0	SURCHARGED	
32.000	3112-3	26.592	0.147	0.000	0.24		9.9	SURCHARGED	
4.000	3112-2-1	26.587	0.207	0.000	0.29		10.0	SURCHARGED	
3.001	3112-2	26.577	0.288	0.000	1.04		38.7	SURCHARGED	
33.002	5112-1	26.416	0.320	0.000	0.16		6.3	SURCHARGED	
31.007	3112	26.414	0.469	0.000	0.12		17.8	SURCHARGED	
31.008	3111	26.411	0.613	0.000	0.14		19.0	SURCHARGED	
31.009	3110	26.407	0.705	0.000	0.19		19.1	SURCHARGED	
31.010	3109	26.406	0.721	0.000	0.15		21.6	SURCHARGED	
35.000	3108-2	26.395	0.145	0.000	0.05		1.9	SURCHARGED	
35.001	3108-1	26.391	0.280	0.000	0.10		3.8	SURCHARGED	
31.011	3108	26.404	0.883	0.000	0.20		26.5	SURCHARGED	
31.012	3107	26.403	0.945	0.000	0.31		28.2	SURCHARGED	
86.000	5137-1	26.869	0.619	0.000	0.55		20.2	FLOOD RISK	

DBFL Cons	sulting	g Enginee	rs	111					Page 9
Ormond Ho	ouse			LAND	S AT M	ILL/ MA	RSH RO	AD	
Upper Orn	nond Qu	uay		DBFL	REF:	170092			
Dublin 7				NETW	ORK A				Micro
Date 09/	10/2019	9 10:50		Desi	gned b	y DCG		- 8	Market Market Control Control
File CAT	CHMENT	A 09.10.	2019.md	x Chec	ked by	DMW			Drainage
Innovyze				Netw	ork 20	18.1		-	
Su	mmary US/MH							(1) for (
PN		Storm						Overflow	
37.000	3138	15 Winter	100	+10%	100/15	Summer			
		15 Winter							
		15 Winter							
		960 Winter 960 Winter			20/15				
		960 Winter 960 Winter							
39.000	3132-2	960 Winter 960 Winter	100	+10%	100/960	Winter			
36.006	3132	960 Winter	100	+10%	1/30	Winter			
31.013	324	960 Winter	100	+10%	30/60	Summer			
		Water Su	rcharged	Flooded			Pipe		
	US/MH		Depth			Overflo			Level
PN	Name	(m)	(m)	(m ³)	Cap.	(1/s)	(1/s)	Status	Exceeded
37.000	3138	26.800	0.250	0.000	0.20		7.2	SURCHARGED	
		26.784	0.710	0.000	0.95		35.3	SURCHARGED	
		26.632			1.31			SURCHARGED	
		26.406 26.401			0.14			SURCHARGED	
36.005		26.397			0.10			SURCHARGED	
		26.398			0.05			SURCHARGED	
39.000	3132-2	26.400			0.07		2.8	SURCHARGED	
36.006		26.396			0.34			SURCHARGED	
31.013	324	26.401	0.972	0.000	0.07		8.9	SURCHARGED	
			©1	982-20	18 Inno	vyze			



DBFL Co Ormond	House			7.1-004.6	LA	NDS AT MIL	L/MAF	SH RO	DAD			2.24.6.42
Upper C					3558	FL REF: 17	2000000		000			
Dublin		Quay			1.0	TWORK B1	0032					
		010 1	5.00		- 3		DOG				_ Mi	cro
Date 04						signed by					Dr	ainag
		NT Bl	-04.10	0.2019.	63,000	ecked by I						
Innovya	e				Ne	twork 2018	1.1					
				Networ	k Desi	gn Table i	for St	orm				
PN	V-0-1-2					Base						
	(m)					Flow (1/s)						Design
						0.0						- 38
				0.053							Condui	
36.000	31.800	0.193	164.8	0.046	5.00	0.0	0.600	۰	225	Pipe/	Condui	÷ 3
	VER BUILDING			0.062	1700						Condui	
				0.050							Condui	_
RESERVE		A 501570		0.060	0.00						Condui	
				0.071	0.00		0.600			-8500	Condui	111111111111111111111111111111111111111
				0.081			0.600			1000	Condui	COLUMN TO
31.005	4.700	0.235	20.0	0.010	0.00	0.0	0.600	0	300	Pipe/	Condui	1000
				0.081							Condui	
31.006	10.000	0.217	46.1	0.000	0.00	0.0	0.600	D	300	Pipe/	Condui	· 💣
				Ne	twork	Results T	able					
PN						Σ Base						
						Flow (1/s)	(1/s)	(1/	s)	(m/s)	(1/s)	(1/s)
34.0	00 4	4.14	5.31	24.280	0.052	0.0	0.0		0.6	1.02	40.4	6.8
85.0	00 4	2.69	5.78	24.535	0.053	0.0	0.0		0.6	1.01	40.4	6.7
36.0	00 4	3.47	5.52	24.345	0.046	0.0			0.5	1.02	40.4	6.0
34.0	01 4	1.79	6.10	24.152	0.213	0.0	0.0		2.4	1.02	40.4	26.5
34.0	02 4	0.93	6.42	24.034	0.263	0.0	0.0		2.9	1.01	40.3	32.1
34.0	03 3	9.72	6.90	23.916	0.323	0.0	0.0		3.5	1.20	47.6	38.2
81.0	04 3	7.88	7.70	23.553	0.858	0.0	0.0		8.8	1.50	105.9	96.8
57.0	00 4	3.60	5.48	24.025	0.081	0.0	0.0		1.0	1.01	40.3	10.5
81.0	05 3	7.84	7.73	23.195	0.949	0.0	0.0		9.7	3.53	249.6	107.0
88.0	00 4	3.51	5.51	25.925	0.081	0.0	0.0		1.0	2.05	81.5	10.5
				24.403							109.0	
81.0	06 3	7.68	7.80	22.960	1.060	0.0	0.0	1	10.8	2.32	164.1	119.0

FL Co	nsulti	ng En	gineers					I	Page 3	1	
	House			LANDS	AT MI	LL/MARSH	ROAD	- 1			
per 0	rmond	Quay		DBFL :	REF: 1	70092					
blin	7			NETWO	RK Bl				Micro		
te 04	/10/20	19 15	:03	Desig	ned by	DCG			Drainage		
le CA	TCHMEN	T B1-	04.10.2019.	. Check	ed by	DMW			niamade		
novyz	e			Netwo	rk 201	8.1]	
			Manho	le Sched	ales fo	or Storm					
MH Name	MH CL (m)	MH Depth	MH Connection	MH Diam.,L*W	PN	Pipe Out	Diameter	PN	Pipes In Invert I)iameter	Backdr
		(m)	THE BOOK OF SECTION	(mm)	1000000	Level (m)	(mm)		Level (m)	(mm)	(mm)
3218	26.980	1.040	Open Manhole	1200	31.000	25.940	225				8
3217	27.040	1.164	Open Manhole	1200	31.001	25.876	225	81.000	25.876	225	
3216	26.610	1.425	Open Manhole	1200	31.002	25.185	225	51.001	25.667	225	4
3215-3	26.690	1.425	Open Manhole	1200	32.000	25,265	225				
15-2-1	26.380	1.225	Open Manhole	1200	33.000	25.155	225	SALL WOOD		2000	
3215-2	26.290	1.419	Open Manhole	1200	32.001	24.871	225	52.000	24.871	225	
	55177							53.000	(A)	225	1
	1 1 1 1 1 1 1	1/0 mg light	Open Manhole		32.002	24.425		32.001		225	
3215	25.990	1.849	Open Manhole	1200	31.003	24.141	300	51.002		225	4
	15.0							52.002	24.216	225	
		2010	Open Manhole	2000	34.000	24.280					
	100000000000000000000000000000000000000	() () () () () ()	Open Manhole		35.000	24.535					
	1 SE 10 SE 1	35.77	Open Manhole		36.000	24.345			27.002		
5214-3	26.170	2.018	Open Manhole	1200	34.001	24.152	225	54.000		225	8
								35.000 36.000		225	
9214-2	26 420	2 205	Open Manhole	1200	34.002	24.034	225	34.001		225	
		72 20 000	Open Manhole		34.002	23.916		34.002		225	
	100	The state of	Open Manhole	0.0000000000000000000000000000000000000	31.004	23.553		31.003		300	
277.5			open memore	0.2200		20.000	-	84.003		225	
3212	25 450	1 425	Open Manhole	1200	37.000	24.025	225	200000	5.5.117.50	8025	
	Totals Totals	75 372 5	Open Manhole	20.50	31.005			S1.004	23.195	300	
			(A)					57.000	23.849	225	5
3209-5	27.250	1.425	Open Manhole	1200	38.000	25.925	225				
		2010	Open Manhole	1200	38.001	24.403	225	38.000	24.403	225	
5209-3	26.000	3.040	Open Manhole	1200	31.006	22.960	300	\$1.005	22.960	300	
								58.001	24.146	225	11
319	26.000	3.257	Open Manhole	0		OUTFALL		81.006	22.743	200	30-80
		Alter of street	10.5 de/10.000 (4.000 (4.000)	5-77,7-76	S1.006	87.0 AT-770	300	58.001	24.146	225	11
				1000 001		2504					
			@	1982-2018	Innov	yze]	

	Page 4
LANDS AT MILL/MARSH ROAD DRFL REF: 170092	
NETWORK B1	Micco
Designed by DCG	Drainage
Checked by DMW Network 2018.1	brumage
	DBFL REF: 170092 NETWORK B1 Designed by DCG Checked by DMW

Simulation Criteria for Storm

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

Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

| Rainfall Model | FSR | Profile Type Summer | Return Period (years) | 2 | Cv (Summer) | 0.750 | Region Scotland and Ireland | Cv (Winter) | 0.840 | M5-60 (mm) | 14.900 Storm Duration (mins) | 30 | Ratio R | 0.279 |

DBFL Consulting Engineers		Page 5
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 NETWORK B1	Micco
Date 04/10/2019 15:03 File CATCHMENT B1-04.10.2019	Designed by DCG Checked by DMW	Drainage
Innovyze	Network 2018.1	les.

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S209-3, DS/PN: S1.006, Volume (m3): 3.9

Unit Reference MD-SHE-0099-5300-1660-5300 Design Head (m) Design Flow (1/s) 1.660 5.3 Calculated Flush-Flow Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) Invert Level (m) 22.960 Minimum Cutlet Pipe Diameter (mm)
Suggested Manhole Diameter (mm) 150 1200

Control Points Head (m) Flow (1/s)

Design Point (Calculated) 1.660 5.3 Flush-Flo* 0.432 5.0 Kick-Flo® 0.882 4.0 Mean Flow over Head Range - 4.5

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

Depth (m)	Flow (1/s)	Depth (m) 1	Flow (1/s)	Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)
0.100	3.2	1.200	4.6	3.000	7.0	7.000	10.4
0.200	4.5	1.400	4.9	3.500	7.5	7.500	10.8
0.300	4.8	1.600	5.2	4.000	8.0	B.000	11.1
0.400	4.9	1.800	5.5	4.500	8.5	8.500	11.5
0.500	4.9	2.000	5.8	5.000	8.9	9.000	11.8
0.600	4.8	2.200	6.0	5.500	9.3	9.500	12.1
0.800	4.4	2.400	6.3	6,000	9.7		
1.000	4.2	2.600	6.5	6.500	10.1		

	nsulting	Engineer	-	100				age 6
rmond	House				AT MILL/MA			
Jpper 0	rmond Qu	ay		DBFL	REF: 170092			
Dublin	7			NETWO	RK B1		N.	Aicco
Date 04	/10/2019	15:03		Desig	ned by DCG			MILI U
Tile CA	TCHMENT	B1-04.10.	2019	. Check	ed by DMW		L)rainac
nnovyz	e			Netwo	rk 2018.1		19	
Man	Are H hole Head oul Sewag Num N	al Reduction Hot Start Le loss Coeff e per hecta wher of Inputumber of Ori Rainfall M	n Factor t (mins) vel (mx) (Global) re (1/s) at Hydro- aline Co- fline Co- Synt codel gion Sco	Simulatio : 1.000 0 0.500 F 0.000 graphs 0 ntrols 1 ntrols 0	low per Person Number of Sto Number of Tim Number of Rea	low - % of : for * 10m3/1 Inlet Coo per Day (: rage Struct e/Area Diag 1 Time Cont Ratio R 0:: (Summer) 0:	Total Flow ha Storage efficcient 1/per/day) ures 1 rams 0 rols 0	0.000 2.000 0.800
	Mar	gin for Flo		ysis Time	step Coarse I			
	D: Return l	Prof	Anal	ysis Time DTS St	step Coarse I	nertia Stat Summer 0, 240, 360	us OFF	, 0 0
PN	D: Return l	Prof. sration(s) Period(s) (limate Chan	Anal ile(s) (mins) years) ge (%) Return	ysis Time DTS St 15, 30	step Coarse I atus ON	Summer 0, 240, 360 720 First (Y)	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overfloe
	D: Return I C: US/MH Name	Prof: uration(s) Period(s) (limate Chan	Anal	ysis Time DTS St 15, 30 Climate Change	step Coarse I atus ON), 60, 120, 18	Summer 0, 240, 360 720 First (Y)	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overfloe
31.000	US/MH Name	Prof: uration(s) Period(s) (; limate Chan- Storm	Anal ile(s) (mins) years) ge (%) Return Period	ysis Time DTS St 15, 30 Climate Change +10%	step Coarse I atus ON), 60, 120, 18	Summer 0, 240, 360 720 First (Y)	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overfloe
	US/MH Name 5218	Prof: uration(s) Period(s) (limate Chan	Anal	ysis Time DTS St 15, 30 Climate Change +10% +10%	step Coarse I atus ON), 60, 120, 18	Summer 0, 240, 360 720 First (Y)	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overflor
\$1.000 \$1.001 \$1.002 \$2.000	D: C: US/MH Name S218 S217 S216 S215-3	Prof. sration(s) Period(s) (limate Change Storm 15 Winter 15 Winter 15 Winter 15 Winter	Anal ile(s) (mins) years) ge (%) Return Period 100 100 100	Usis Time DIS 3t 15, 30 Climate Change +10% +10% +10%	step Coarse I atus ON 0, 60, 120, 18 First (X) Surcharge	Summer 0, 240, 360 720 First (Y) Flood	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overflor
\$1.000 \$1.001 \$1.002 \$2.000 \$3.000	Ds/MH Name \$218 \$217 \$216 \$215-3 \$215-2-1	Prof. sration(s) Period(s) () limate Change Storm 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter	Anal ile(s) (mins) years) ge (%) Return Period 100 100 100 100 100	Vsis Time DTS 3t 15, 30 Climate Change +10% +10% +10% +10%	step Coarse I atus ON 0, 60, 120, 18 First (X) Surcharge	Summer 0, 240, 360 720 First (Y) Flood	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overflor
\$1.000 \$1.001 \$1.002 \$2.000 \$3.000 \$2.001	US/MH Name 5218 5217 5216 5215-2 5215-2-1 5215-2	Prof: pration(s) Period(s) () Iimate Change Storm 15 Winter	Return Period 100 100 100 100 100	Usis Time DTS 3t 15, 30 Climate Change +10% +10% +10% +10% +10% +10%	First (X) Surcharge 100/15 Summe: 30/15 Summe:	Summer 0, 240, 360 720 First (Y) Flood	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overfloo
\$1.000 \$1.001 \$1.002 \$2.000 \$3.000 \$2.001 \$2.002	US/MH Name 5218 5217 5215-3 3215-2-1 5215-2 5215-1	Prof. pration(s) Period(s) () Iimate Change Storm 15 Winter	Anal ile(s) (mins) years) ge (%) Return Period 100 100 100 100 100 100 100 100	Time DTS St DTS	First (X) Surcharge 100/15 Summe: 30/15 Summe: 30/15 Summe:	Summer Summer O, 240, 360 720 First (Y) Flood	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overfloo
\$1.000 \$1.001 \$1.002 \$2.000 \$3.000 \$2.001 \$2.002 \$1.003	US/MH Name \$218 \$217 \$216 \$215-2 \$215-2 \$215-2 \$215-1 \$215	Prof. pration(s) Period(s) () limate Change Storm 15 Winter	Anal ile(s) (mins) years) ge (%) Return Period 100 100 100 100 100 100 100 100 100	Time DTS St DTS	First (X) Surcharge 100/15 Summer: 30/15 Summer: 30/15 Summer: 30/15 Summer:	Summer Summer O, 240, 360 720 First (Y) Flood	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overflor
\$1.000 \$1.001 \$1.002 \$2.000 \$3.000 \$2.001 \$2.002	US/MH Name \$218 \$217 \$216 \$215-2 \$215-2 \$215-1 \$215-1 \$215-1 \$214-3A	Prof. pration(s) Period(s) () Iimate Change Storm 15 Winter	Anal ile(s) (mins) years) ge (%) Return Period 100 100 100 100 100 100 100 100 100 1	Time DTS St DTS	First (X) Surcharge 100/15 Summer: 30/15 Summer: 30/15 Summer: 30/15 Summer:	Summer 0, 240, 360 720 First (Y) Flood	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overflor
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\$1.000 \$1.001 \$1.002 \$2.000 \$3.000 \$2.001 \$2.002 \$1.003 \$4.000 \$5.000 \$4.000 \$4.001 \$4.002	US/MH Name 5218 5217 5215-3 3215-2-1 5215-2 5214-3A 5214-3B 5214-3B 5214-2 5214-2 5214-2 5214-2	Prof. pration(s) Period(s) (; limate Change Storm 15 Winter	Anal ile(s) (mins) years) ge (%) Return Period 100 100 100 100 100 100 100 100 100 1	Time DTS St DTS	First (X) Surcharge 100/15 Summer: 30/15 Summer:	Summer Summer	and Winte , 480, 600, , 960, 144 1, 30, 10 10, 10, 1	Overflor
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DBFL Consulting Engineers	Page 7			
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 NETWORK B1	Micro		
Date 04/10/2019 15:03 File CATCHMENT B1-04.10.2019	Designed by DCG Checked by DMW	Drainage		
Innovyze	Network 2018.1	W. V		

ALCOHOLOGICAL CONTRACTOR AND	CALCULATION OF TWO IS	Andrew Control of the	CONTRACTOR STATE OF THE PARTY O		THE RESIDENCE TO	NAMES OF TAXABLE PARTY OF TAXABLE PARTY.
Summary of	Critical	Results	by Maximum	Level	(Rank 1)	for Storm

	US/MH	Water Level	Surcharged Depth			Overflow	Pipe Flow		Level
PN	Name	(m)	(m)	(m²)	Cap.	(1/s)	(1/s)	Status	Exceeded
31.000	3218	26.042	-0.123	0.000	0.33		11.2	OK	
\$1.001	3217	25.997	-0.104	0.000	0.54		22.3	OK	
31.002	3216	25.394	-0.016	0.000	0.92		51.3	OK	
52.000	5215-3	25.812	0.322	0.000	0.37		21.4	SURCHARGED	
53.000	3215-2-1	25.803	0.423	0.000	0.52		18.8	SURCHARGED	
52.001	3215-2	25.774	0.678	0.000	0.99		45.9	SURCHARGED	
52.002	3215-1	25.444	0.794	0.000	1.33		50.4	FLOOD RISK	
51.003	3215	25.142	0.701	0.000	0.92		93.3	SURCHARGED	
54.000	3214-3A	25.292	0.787	0.000	0.27		9.9	SURCHARGED	
\$5,000	3214-4	25.317	0.557	0.000	0.36		13.8	FLOOD RISK	
\$6.000	3214-3B	25.305	0.735	0.000	0.26		9.7	FLOOD RISK	
54.001	3214-3	25.282	0.905	0.000	1.01		36.9	SURCHARGED	
54.002	3214-2	25.149	0.890	0.000	1.19		43.3	SURCHARGED	
54.003	3214-1	24.987	0.846	0.000	1.12		50.4	SURCHARGED	
31.004	3214	24.641	0.788	0.000	1.56		153.7	SURCHARGED	
57.000	3213	24.533	0.283	0.000	0.07		2.8	SURCHARGED	
31.005	315	24.532	1.037	0.000	0.26		31.7	SURCHARGED	
58.000	3209-5	26.013	-0.137	0.000	0.33		25.6	OK	
\$8.001	3209-4	24.530	-0.098	0.000	0.05		3.8	OK	
31.006	3209-3	24.530	1.270	0.000	0.04		5.2	SURCHARGED	

BFL Co		ng E	ngine	ers	420,000		200027120		023	Pag	re 1
rmond					2100	NDS AT MII		SH ROA	AD.		
pper 0		Quay			1363.2	DBFL REF: 170092					-
ublin					163556	CATCHMENT B2					rm
ate 08					100000	Designed by AOS					ainac
ile CA	TCHMEN	IT B2	- 04	.10.20.		ecked by I				DI.	umuç
nnovyz	e				Net	twork 2018	3.1				
		STOR		<u>Desi</u>	ign Cri	the Modif: teria for ND Manhole 3	Stor	m	,	<u>d</u>	
				transmer.		1 - Scotlan					
		Retu		ok kainta riod (yea		2	a ana .	ireland		PIMP (10
				M5-60 (mm) 14.	900					
	14.	. w i pour-	Pair	Rati fall (mm/	o R 0.				ckdrop H ckdrop H	The state of the s	
Maximum		of Con	centr:	ation (mi	ns)	30 Min Des	ign De	pth for	Optimis	ation (r	n) 1.20
	257					000 Min					
	Ve	lumet	ric R	moff Coe	ff. 0.	750 Mi	n 3lop	e for O	ptimisat	ion (1:)	() 50
				Des	igned w	ith Level S	offits				
				Networ	k Desi	gn Table :	for St	orm			
PN						Base Flow (1/s)				ion Type	e Auto Desig
31.000	59.500	0.580	102.	6 0.068	5.00	0.0	0.600	0	225 Pipe	/Condui	t 👸
32.000	31.600	0.186	169.	9 0.042	5.00	0.0	0.600	0	225 Pipe	/Condui	t 👸
31.001	12.400	0.124	100.	0.040	0.00	0.0	0.600	0	225 Pipe	/Condui	•
				2 0.058					225 Pipe		_
33.001	13.800	0.081	170.	4 0.032	0.00	0.0	0.600	0	225 Pipe	/Condui	் மீ
31.002	1.000	0.006	166.	7 0.000	0.00	0.0	0.600	0	225 Pipe	/Condui	. 0
				Ne	etwork	Results I	able				
PN	Ras	in !	r.c.	US/IL E	I.Area	E Base	Foul	Add F1	ow Vel	Cap	Flow
	(mm/	hr) (r	nins)	(m)	(ha)	Flow (1/s)	(1/s)	(1/s)	(m/s)	(1/s)	(1/s)
31.00	00 42	.73	5.77	22.455	0.068	0.0	0.0	0	.8 1.29	51.3	8.7
52.00	00 43	.45	5.53	23.305	0.042	0.0	0.0	0	.5 1.00	39.8	5.4
81.00	01 42	.28	5.93	21.875	0.150	0.0	0.0	1	.7 1.31	52.0	18.9
53.00	00 42	.61	5.81	21.880	0.058	0.0	0.0	0	.7 1.00	39.7	7.4
53.00	01 41	.96	6.04	21.595	0.090	0.0	0.0	1	.0 1.00	39.7	11.3
\$1.00	02 41	.91	6.06	21.514	0.240	0.0	0.0	2	.7 1.01	40.2	30.0
				(

DBFL Consulting Engineers			Page 2
Ormond House	LANDS AT MILL/MARS	H ROAD	
Upper Ormond Quay	DBFL REF: 170092		
Dublin 7	CATCHMENT B2		VI
Date 08/10/2019 11:11	Designed by AOS		MICTO
File CATCHMENT B2 - 04.10.20	STATE OF THE STATE		Drainage
The second of the second secon	Network 2018.1		
Innovyze	Network 2016.1		
Simula	tion Criteria for Stor	rm_	
Areal Reduction Facto	f 0.750 Additional Flow or 1.000 MADD Factor	* 10m3/ha Stora	ge 2.000
Hot Start Level (mm) 0 a) 0 Flow per Person p	er Dav (1/per/da	w) 0.000
Manhole Headloss Coeff (Global		Run Time (mir	
Foul Sewage per hectare (1/s) 0.000 Outp	ut Interval (mir	15) 1
W			
	ographs O Number of Storagontrols 1 Number of Time/		
	ontrols 0 Number of Real 1		
Synth	etic Rainfall Details		
Rainfall Model	FSR	Profile Type St	ummer
Return Period (years)	2	Cv (Summer)	
Region Scot	land and Ireland	Cv (Winter)	0.840
M5-60 (mm)	14,900 Storm Du	ration (mins)	30
Ratio R	0.279		

DBFL Consulting Engineers	2	Page 3
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 CATCHMENT B2	Misso
Date 08/10/2019 11:11 File CATCHMENT B2 - 04.10.20	Designed by AOS Checked by DMW	Drainage
Innovyze	Network 2018.1	Ver

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S306, DS/PN: S1.002, Volume (m3): 2.6

Unit Reference MD-SHE-0071-2000-0705-2000 Design Head (m) 0.705 Design Flow (1/s) 2.0 Flush-Flos Calculated Objective Minimise upstream storage Application Surface Sump Available Diameter (mm) Invert Level (m) 21.514 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200

 Control
 Points
 Head (m)
 Flow (1/s)

 Design
 Foint (Calculated)
 0.705
 2.0

 Flush-Flos
 0.208
 2.0

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

Depth (m)	Flow (1/s)	Depth (m) F	low (1/s)	Depth (m) Fl	ow (1/s) I	epth (m) F	low (1/s)
0.100	1.8	1.200	2.5	3.000	3.9	7.000	5.8
0.200	2.0	1.400	2.7	3.500	4.2	7.500	6.0
0.200	2.0	1.600	2.9	4.000	4.4	B.000	6.2
0,400	1.8	1.800	3.1	4.500	4.7	8.500	6.4
0.500	1.7	2.000	3.2	5.000	4.9	9.000	6.6
0.600	1.9	2.200	3.4	5.500	5.2	9.500	6.7
0.800	2.1	2.400	3.5	6.000	5.4		
1.000	2.3	2.600	3.6	6.500	5.6		

DBFL Cons	sulting	g Enginee	rs						Page 4
Ormond Ho	ouse			LAND	S AT M	ILL/MAF	RSH ROAL)	
Jpper Orn	nond Qu	uay		DBFL	REF:	170092			-
Oublin 7				CATC	HMENT B	B2			Micco
Date 08/	10/2019	9 11:11		Desi	gned by	y AOS			MILLIO
File CATO	CHMENT	B2 - 04.	10.20.	. Chec	ked by	DMW			urainac
Innovyze		202		300	ork 20	00 DOM: N			
Manho	Are Head Num Num Num Num Num Num Num Nu	Hot Start I Hot Start I Hots Start I Hoss Coeff He per hect Mumber of In Rainfall M5-60 Argin for F	on Factor (mins evel (mm (1/5)) (Global are (1/5)) (If ine Confilme Confilm	Simulati r 1.000 i) 0 i) 0 i) 0.500 i) 0.000 ographs 0 ontrols 1 ontrols 0 thatic Ra- cotland a:	on Crite Additi M2 Flow per Number Number Ind Irels 14.9 g (mm) 3 mestep Status	of Store of Real	ow - % o or * 10m Inlet ' per Day rage Stru */Area Di 1 Time Co Ratio R Summer) Winter) DVD St ertia St	agrams 0 ontrols 0 0.279 0.750 0.840 atus OFF	ow 0.000 ge 2.000 ge 2.000 y) 0.000
	US/ME		nge (%)						10 Overflow
PN	name	SCOIM	reriod	change	surch	arge	2100d	Overflow	ACT.
		15 Winter							
		15 Winter			100:110				
		480 Winter 480 Winter			100/180				
33.001	5304-1	480 Winter	100	+10%	30/60	Summer			
31.002	3306	480 Winter	100	+10%	30/30	Summer			
	SERVICE S	Water Su				TEN TON	Pipe		20 BUSA
TORY	US/MH Name	Level	Depth (m)	Volume					Level
PN	name	(m)	(m)	(m-)	cap.	(1/5)	(1/5)	Status	Exceeded
31.000	3308	22,560	-0.120	0.000	0.43		21.2	OK	
		23.399	-0.131	0.000	0.36		13.3		
		22.182	0.082	0.000	0.15			SURCHARGED	
		22.183		0.000				SURCHARGED	
		22.181		0.000				SURCHARGED	
	-						2.0		
					200				
			©	1982-203	18 Inno	vyze			

DBFL Co	A 100 100 100 100	ng Er	ngine	ers					100000		Pag	ge 1
Ormond	- TOTAL CONT. T.	argy are in			50700	NDS AT MII		SH R	OAD			
Jpper 0	rmond	Quay			DB	FL REF: 17	70092				1	
Dublin					938	TCHMENT BS					M	rm
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File CA	TCHMEN	IT B3-	-04.1	0.201	ALC: U.S. C.	ecked by I	2000/				וטו	טוו וטנ
Innovyz	e				Ne	twork 2018	3.1					
		STORM	1 SEW			the Modif			al M	ethod	1	
			Pi	pe Sise	s STANDA	RD Manhole S	Sizes :	TANDA	RD			
						el - Scotlan	d and	Irelan	nd		D716D (
		Ketui	rn Per	m5-60		900	Add F	low /	Clim	ate Ch		1011
				Ra	tio R 0.	279					- I make the second of the	m) 0.20
SZESKOSKO	Ma	eximum	Raini	all (m	m/hr)	100	Max	imum 1	Backd	rop He	eight (m) 1.50
Maximum	n Time o					30 Min Des 000 Min						
	Ve				oeff. 0.							X) 50
				2080-3			**********					
				D	esigned w	rith Level 3	offits					
				Netwo	ork Desi	.gn Table :	for St	orm				
	-C-V2NG948			(0)	sarv spreppro	W25W30113	50.00	The Land		Tarista.		
PN	Length	Fall	Slop	e I.Are	a T.E.	Base	k	HYD	DIA	Secti	LOD TVD	e Auto
PN	Length (m)					Base Flow (1/s)					on Typ	Desig
\$1.000	(m) 44.800	(m) 0.264	(1:X) (ha)	(mins)	Flow (1/s) 0.0	(mm.)	SECT	(mm) 225	Pipe/	/Condui	Desig
\$1.000	(m) 44.800	(m) 0.264	(1:X) (ha)	(mins)	Flow (1/s) 0.0	(mm.)	SECT	(mm) 225	Pipe/	320.035	Desig
\$1.000 \$1.001	(m) 44.800 37.900	(m) 0.264 0.292	(1:X 169. 129.) (ha) 7 0.08 8 0.06	(mins)	Flow (1/s) 0.0 0.0	(mm.) 0.600 0.600	SECT o o	(mm) 225 225	Pipe/	/Condui	Desig t å t ø
\$1.000 \$1.001 \$2.000	(m) 44.800 37.900 28.400	(m) 0.264 0.292 0.171	(1:X 169. 129.) (ha) 7 0.08 8 0.06 1 0.07	(mins) 35 5.00 32 0.00	Flow (1/s) 0.0 0.0	(mm) 0.600 0.600 0.600	SECT 0 0	(mm) 225 225 225	Pipe/ Pipe/	/Condui /Condui /Condui	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002	(m) 44.800 37.900 28.400 28.800	(m) 0.264 0.292 0.171 0.169	(1:X 169. 129. 166.) (ha) 7 0.08 8 0.06 1 0.07 4 0.04	(mins) 85 5.00 83 0.00 71 5.00	Flow (1/s) 0.0 0.0 0.0	(mm) 0.600 0.600 0.600	SECT o o	(mm) 225 225 225 225 225	Pipe/ Pipe/ Pipe/	/Condui /Condui	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003	(m) 44.800 37.900 28.400 28.800 16.900	(m) 0.264 0.292 0.171 0.169 0.099	(1:X 169. 129. 166. 170.) (ha) 7 0.08 8 0.06 1 0.07 4 0.04 7 0.01	(mins) 85 5.00 83 0.00 71 5.00 81 0.00	Flow (1/s) 0.0 0.0 0.0 0.0 0.0	(mm) 0.600 0.600 0.600 0.600	SECT o o	(mm) 225 225 225 225 225 225	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/	/Condui /Condui /Condui	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004	(m) 44.800 37.900 28.400 28.800 16.900 63.600	(m) 0.264 0.292 0.171 0.169 0.099 0.374	(1:X 169. 129. 166. 170. 170.) (ha) 7 0.08 8 0.06 1 0.07 4 0.04 7 0.01 1 0.02	(mins) 85 5.00 83 0.00 71 5.00 81 0.00	Flow (1/s) 0.0 0.0 0.0 0.0 0.0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600	SECT 0 0	(mm) 225 225 225 225 225 225 225 225	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/	/Condui /Condui /Condui /Condui /Condui	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119	(1:X 169.129. 166. 170. 170. 170.	(ha) (ha) (ha) (ha) (ha) (ha) (ha) (ha)	(mins) 5 5.00 6 5.00 7 5.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00 8 0.00	Flow (1/s) 0.0 0.0 0.0 0.0 0.0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600	SECT	(mm) 225 225 225 225 225 225 225 225	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/	/Condui /Condui /Condui /Condui /Condui /Condui	Design t
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119	(1:X 169.129. 166. 170. 170. 170.) (ha) 7 0.088 0.06 1 0.07 4 0.04 7 0.01 1 0.02 7 0.03	(mins) 5.00 5.00 10.00 11.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600	SECT	(mm) 225 225 225 225 225 225 225 225	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/	/Condui /Condui /Condui /Condui /Condui /Condui	Design t
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384	(1:X 169. 129. 166. 170. 170. 169.) (ha) 7 0.088 0.06 1 0.07 4 0.04 7 0.01 1 0.02 7 0.03	(mins) 5.00 5.00 1.5.00 1.0.00 1.0.00 2.0.00 2.5.00 0.0.00 Network	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600	SECT	(mm) 225 225 225 225 225 225 225 225 200	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/	/Condui /Condui /Condui /Condui /Condui /Condui	Design
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\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rai	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in Thr) (=	(1:X 169. 129. 166. 170. 170. 170. 169.) (ba) 7 0.08 8 0.06 1 0.07 4 0.04 7 0.01 1 0.02 7 0.03 8 0.10 US/IL (m)	(mins) 5 5.00 5 5.00 7 5.00 1 5.00 1 0.00 2 0.00 2 0.00 Network E I.Area (ha)	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Eesults T	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 Foul	Add (1/	(mm) 225 225 225 225 225 225 225 225 225	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s)	Condui Condui Condui Condui Condui Condui Condui Condui	Design to \$\frac{1}{2}\$
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rair (mm/	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in Thr) (m	(1:X 169. 129. 166. 170. 170. 170. 169. 169.) (ha) 7 0.088 0.06 1 0.07 4 0.04 7 0.01 1 0.02 7 0.03 8 0.10 US/IL (m) 23.752	(mins) 5 5.00 6 5.00 7 1 5.00 8 1 0.00 8 2 0.00 8 5 5.00 9 0.00 Network E I.Area (ha) 0.065	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600	Add (1/	(mm) 225 225 225 225 225 225 225 225 210 210 210	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s)	Condui Condui Condui Condui Condui Condui Condui Condui	Design t
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rair (mm/	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in Thr) (m	(1:X 169. 129. 166. 170. 170. 170. 169. 169.) (ha) 7 0.088 0.06 1 0.07 4 0.04 7 0.01 1 0.02 7 0.03 8 0.10 US/IL (m) 23.752	(mins) 5 5.00 5 5.00 7 5.00 1 5.00 1 0.00 2 0.00 2 0.00 Network E I.Area (ha)	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 Foul	Add (1/	(mm) 225 225 225 225 225 225 225 225 210 210 210	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s)	Condui Condui Condui Condui Condui Condui Condui Condui	Design t
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rai: (mm/ 00 42 01 41	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in Thr) (m	(1:X 169. 129. 166. 170. 170. 169. 169. 169.	(m) (ba) (ba) (ba) (ba) (ba) (ba) (ba) (ba	(mins) 5 5.00 6 5.00 7 1 5.00 8 1 0.00 8 2 0.00 8 5 5.00 1 0.00 Network 2 I.Area (ha) 0.065	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600	SECT	(mm) 225 225 225 225 225 225 225 225 210 1.0 1.7	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00	Condui Condui Condui Condui Condui Condui Condui Condui	Design t
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rais (mm/ 00 42 01 41 00 43	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in Thr) (m) .80 .26 .63	(1:X 169. 129. 166. 170. 170. 170. 169. 169. 2.C. nins) 5.75. 6.30 5.47	US/IL (m) 23.752 24.095	(mins) 5.00 5.00 1.5.00 1.00 1.00 2.00 2.00 3.5.00 0.00 Network E I.Area (ha) 0.085 0.148 0.071 0.260	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.000 0.000 0.000 0.000 0.000	Add (1/	(mm) 225 225 225 225 225 225 225 210 1.0 1.7 0.8 2.8	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.15	Condui Condui Condui Condui Condui Condui Condui Condui Condui	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005 PN \$1.00 \$1.00 \$1.00 \$1.00 \$1.00 \$1.00 \$1.00	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rair (mm/ 00 42 01 41 00 43 02 40 03 39	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in T hr) (m .80 .26 .63 .02 .34	(1:X 169. 129. 166. 170. 170. 170. 169. 169. 169.	US/IL (m) 23.752 24.095 23.027	(mins) 5 5.00 5 5.00 7 5.00 8 0.00 8 0.00 8 5.00 0 0.00 Network E I.Area (ha) 0.085 0.148 0.071 0.260 0.270	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600	Add (1/	(mm) 225 225 225 225 225 225 225 200 1.0 1.7 0.8 2.8 2.9	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.15	Condui Condui Condui Condui Condui Condui Condui Condui Condui Condui	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005 PN \$1.00 \$1.00 \$1.00 \$1.00 \$1.00 \$1.00 \$1.00	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rai (mm/ 00 42 01 41 00 43 02 40 03 39 04 37	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in T hr) (m .80 .26 .63 .02 .34 .01	(1:X 169. 129. 166. 170. 170. 170. 169. 169. 5.75. 6.30 5.47 6.78 7.06 8.12	US/IL (m) 23.752 23.196 22.928	(mins) 05 5.00 07 5.00 08 0.00 08 0.00 08 5.00 00 0.00 Network E I.Area (ha) 0.085 0.148 0.071 0.260 0.292	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600	Add (1/	(mm) 225 225 225 225 225 225 225 225 200 1.7 0.8 2.8 2.9	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ 1.00 1.15 1.01	/Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condu	Design to the control of the control
\$1.000 \$1.001 \$2.000 \$1.002 \$1.003 \$1.004 \$3.000 \$1.005 PW \$1.00 \$1.00 \$1.00 \$1.00 \$1.00 \$1.00 \$1.00	(m) 44.800 37.900 28.400 28.800 16.900 63.600 20.200 65.200 Rain (mm/ 00 42 01 41 00 43 02 40 03 39 04 37 00 44	(m) 0.264 0.292 0.171 0.169 0.099 0.374 0.119 0.384 in Thr) (m) .80 .26 .63 .02 .34 .01 .04	(1:X 169. 129. 166. 170. 170. 170. 169. 169. 169. 5.75. 6.30 5.47 6.78 7.06 8.12	US/IL (m) 23.752 23.196 22.742	(mins) 05 5.00 07 5.00 08 0.00 08 0.00 08 5.00 00 0.00 Network E I.Area (ha) 0.085 0.148 0.071 0.260 0.292	Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	(mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600	Add (1/	(mm) 225 225 225 225 225 225 225 225 200 1.0 1.7 0.8 2.9 2.9 0.4	Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.00 1.00 1.00	Condui Condui Condui Condui Condui Condui Condui Condui Condui Condui 39.8 45.6 40.2 39.7 39.7 39.7	Design to the control of the control

Maria Company			ng E	ngine	ers	Tall						Pag	e 2
Ormond						75300	NDS AT MII		SH R	OAD			
Upper (rmo	nd	Quay			DB	FL REF: 17	0092					-
Dublin						CA	TCHMENT B3	3				Mi	m
Date 04	1/10	/20	19 1	4:57		De	signed by	DCG				Balance Co.	ainago
File CA	ATCH	MEN	T B3	-04.1	10.2019.	Ch	ecked by I	WM				DIG	an iayi
Innovy	e					Ne	twork 2018	1.1					
					Networ	k Desi	qn Table :	for St	torm				
PN	Len		Fall				Base Flow (1/s)					on Type	Auto Design
34.000	9.0	83	VENER				0.0					Conduit	NEW YORK
							0.0				- 15-31/		-72
							0.0				25-25		3
					0 0.012							Conduit	7
					0 0.019		0.0	0.600	0	300	Pipe/	Conduit	•
31,009	33.	100	0.203	163.	1 0.010	0.00	2.0	0.600	٥	375	Pipe/	Conduit	
					0 0.062							Conduit	0 1000
					3 0.045							Conduit	
	05053				8 0.062	1 150000	2000	0.600) (S			Conduit	
					7 0.090 9 0.100			0.600				Conduit	-
					0 0.055							Conduit	-
					2 0.015							Conduit	
38.000	18.	000	0.450	40.	0 0.069	5.00	0.0	0.600	٥	225	Pipe/	Conduit	o con
					N	etwork	Results T	able					
PN							Σ Base					7	
		mm./	hr) (mins)	(m)	(ha)	Flow (1/s)	(1/s)	(1/	s)	(m/s)	(1/s)	(1/s)
34.0	0.0	43	.70	5.45	26.015	0.065	0.0	0.0		0.8	1.96	77.7	8.5
51.0	06	33	.89	9.83	22.095	0.550	0.0	0.0		5.0	1.00	70.4	55.5
85.0					24.825							93.8	
51.0			1.00		21.899	C 1000	0.7.7.7	0.0				82.6	
\$1.0 \$1.0					21.856	0.651		0.0				81.3 156.4	
36.0	00	44	.36	5.23	23.695	0.062	0.0	0.0		0.7	2.08	82.5	8.2
31.0	10	31	.63	11.34	21.070	0.768	2.0	0.0		6.8	1.15	126.8	74.6
37.0	00	43	.29	5.58	22.275	0.062	0.0	0.0		0.7	1.00	39.8	8.0
31.0	11	31	.41	11.50	20.833	0.920	2.0	0.0		8.0	1.15	126.6	88.3
31.0					20.789			0.0				126.9	
31.0 31.0					20.676			0.0				126.8 144.0	
					25.551	0.069		0.0				82.5	

DBFL Co		-	nginee	ers	Te-	VIDO 37 V	T				Page	3
rmond					351	NDS AT MII		RSH RO	DAD			
pper C	rmond	Quay			250	FL REF: 17						_
ublin	7				CA	TCHMENT B3	3				Mic	m
ate 04	/10/2	019 1	4:57		De	signed by	DCG				100	
Tile CF	TCHME	NT B3	-04.10	.2019.	Ch	ecked by I	WMC				Ulc	iinag
Innovyz	CONTRACTOR					twork 2018	137.11					
	-		9		14797. 21797.01 10		900 900	2				
PN	•	• • •				qn Table :						
20	(m)	(m)	(1:X)			Base Flow (1/s)				secti	ion Type	Design
38.001	37.500	1.500	25.0	0.070	0.00	0.0	0.600	0	225	Pipe,	Conduit	•
The second second				0.005			0.600				Conduit	₩.
			7.77	0.055			0.600				Conduit	
		100		0.060							Conduit	
							0.600			100	/Conduit	
77.75			7.7	0.065	1973/2015		0.600				Conduit	
39.001	20.200	0.119	169.7	0.072	0.00	0.0	0.600	۰	225	Pipe,	/Conduit	o
				0.045			0.600				Conduit	
38.007	11.900	0.595	20.0	0.062	0.00	0.0	0.600	0	225	Pipe,	/Conduit	4
31,015	1.000	0.010	100.0	0.000	0.00	0.0	0.600	0	375	Pipe	/Conduit	•
				Ne	etwork	Results I	able					
PN	11000					Σ Base						
	(mm	/hr) (mins)	(m)	(ha)	Flow (1/s)	(1/s)	(1/	s)	(m/s)	(1/s)	(1/s)
38.0		C 7 / 217		25.101	0.139	1 100	0.500				104.5	
58.0				23.601	0.144		0.0				43.9 43.7	
58.0			6.83		0.199		0.0				61.2	
58.0				22.752			0.0				39.7	
					0.023				0.0			
89.0				24.105	0.065		0.0				39.8	
39.0	01 4	3.39	5.55 1	24.030	0.137	0.0	0.0		1.6	1.00	39.8	17.7
38.0	06 9	B B1	7 20 1	22.625	0.511	0.0	0.0		5 4	2 07	82.5	59 1
58.0				22.305	0.573		0.0				116.9	
\$1.0	15 9	0.57	12 15	20.604	1.663	2.0	0.0		4 n	1 83	200.1	53 6
01.0	*				2.003	2.0	0.0	1 15				44.0
				6	D1982-	2018 Innov	vze					

DBFL	Consult	ting E	ngin	eers						Page 4	- 19	
Ormon	d House	9			LANI	DS AT 1	MILL. MARS	H ROAD	:			
Upper	Ormon	d Quay	î.		DBFI	L REF:	170092					
Dubli	n 7				CAT	CHMENT	B3			Micro		
Date	04/10/2	2019 1	4:57	8	Des	igned k	y DCG				7.0	
File	CATCHME	ENT BS	-04.	10.2019	Che	ked by	7 DMW			Drainad	Je.	
Innov	yze				Net	work 20	18.1					
	3-8			Manl	hole Sche	dules	for Storn	n.				
MH Name	MH CL (m)	MH Depth	100 M	MH nection	MH Diam., L+W	PN	Pipe Out	Diameter	PN	Pipes In Invert	Diameter	Backdrop
		(m)			(mm)	47	Level (m)	(mm)		Level (m)	()	(mm)
3418	25.450	1.698	Open	Manhole	1200	31.000	23.752	225			.81	
3417	25.490	2,002	Open	Manhole	1200	31.001	23.488	225	81.000	23.488	22	5
3416-1	25.520	1.425	Open	Manhole	1200	32.000	24.095	225				~
3416	25.000	1.804	Open	Manhole	1200	31.002	23.196	225	\$1.001	23.196	22	5
			O.E.O.						52.000	23.924	225	728
3415	24.297	1.270	Open	Manhole	1200	31.003	23.027	225	81.002	23.027	22	5
3414	24.180	1.252	Open	Manhole	1200	31.004	22.928	225	\$1.003	22.928	22	5
3413-1	24.530	1.788	Open	Manhole	1200	33.000	22.742	225				
3413	24.780	2.301	Open	Manhole	1200	31.005	22.479	300	31.004	22.554	22	5
			3344						33.000	22.623	223	69
3412-1	27.440	1.425	Open	Manhole	1200	34.000	26.015	225				
3412	25.850	3.755	Open	Manhole	1200	31.006	22.095	300	\$1,005	22.095	300	0
									34.000	24.853	22	2683
3410-1	26.250	1.425	Open	Manhole	1200	35.000	24.825	225				
3411	25.190	3.291	Open	Manhole	1200	31.007	21.899	300	31.006	21.899	30)
			0.001000						85.000	23.954	22	1980
3410	24.870	3.014	Open	Manhole	1200	31.008	21.856	300	31.007	21.856	301)
3300	24.800	3.527	Open	Manhole	1350	31.009	21.273	375	\$1,008	21.797	300	449
3406-1	24.770	1.075	Open	Manhole	1200	36.000	23.695	225				
3409	23.860	2.790	Open	Manhole	1350	31.010	21.070	375	31.009	21.070	37	5
									36.000	22.967	22	1747
3405-1	25.720	3.445	Open	Manhole	1200	37.000	22.275	225				
3408	24.010	3.177	Open	Manhole	1350	31.011	20.833	375	51.010	20.833	373	51
	MARKET LITTLE		2007.00						57.000	22.070	(22	1087
3407	23.460	2.671	Open	Manhole	1350	31.012	20.789	275	\$1.011	20,789	27	5
3406	23.210	2.534	Open	Manhole	1350	31.013	20.676	375	\$1.012	20.676	37	5
3405	22.970	2.346	Open	Manhole	1350	31.014	20.624	375	51.013	20.624	37	5
358	27.170	1.619	5.0	Manhole	1200	38.000	25.551	225				
357	26.560	1.459	Open	Manhole	1200	38.001	25.101	225	58.000	25.101	22	5
				Manhole		38.002			58.001	23.601	223	5
				Manhole	170,000,000,000		23.433		58.002		100	
	100000000000000000000000000000000000000	A60 CO.	100	Manhole			23.024		200 St 25	23.024	1 25000	5
		100000000000000000000000000000000000000	21-200	Manhole	0.0000000000000000000000000000000000000	100000000000000000000000000000000000000	22.752		58.004	22.752	22	5
			250000	Manhole	0.000000	The state of the state of	24.105					
		200 200		Manhole			24.030		11110000	24.030	2 3 1 2	5
352	26.130	3.505	Open	Manhole	1200	38.006	22.625	225	58.005	22.625	22	5
									59.001	23.911	22	1286
351	25.180	2.875	Open	Manhole	1200	38.007	22,305	225	58.006	22.305	22	5
1					©1982-20	18 Inn	OVVZA				- 3	

S0 26.000 5.396 Open Manhole 1350 S1.015 20.604 375 S1.014 20.604 375 S8.007 21.710 225 S8.000 25.000 4.406 Open Manhole O OUTFALL S1.015 20.594 275			- 1	Page 5						Engineers	lting	Consu	DBFL
Date 04/10/2019 14:57 Designed by DCG Checked by DMW DCG Checked by DMW Innovyze Network 2018.1							: 170092	FL REF	DBI	ay			110000
Time			Allen	Micco			T B3	TCHMEN	CA			in 7	Dubl
Manhole Schedules for Storm Manhole Manh			ann	Drain			by DCG	signed	Des	14:57	/2019	04/10	Date
Manhole Schedules for Storm Manhole Schedules for Storm Manhole Schedules for Storm Manhole Schedules for Storm Manhole Manh			JUL	DIGITIE					-17	B3-04.10.2 <mark>0</mark>	MENT	CATCH	File
MH MH MH Depth Connection Diam. L*W PN Invert Diameter Level (m) Invert Diameter Level (m) Evel (m) Ev							2018.1	twork	Net			vyze	Inno
Name CL (m) Depth (m) Connection Diam., L*W (mm) PN Invert Diameter Level (m) (mm) Evel (m) (mm) Cl (mm)						orm	s for Sto	edule	nhole Sch	<u>Ma</u>			
St.000 4.406 Open Manhole O OUTFALL St.007 21.710 225	kdrop mm)	200 20		Invert		Diameter	Invert	PN	Diam.,L*W		Depth	100 mg (100 mg)	5.5
S 25.000 4.406 Open Manhole 0 OUTFALL S1.015 20.594 375	956	903				375	20.604	31.015	1350	Open Manhole	5.396	26.000	30
Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m²/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (1/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (1/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Offline Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Profile Type Summer Return Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 14.900 Storm Duration (mins) 30	930	433					OUTFALL		0	Open Manhole	4.406	25.000	3
Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficeient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (1/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (1/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Profile Type Summer Return Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 14.900 Storm Duration (mins) 30						orm	ia for St	riter	ulation (Sim			
Rainfall Model FSR Profile Type Summer Return Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 14.900 Storm Duration (mins) 30				ins) 60 ins) I	Fime (m rval (m tures) grams (Run 1 stput Inter rage Struc e/Area Dia	Ou ber of Sto ber of Tim	0 0 0 Numi 1 Numi	(1/s) 0.50 (1/s) 0.00 Hydrographs ne Controls	oss Coeff (GI per hectare ber of Input umber of Onli	e Headl Sewage Num N		
Return Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 14.900 Storm Duration (mins) 30						<u>ls</u>	ll Detai	Rainfa	vnthetic	<u>s</u>			
Return Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 14.900 Storm Duration (mins) 30				Summer	Type	Profile	FSR			infall Model	R:		
				0.750 0.840	inter)	Cv (W:	and 900 Storm	14.	Scotland a	Region	turn Pe	Ret	
©1982-2018 Innovyze													

DBFL Consulting Engineers		Page 6
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL MARSH ROAD DBFL REF: 170092 CATCHMENT B3	Micco
Date 04/10/2019 14:57 File CATCHMENT B3-04.10.2019	Designed by DCG Checked by DMW	Drainage
Innovyze	Network 2018.1	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S0, DS/PN: S1.015, Volume (m3): 8.4

Unit Reference MD-SHE-0118-7400-1570-7400 Design Head (m) Design Flow (1/s) 1.570 Flush-Flos Calculated Objective Minimise upstream storage Application Surface Sump Available Diameter (mm) 118 Invert Level (m) 20.604 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200

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

Depth (m)	Flow (1/s)	Depth (m) F	low (1/s)	Depth (m) Flo	ow (1/s)	Depth (m)	Flow (1/s)
0.100	4.2	1.200	6.5	3.000	10.0	7.000	15.0
0.200	6.6	1.400	7.0	3.500	10.8	7.500	15.5
0.300	7.1	1.600	7.5	4.000	11.5	8.000	16.0
0.400	7.4	1.800	7.9	4.500	12.2	8.500	16.5
0.500	7.4	2.000	8.3	5.000	12.8	9.000	16.9
0.600	7.3	2.200	8.7	5.500	13.4	9.500	17.4
0.800	6.9	2.400	9.0	6.000	13.9		
1.000	6.0	2.600	9.4	6.500	14.5		

DBFL Consulting Engineers		Page 7
Ormond House	LANDS AT MILL.MARSH ROAD	3 (1)
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	CATCHMENT B3	Micco
Date 04/10/2019 14:57	Designed by DCG	Desinage
File CATCHMENT B3-04.10.2019	Checked by DMW	Diamage
Innovyze	Network 2018.1	***

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (1/per/day) 0.000 Foul Sewage per hectare (1/s) 0.000

> Number of Input Hydrographs O Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details
Rainfall Model FSR Ratio R 0.279
Region Scotland and Ireland Cv (Summer) 0.750 M5-60 (mm) 14.900 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF Analysis Timestep Coarse Inertia Status OFF DTS Status ON

Profile(s) Summer and Winter Duration(s) (mins) 15, 20, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 Return Period(s) (years) 1, 30, 100 Climate Change (%) 10, 10, 10

PN	US/MH Name	s	torm					 First (E) Overflow	
					80800056				
31.000	3418	15	Winter	100	+10%	30/15	Winter		
31.001	3417	15	Winter	100	+10%	30/15	Summer		
32.000	3416-1	15	Winter	100	+10%	100/15	Winter		
31.002	3416	15	Winter	100	+10%	30/15	Summer		
31.003	3415	30	Winter	100	+10%	30/15	Summer		
31.004	3414	30	Winter	100	+10%	30/15	Summer		
33.000	3413-1	30	Winter	100	+10%	100/15	Summer		
31.005	3413	30	Winter	100	+10%	30/15	Summer		
34.000	3412-1	15	Winter	100	+10%				
31.006	3412	30	Winter	100	+10%	30/15	Summer		
35.000	3410-1	15	Winter	100	+10%				
31.007	3411	30	Winter	100	+10%	30/15	Summer		
81.008	3410	30	Winter	100	+10%	30/15	Summer		
31.009	3300	30	Winter	100	+10%	30/15	Summer		
36.000	3406-1	15	Winter	100	+10%				
31.010	3409	1440	Winter	100	+10%		Summer		
37.000	3405-1	15	Winter	100	+10%				
31.011	3408	1440	Winter	100	+10%		Summer		
					+10%				
					+10%				
			Winter		+10%				

DBFL Consulting Engineers		Page 8
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL.MARSH ROAD DBFL REF: 170092 CATCHMENT B3	Mireo
Date 04/10/2019 14:57 File CATCHMENT B3-04.10.2019	Designed by DCG Checked by DMW	Drainage
Innovyze	Network 2018.1	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

	US/MH	Water Level	Surcharged Depth	Flooded Volume	Flow /	Overflow	Pipe Flow		Level
PN	Name	(m)	(m)	(m 3)	Cap.	(1/s)	(1/s)	Status	Exceeded
31.000	3418	24.511	0.534	0.000	0.58		22.0	SURCHARGED	
31.001	3417	24.446	0.733	0.000	0.68		29.2	SURCHARGED	
32.000	3416-1	24.361	0.041	0.000	0.60		22.3	SURCHARGED	
31.002	3416	24.320	0.899	0.000	1.37		50.7	SURCHARGED	
31.003	3415	24.071	0.819	0.000	1.30		46.0	FLOOD RISK	
31.004	3414	23.897	0.744	0.000	1.30		49.9	FLOOD RISK	
33.000	3413-1	23.371	0.404	0.000	0.24		8.5	SURCHARGED	
31.005	3413	23.367	0.588	0.000	0.87		70.6	SURCHARGED	
34.000	3412-1	26.096	-0.144	0.000	0.28		20.5	OK	
31.006	3412	23.088	0.693	0.000	1.35		89.5	SURCHARGED	
35.000	3410-1	24.902	-0.148	0.000	0.26		22.4	OK	
31.007	3411	22.720	0.521	0.000	1.72		104.9	SURCHARGED	
31.008	3410	22.532	0.376	0.000	1.78		109.1	SURCHARGED	
31.009	3300	22.334	0.686	0.000	0.81		112.5	SURCHARGED	
36.000	3406-1	23.772	-0.148	0.000	0.26		19.8	OK	
31.010	3409	22.180	0.735	0.000	0.15		17.6	SURCHARGED	
37.000	3405-1	22.393	-0.107	0.000	0.52		19.6	OK	
31.011	3408	22.176	0.968	0.000	0.22		20.5	SURCHARGED	
31.012	3407	22.174	1.010	0.000	0.20		22.4	SURCHARGED	
31.013	3406	22.170	1.119	0.000	0.24		23.5	SURCHARGED	
31.014	3405	22.168	1.169	0.000	0.30		23.7	SURCHARGED	

DBFL	Consult	ing E	ngineers		. cresocatoria			OM SUCCESSION TO	Page	9
	d House				LANDS A	AT MILI	.MARSH	ROAD		
Upper	Ormond	Quay			DBFL RE	EF: 170	092			
Dubli	n 7				CATCHME	ENT B3			Micr	
Date	04/10/2	019 1	4:57		Designe	ed by I	CG		Desi	0.200
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Innov	vze			247.201.01.0	Network	2018.	1			
	Summar	y of	Critical	Result	s by Ma	ximum	Level (Rank 1) fo	or Storm	10140000
										Water
Y202	US/MH	(223)						() First (E)		
PN	Name	Stor	n Perio	d Chang	e Surc	harge	Flood	Overflow	Act.	(m)
38.000	358	15 Win	nter 10	0 +10	8					25.635
	357				8					25.209
			nter 10		€ 30/15					24.894
			nter 10		30/15					24.764
			nter 10		\$ 30/15 \$ 30/15					24.332
			nter 10		100/15					24.362
			nter 10		100/15					24.308
38.006	852	15 Wis	nter 10	0 +10	\$ 30/15	Summer				23.675
38.007	351	15 Wit	nter 10	0 +10	\$ 30/15					22.880
81.015	30 1	440 Wi	nter 10	0 +10	1/480	Winter				22.167
			Surcharge				Pipe			
	222	US/MH			e Flow /				Level	
	PN	Name	(m)	(m,)	Cap.	(1/s)	(1/s)	Status	Exceeded	
	38.000	358	-0.14	1 0.00	0 0.30		22.0	OK		
	38.001	357	-0.11	7 0.00	0.46		45.6	OK		
	38.002				0.85			FLOOD RISK		
	38.003				0 1.04			FLOOD RISK		
	38.005	354 353			0 1.89			SURCHARGED		
		352-2			0.60			SURCHARGED		
	39.001	352-1	0.05	3 0.00	0 1.19		43.0	SURCHARGED		
	88.006				0 1.58			SURCHARGED		
	38.007		0.35		0 1.26			SURCHARGED		
	31.015	50	1.18	8 0.00	0.08		7.4	SURCHARGED		
				@100	2-2018	Tnnow	7.0			
				@136	2-2019	Tunovà	26			

Demond	nsulti	ing E	igine	ers		Section in the Section of the		02000	-		Pa	ge l
37333330	House				175	ANDS AT MI		RSH R	OAD			
pper 0	rmond	Quay			DE	BFL REF: 1	70092				100	
ublin	7				NE	ETWORK C1					N/I	icen
ate 08	/10/20	19 14	4:53		De	esigned by	DCG				H.	
Tile CA	ATCHMEN	IT C1-	- 08.	.10.20)1 CH	hecked by	DMW				Di	rainac
Innovyz	e				Ne	etwork 201	8.1					
		STORM	1 SEW			the Modif			al M	letho	<u>d</u>	
			Pi	pe Sis	es STANDA	ARD Manhole	Sises	STANDA	RD			
		12530				lel - Scotlar	nd and	Irela	nd		0200000	ASSET 17500
		Retur	rn Pe		years)	2	344 F	7 mar /	Clim	0		(%) 10 (%) 1
					atio R 0							(m) 1.50
	M:	estimum	Rain	fall (r	mm/hr)	50	Max	imum	Backd	rop He	eight ((m) 1.50
Maximum	n Time o	of Con	centr:	ation	(mins)	30 Min Des						
	Tr.					.000 Min						
	8.0	- Lunie 61					510	- 101	oper			
					Designed	with Level 3	Soffits					
				<u>Ne</u>	twork De	esign Table	e for	<u>C1</u>				
		#	- Inc	dicate:	pipe ler	ngth does no	t match	n coor	dinat			
PN	Length	Fall	Slop	e I.Aı	ea T.E.	Base	k	EYD	DIA	Sect	ion Typ	e Auto
	(m)	(m)	(1:X) (ha) (mins)	Flow (1/s)	(mm)	SECT	(mm)			Desig
1.000	28.600	0.168	170.	2 0.0	64 5.00	0.0	0.600	۰	225	Pipe	/Condui	it 👸
					.54 0.00		0.600				/Condui	it 💣
					.09 0.00						/Condui	it 💣
					0.00	0.0	0.600	. 0	300		/Condui	
		ひっとうじ	TOT.		00 000		0 500	0.5	200	The second		
		0.267	112		.09 0.00		0.600					t 🔐
	-575-575	- 7.07.7		9 0.1	.55 0.00	0.0	0.600	۰	375	Pipe	/Condui	் ச ி
1.006 1	15.400#	0.286	53.	9 0.1		0.0	0.600	0	375 375	Pipe Pipe		it றி it றி
1.006 1	15.400#	0.286	53.	9 0.1	.55 0.00 100 0.00 100 0.00	0.0	0.600 0.600 0.600	0	375 375	Pipe Pipe	/Condui /Condui	it றி it றி
1.006 1	15.400# 14.423 Rai	0.286 0.100	53. 144.	9 0.1 8 0.0 2 0.0	.55 0.00 000 0.00 000 0.00 Network	0 0.0 0 0.0 0 0.0 C Results 1	0.600 0.600 0.600 Fable	Adid I	375 375 375	Pipe Pipe Pipe	/Condui /Condui /Condui /Condui	it of it of it of
1.006 1 1.007	15.400# 14.423 Rai	0.286	53. 144.	9 0.1 8 0.0 2 0.0	.55 0.00 000 0.00 000 0.00 Network	0 0.0 0 0.0 0 0.0 c Results 1	0.600 0.600 0.600 Fable	Adid I	375 375 375	Pipe Pipe Pipe	/Condui /Condui /Condui	it of it of it of
1.006 1 1.007	15.400# 14.423 Rai (mm/)	0.286 0.100 n T hr) (m	53. 144. .C. ins)	9 0.1 8 0.0 2 0.0	55 0.00 00 0.00 00 0.00 Network E I.Area (ha)	0 0.0 0 0.0 0 0.0 c Results : a E Base Flow (1/s)	0.600 0.600 0.600 Table Foul (1/s)	0 0 0 Add 1 (1/	375 375 375 **Tow	Pipe Pipe Pipe Vel (m/s)	/Condui /Condui /Condui /Condui	it 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1.006 1 1.007 PN 1.00	Rai (mm/) 00 44.	0.286 0.100 n T hr) (m	53. 144. .C. .ins)	9 0.1 8 0.0 2 0.0 US/IL (m)	Network E I.Area (ha)	0 0.0 0 0.0 0 0.0 c Results 1 a E Base Flow (1/s) 4 0.0	0.600 0.600 0.600 Foul (1/s)	0 0 0 Add 1 (1/	375 375 375 275 *low s) 0.8 2.4	Pipe Pipe Pipe Vel (m/s)	Cap (1/s)	it of
1.006 1 1.007 PN 1.00 1.00	Rai (mm/) 00 44. 01 40.	0.286 0.100 n T hr) (m	53. 144. .C. ins) 5.48 6.70 7.99	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.587 26.044	Network E I.Area (ha) 0.064	0 0.0 0 0.0 0 0.0 c Results 1 a E Base Flow (1/s) 4 0.0 7 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0	0 0 0 Add 1 (1/	375 375 375 275 2.4 3.8	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11	/Condui /Condui /Condui /Condui /Condui 829.7 86.3 78.3	it of
1.006 1 1.007 PN 1.00 1.00 1.00	Rai (mm/) 00 44 01 40 02 37	0.286 0.100 n T hr) (m .05 .62 .64	53. 144. .C. ins) 5.48 6.70 7.99 8.93	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.587 26.044 25.614	Network E I.Area (ha) 0.064 0.218 0.436	0 0.0 0 0.0 0 0.0 c Results 1 a E Base Flow (1/s) 4 0.0 5 0.0 7 4.5 6 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0	0 0 0 Add 1 (1/	375 375 375 275 2.4 3.8 4.7	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11 1.43	/Condui /Condui /Condui /Condui /Condui 89.7 86.3 78.3	Flow (1/s) 8.4 26.4 41.6 51.4
1.006 1 1.007 PN 1.00 1.00 1.00 1.00	Rai (mm/l 00 44 01 40 02 37 03 35 04 34	0.286 0.100 n T hr) (m .05 .62 .64 .79	53. 144. .C. ins) 5.48 6.70 7.99 8.93 9.47	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.587 26.044 25.614	Network E I.Area (ha) 0.064 0.218 0.436 0.548	0 0.0 0 0.0 0 0.0 c Results 1 a E Base Flow (1/s) 4 0.0 5 0.0 7 4.5 6 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0	0 0 0 1 Addd 1 (1/	375 375 375 275 0.8 2.4 3.8 4.7 5.6	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11 1.43 1.34	/Condui /Condui /Condui /Condui /Condui 89.7 86.3 78.3 101.4 148.3	Flow (1/s) 8.4 26.4 41.6 51.4 61.5
1.006 1 1.007 PN 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	Rai (mm/! 00 44 01 40 02 37 03 35 04 34 05 34	0.286 0.100 n T hr) (m .05 .62 .64 .79 .83	53. 144. (.C. ins) 5.48 6.70 7.99 8.93 9.47 9.77	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.847 25.614 24.866 24.626	Network Σ I.Area (ha) 0.064 0.218 0.0436 0.548	0 0.0 0 0.0 0 0.0 c Results 1 a E Base Flow (1/s) 4 0.0 7 4.5 6 4.5 5 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0 0.0	0 0 0 1 Adid 1 (1/	375 375 375 275 2.4 3.8 4.7 5.6 7.0	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11 1.43 1.34 1.70	/Condui /Condui /Condui /Condui /Condui /Condui 39.7 86.3 78.3 101.4 148.3 188.3	Flow (1/s) 8.4 26.4 41.6 51.4 61.5 76.5
1.006 1 1.007 PN 1.00 1.00 1.00 1.00 1.00	Rai (mm/) 00 44 01 40 02 37 03 35 04 34 05 34	0.286 0.100 n T hr) (m .05 .62 .64 .79 .83 .33	53. 144. .C. ins) 5.48 6.70 7.99 8.93 9.47 9.77 9.87	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.87 25.614 24.866 24.866 24.359	Network Σ I.Area (ha) 0.064 0.218 0.0436 0.548 0.700 0.700	0 0.0 0 0.0 0 0.0 c Results : a E Base Flow (1/s) 4 0.0 7 4.5 6 4.5 5 4.5 0 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0 0.0	0 0 0 1 Adid 1 (1/	375 375 375 375 0.8 2.4 3.8 4.7 5.6 7.0 7.0	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11 1.43 1.34 1.70 2.47	/Condui /Condui /Condui /Condui /Condui 89.7 86.3 78.3 101.4 148.3	Flow (1/s) 8.4 26.4 41.6 51.4 61.5 76.5 76.5
1.006 1 1.007 PN 1.00 1.00 1.00 1.00 1.00 1.00	Rai (mm/! 00 44 01 40 02 37 03 35 04 34 05 34 06 34	0.286 0.100 n T hr) (m .05 .62 .64 .79 .83 .33	53. 144. .C. ins) 5.48 6.70 7.99 8.93 9.47 9.77 9.87	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.87 25.614 24.866 24.866 24.359	Network Σ I.Area (ha) 0.064 0.218 0.0436 0.548 0.700 0.700	0 0.0 0 0.0 0 0.0 c Results : a E Base Flow (1/s) 4 0.0 7 4.5 6 4.5 5 4.5 0 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0 0.0	0 0 0 1 Adid 1 (1/	375 375 375 375 0.8 2.4 3.8 4.7 5.6 7.0 7.0	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11 1.43 1.34 1.70 2.47	Cap (1/s) 39.7 86.3 78.3 101.4 148.3 273.2	Flow (1/s) 8.4 26.4 41.6 51.4 61.5 76.5 76.5
1.006 1 1.007 PN 1.00 1.00 1.00 1.00 1.00 1.00	Rai (mm/! 00 44 01 40 02 37 03 35 04 34 05 34 06 34	0.286 0.100 n T hr) (m .05 .62 .64 .79 .83 .33	53. 144. .C. ins) 5.48 6.70 7.99 8.93 9.47 9.77 9.87	9 0.1 8 0.0 2 0.0 US/IL (m) 26.830 26.87 25.614 24.866 24.866 24.359	Network Σ I.Area (ha) 0.064 0.218 0.0436 0.548 0.700 0.700	0 0.0 0 0.0 0 0.0 c Results : a E Base Flow (1/s) 4 0.0 7 4.5 6 4.5 5 4.5 0 4.5	0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0 0.0	0 0 0 1 Adid 1 (1/	375 375 375 375 0.8 2.4 3.8 4.7 5.6 7.0 7.0	Pipe Pipe Pipe Vel (m/s) 1.00 1.22 1.11 1.43 1.34 1.70 2.47	Cap (1/s) 39.7 86.3 78.3 101.4 148.3 273.2	Flow (1/s) 8.4 26.4 41.6 51.4 61.5 76.5 76.5

MH Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	14:53 21- 08:10:20 <u>M</u>	DBF: NET Des. 1 Che Net anhole Sc ME Diam.,L*W (mm) 1200 1200 1200 1200	L REF WORK igned cked work hedul PN 1.000 1.001	by DCG by DMW 2018.1 es for Cl Pipe Out Invert Level (m) 26.830 26.587	Diemeter (mm)		Micro Drain Pipes In Invert Level (m)	Diameter	Backdr (mm)
/2019 MENT C MH Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	MH Connection Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole	NET Des Che Net anhole Sc MH Diam.,L*W (mm) 1200 1200 1200 1200	WORK igned cked work hedul PN 1.000 1.001	C1 by DCG by DMW 2018.1 es for C1 Pipe Out Invert Level (m) 26.830 26.587	Diameter (mm)		Pipes In Invert	Diameter	40.74
MH Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	MH Connection Open Manhole	Des. Che Net anhole Sc ME Diam.,L*W (mm) 1200 1200 1200 1200	igned cked work hedul PN 1.000 1.001	by DCG by DMW 2018.1 es for Cl Pipe Out Invert Level (m) 26.830 26.587	Diameter (mm)		Pipes In Invert	Diameter	40.74
MH Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	MH Connection Open Manhole	netranhole Sc MH Diam.,L*W (mm) 1200 1200 1200 1200	eked work hedul PN 1.000 1.001	by DMW 2018.1 es for Cl Pipe Out Invert Level (m) 26.830 26.587	Diameter (mm)		Pipes In Invert	Diameter	40.74
MH Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	ME Connection Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole	MH Diam.,L*W (mm)	PN 1.000 1.001 1.002	2018.1 es for C1 Pipe Out Invert Level (m) 26.830 26.587	Diameter (mm)		Pipes In Invert	Diameter	40.74
Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	ME Connection Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole	MH Diam.,L*W (mm) 1200 1200 1200 1200	PN 1.000 1.001 1.002	Pipe Out Invert Level (m) 26.830 26.587	Diameter (mm)		Invert		40.74
Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	ME Connection Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole	ME Diam.,L*W (mm) 1200 1200 1200 1200	PN 1.000 1.001 1.002	Pipe Out Invert Level (m) 26.830 26.587	Diameter (mm)		Invert		40.74
Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole	Diam.,L*W (mm) 1200 1200 1200 1200	1.000 1.001 1.002	Invert Level (m) 26.830 26.587	(mm) 225		Invert		40.74
Depth (m) 1.430 1.903 3.222 2.546 1.254 1.414 1.341	Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole Open Manhole	Diam.,L*W (mm) 1200 1200 1200 1200	1.000 1.001 1.002	Invert Level (m) 26.830 26.587	(mm) 225		Invert		40.74
1.430 1.903 3.222 2.546 1.254 1.414 1.341	Open Manhole Open Manhole Open Manhole Open Manhole	1200 1200 1200 1200	1.001 1.002	26.830 26.587	225		Level (m)	(mm)	(mm.)
1.903 3.222 2.546 1.254 1.414 1.341	Open Manhole Open Manhole Open Manhole Open Manhole	1200 1200 1200	1.001 1.002	26.587					
1.903 3.222 2.546 1.254 1.414 1.341	Open Manhole Open Manhole Open Manhole Open Manhole	1200 1200 1200	1.002		300				
3.222 2.546 1.254 1.414 1.341	Open Manhole Open Manhole Open Manhole	1200 1200	1.002			1.000	26.662	225	
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1.414		1350		25.614		300000000000000000000000000000000000000	25.614	300	
1.341	Open Manhole		1.004	24.866	375	1.003	24.941	300	
26.30	The second secon	1350	1.005	24.626	375	1.004	24.626	375	
2.427	Open Manhole	1350	1.006	24.359	375	1.005	24.359	375	
	Open Manhole	1350	1.007	24.073	375	1.006	24.073	375	
2.527	Open Manhole	0		OUTFALL		1.007	23.973	375	
Headl Sewage Numb	t Start Level oss Coeff (Glo per hectare er of Input H umber of Onlin	(mm) 0 bbal) 0.500 (1/s) 0.000 ydrographs e Controls	0 Numi	Ou ber of Stor ber of Time	per Day Run tput Inte age Struc /Area Dia	(1/per Time (1 rval (1 tures grams	/day) 0.000 nins) 6 nins) .	0	
	Sy	nthetic R	ainfa	ll Detail	Ls				
Ra	infall Model			FSR	Profil	e Type	Summer		
urn Pe	The state of the s			2					
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	Area Ho Headl Sewage Numb Nu Hum	Areal Reduction Farth of Start (no. 18 telephone) Hot Start Level to Headloss Coeff (Glossewage per hectare) Number of Input Houmber of Onlin Number of Offlin Rumber of Offlin Rainfall Model tourn Period (years) Region (MS-60 (mm)	Areal Reduction Factor 1.000 Hot Start (mins) 0 Hot Start Level (mm) 0 Headloss Coeff (Global) 0.500 Sewage per hectare (1/s) 0.000 Number of Input Hydrographs Number of Online Controls Number of Offline Controls Synthetic R Rainfall Model curn Period (years) Region Scotland an M5-60 (mm)	Areal Reduction Factor 1.000 Hot Start (mins) 0 Hot Start Level (mm) 0 Flow Headloss Coeff (Global) 0.500 Sewage per hectare (1/s) 0.000 Number of Input Hydrographs 0 Num Number of Offline Controls 1 Num Number of Offline Controls 0 Num Synthetic Rainfa Rainfall Model curn Period (years) Region Scotland and Irel M5-60 (mm) 15.	Areal Reduction Factor 1.000 MADD Fact Hot Start (mins) 0 Hot Start Level (mm) 0 Flow per Person Headloss Coeff (Global) 0.500 Sewage per hectare (1/s) 0.000 Ou Number of Input Hydrographs 0 Number of Stor Number of Online Controls 1 Number of Time Number of Offline Controls 0 Number of Real Synthetic Rainfall Detail Rainfall Model FSR curn Period (years) 2 Region Scotland and Ireland M5-60 (mm) 15.000 Storm	Areal Reduction Factor 1.000 MADD Factor * 10m3 Hot Start (mins) 0 Inlet C Hot Start Level (mm) 0 Flow per Person per Day Headloss Coeff (Global) 0.500 Run Sewage per hectare (1/s) 0.000 Output Inte Number of Input Hydrographs 0 Number of Storage Struc Number of Online Controls 1 Number of Time/Area Dia Number of Offline Controls 0 Number of Real Time Cor Synthetic Rainfall Details Rainfall Model FSR Profil Furn Period (years) 2 Cv (3 Region Scotland and Ireland Cv (W M5-60 (mm) 15.000 Storm Duration	Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storendard Maddle Matter Manner Man	Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (1/per/day) 0.000 Headloss Coeff (Global) 0.500 Run Time (mins) 60 Sewage per hectare (1/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Profile Type Summer curn Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 15.000 Storm Duration (mins) 30	Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (1/per/day) 0.000 Headloss Coeff (Global) 0.500 Run Time (mins) 60 Sewage per hectare (1/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Profile Type Summer curn Period (years) 2 Cv (Summer) 0.750 Region Scotland and Ireland Cv (Winter) 0.840 M5-60 (mm) 15.000 Storm Duration (mins) 30

DBFL Consulting Engineers		Page 3
Ormond House	LANDS AT MILL/MARSH ROAD	
Upper Ormond Quay	DBFL REF: 170092	
Dublin 7	NETWORK C1	Micco
Date 08/10/2019 14:53	Designed by DCG	Desinage
File CATCHMENT C1- 08.10.201	Checked by DMW	Drainage
Innovyze	Network 2018.1	Wit .

Online Controls for Cl

Hydro-Brake® Optimum Manhole: 24, DS/PN: 1.006, Volume (m³): 5.1

Unit Reference MD-SHE-0094-4100-1160-4100 Design Head (m) Design Flow (1/s) 1.160 4.1 Calculated Flush-Flos Objective Minimise upstream storage Application Sump Available Yes Diameter (mm) Invert Level (m) 24.359 Minimum Cutlet Pipe Diameter (mm)
Suggested Manhole Diameter (mm) 150 1200

Control Points Head (m) Flow (1/s)

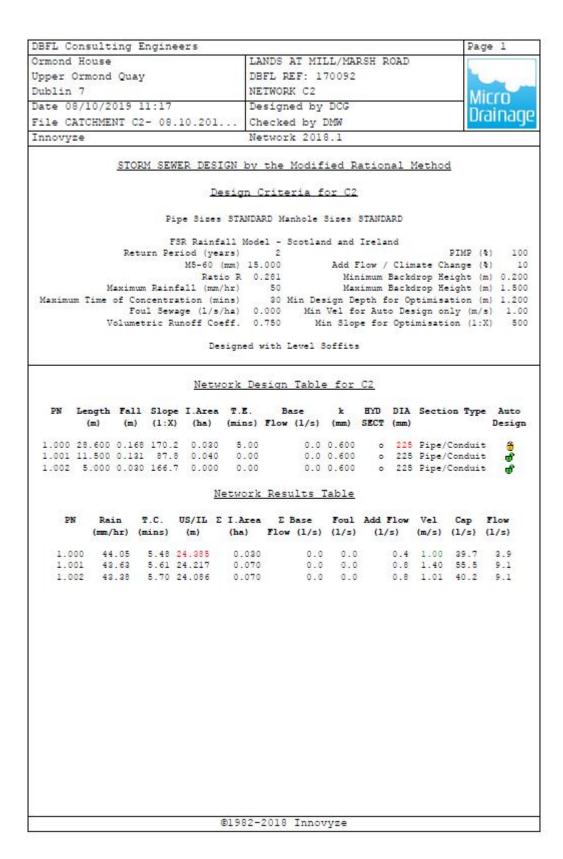
| Design Point (Calculated) | 1.160 | 4.1 | Flush-Flo²⁴ | 0.343 | 4.1 | Kick-Flo²⁹ | 0.719 | 3.3 | Mean Flow over Head Range | - 3.6

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

Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)	Depth (m) F	low (1/s)	Depth (m)	Flow (1/s)
0.100	3.0	1.200	4.2	3.000	6.4	7.000	9.5
0.200	3.9	1.400	4.5	3.500	6.9	7.500	9.8
0.300	4.1	1.600	4.8	4.000	7.3	8.000	10.2
0.400	4.1	1.800	5.0	4.500	7.7	8.500	10.4
0.500	4.0	2.000	5.3	5.000	8.1	9.000	10.7
0.600	3.8	2.200	5.5	5.500	8.5	9.500	11.0
0.800	3.5	2.400	5.7	6.000	8.9		
1.000	3.8	2.600	6.0	6.500	9.2		

	sultin	g Engine	ers		11111			Page 4
rmond Ho		A TABLE OF THE COLOR	1000000	LAN	DS AT MILL/MAR	SH RO	AD	
pper Orn	nond C	uay		DBF	L REF: 170092			
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		Climate Ch	ange (%)					, 10
			ange (≹)					, 10
		Climate Cha	850	Climate	First (X)	First		
U		Climate Cha	Return	Climate Change			(Y) First (E) Overflow
PN 1	IS/MH Name	Climate Ch:	Return Period	Change			(Y) First (E) Overflow
PN 1	JS/MH Name 30	Climate Ch: Storm 15 Winter	Return Period	Change +10%			(Y) First (E) Overflow
PN 1	JS/MH Name 30 29	Storm 15 Winter 15 Winter	Return Period	*10% +10%	Surcharge		(Y) First (E) Overflow
PN 1	JS/MH Name 30 29 28	Storm 15 Winter 15 Winter	Return Period	+10% +10% +10%			(Y) First (E) Overflow
PN 1	JS/MH Name 30 29 28 27	Storm 15 Winter 15 Winter 15 Winter	Return Period 100 100 100	+10% +10% +10%	Surcharge		(Y) First (E) Overflow
PN 1 1.000 1.001 1.002 1.003 1.004 1.005	30 29 28 27 26 25 1	Storm 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 440 Winter	Return Period 100 100 100 100 100	**D\$ +10\$ +10\$ +10\$ +10\$ +10\$ +10\$ +10\$	30/15 Summer 100/15 Summer 100/1440 Winter		(Y) First (E) Overflow
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PN 1 1.000 1.001 1.002 1.003 1.004 1.005 1.006	30 29 28 27 26 25 1 24 1	Storm 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 440 Winter	Return Period 100 100 100 100 100 100	+10% +10% +10% +10% +10% +10% +10%	30/15 Summer 100/15 Summer 100/1440 Winter		(Y) First (E) Overflow
PN 1 1.000 1.001 1.002 1.003 1.004 1.005 1.006	30 29 28 27 26 25 1 24 1	Storm 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 40 Winter 440 Winter 440 Winter	Return Period 100 100 100 100 100 100 100	Change +10% +10% +10% +10% +10% +10% +10% +10%	30/15 Summer 100/15 Summer 100/15 Summer 100/1440 Winter 30/480 Winter	Flood	(Y) First (E) Overflow
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DBFL Cons	ultin	g Engi	neers	0.00+00-110			encern enterior		Page 5
Ormond Ho				LAN	DS AT N	MILL/MAR	SH ROA	D	
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Sublin 7				NET	WORK CI				Micco
ate 08/1	0/201	9 14:5	3	Des:	igned k	y DCG			Micro
Tile CATC	HMENT	C1- 0	8.10.201.	Che	cked by	DMW			Drainag
Innovyze				Net	work 20	18.1			177
<u>s</u>		Water	Surcharged Depth	Flooded			Pipe		r Cl
PN	Name	(m)	(m)	(m°)	Cap.	(1/s)	(1/s)	Status	Exceeded
			(E	1982-20)18 Inn	ovvze			



DBFL Con	enl+in	a Fna	inears					- 1	Page 2	1	
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ME	МН	ME	MH	MH	ì	Pipe Out		É	Pipes In		F
Name	Acres and the second		Connection	THE RESERVE TO SHARE BY	PN	Invert	Dismeter	PN	Invert D	ameter	Backdr
Trust.	02 (2)	(m)	Connection	(mm)		Level (m)		8.00	Level (m)	(mm)	(mm)
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50,500,000	- Para and a		Open Manhole			24.385		l			
			Open Manhole	1		24.217		1.000		225	
			Open Manhole		1.002	24.086	225		24.086	225	1
STORMTECH	25.500	1.444	Open Manhole	0		OUTFALL		1.002	24.056	225	
			Simul	ation Cri	teria	for C2					
	Nu	mber o Number	hectare (1/s) f Input Hydro of Online Co of Offline Co	graphs 0 N ntrols 1 N	umber umber umber	of Time/Are of Real Tim	Structure	s 1 s 0) "1		
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			Ratio R		0.281			715			
			©1	982-2018	Tanas					1	

DBFL Consulting Engineers		Page 3
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 NETWORK C2	Micro
Date 08/10/2019 11:17	Designed by DCG	Desipage
File CATCHMENT C2- 08.10.201	Checked by DMW	Drainage
Innovyze	Network 2018.1	*

Online Controls for C2

Hydro-Brakes Optimum Manhole: 3, DS/PN: 1.002, Volume (m3): 2.0

Unit Reference MD-SHE-0073-2000-0600-2000 Design Head (m) 0.600 Design Flow (1/s) 2.0 Flush-Flos Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 73 Invert Level (m) 24.086 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm)

Control Points Head (m) Flow (1/s)

Design Point (Calculated) 0.600 2.0 Flush-Flos 0.177 2.0 Kick-Flos 0.397 1.7 Mean Flow over Head Range - 1.7

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

Depth (m)	Flow (1/s)						
0.100	1.9	1.200	2.7	3.000	4.2	7.000	6.3
0.200	2.0	1.400	2.9	3.500	4.5	7.500	6.5
0.200	1.9	1.600	3.1	4.000	4.8	8.000	6.7
0.400	1.7	1.800	3.3	4.500	5.1	8.500	6.9
0.500	1.8	2.000	3.5	5.000	5.3	9.000	7.1
0.600	2.0	2.200	3.6	5.500	5.6	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.8		
1.000	2.5	2.600	3.9	6.500	6.0		

DBFL Consul	ting Engi	neers						Page	4
Ormond House	9	110000	1	LANDS A	AT MILI	/MARSH	ROAD		
Upper Ormon	d Quay		1	DBFL RE	EF: 170	092			
Dublin 7			1	NETWORK	C2			Mir	
Date 08/10/	2019 11:1	7	1	Designe	ed by I	OCG:		Dra	inago
File CATCHM	ENT C2- 0	8.10.20	1	Checked	d by Di	W		Did	maye
Innovyze			1	Networ)	2018.	1		***	
Summ Manhole Foul 3	Areal Red Hot Sta Headloss C ewage per Number of Number of Rainf M	uction F. Start (r rt Level oeff (Glo hectare : Input H of Onlin of Offlin all Mode: Region 5-60 (mm or Flood Profile n(s) (mir	Result Simu actor 1. nins) (mm) obal) 0. (1/s) 0. (ydrograp e Contro e Contro Synthet n Scotla Risk War Analysis (s)	ts by lation 000 A 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Criteria ddition MADD w per Poumber of umber of fall Det FSR Ireland 15.000 m) 300 eep Coar	n Level al Flow - Factor Fa		1 Flow 0.0 torage 2.0 ecient 0.0 r/day) 0.0 s 1 s 0 s 0	000 000
20000		Change						10, 10	
US/MH PN Name 1.000 22-6 1.001 22-5 1.002 3	Storm 120 Winter 120 Winter	Period 100 100	Change +10% +10%	Surch 30/60 1	arge Winter		First (E) Overflow	Act.	Water Level (m) 24.566 24.585 24.598
		charged				Pipe			
PN	US/MH Name						Status	Level Exceeded	
		0.143				3.4	OK SURCHARGED		
	3		0.000				SURCHARGED		
			@1982	-2018	Innovy	ze			

Ormond House Jpper Ormone		-	rs							Pag	ge l
pper Ormono	2			35.55	NDS AT MIL		SH R	OAD			
Dublin 7				DB	FL REF: 17	0092				1	
ublin 7				NE	TWORK C4					M	rrn
ate 07/10/2	2019 12	:17		De	signed by	DCG				IVI	nin as
ile CATCHM	ENT C4	04.01	0.201.	Che	ecked by D	MW				Di	ainag
nnovyze				Ne	twork 2018	.1					
Maximum Time	Retu: Maximum of Con Fou	Pipe FSR rn Peri Rainfa centrat 1 Sewag	De Rainfa od (yea M5-60 (Rati ll (mm/ ion (mi e (1/s/	SIGN C STANDAI all Mode rs) mm) 15. o R 0. hr) ns)	.000	or C4 Sizes : d and Add F Min Max ign De	STANDA Irelan low / imum : imum : pth for Aut-	ARD Clim Backd Backd or Op o Des	ate Cl rop He rop He timiss ign or	PIMP (hange (leight (l	e) 1 m) 0.20 m) 1.50 m) 1.20 s) 1.0
		-	Netwo	ork Des	with Level 3	for	C4_		11-25		
		- indi	cates p	ipe ien	gth does not	match	coor	dinat	es		
	a Fall	Slope	I.Area	T.B.	Base	k	HYD	DIA		ion Typ	
PN Lengti	a Fall	Slope	I.Area	T.B.		k	HYD	DIA		ion Typ	e Auto Desig
(m) 1.000 42.800	m Fall (m)	Slope (1:X) 29.9	I.Area (ha)	T.B. (mins) 5.00	Base Flow (1/s)	k (mm) 0.600	HYD SECT	DIA (mm)	Sect	/Condui	Desig
(m) 1.000 42.800 1.001 51.200	m) # 1.430 # 2.327	Slope (1:X) 29.9 22.0	I.Area (ha) 0.078 0.078	T.B. (mins) 5.00 0.00	Base Flow (1/s)	k (mm) 0.600 0.600	HYD SECT	DIA (mm) 225 225	Sect. Pipe Pipe	/Condui /Condui	Design t d t d
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(m) 1.000 42.800 1.001 51.200 1.002 25.200 1.003 55.100	# 1.430 # 2.327 # 1.200 # 1.137	Slope (1:X) 29.9 22.0 21.0 48.5	I.Area (ha) 0.078 0.078 0.039 0.039	T.E. (mins) 5.00 0.00 0.00	Base Flow (1/s) 0.0 0.0 0.0	k (mm) 0.600 0.600 0.600	HYD SECT	DIA (mm) 225 225 225 225	Sect Pipe Pipe Pipe	/Condui /Condui /Condui /Condui	Design to the control of the control
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(m) 1.000 42.800 1.001 51.200 1.002 25.200 1.003 55.100 2.000 29.00 1.004 19.29 1.005 11.40 1.006 1.00 PN Ro (mm	# Fall (m) # 1.430 # 2.327 # 1.200 # 1.137 0 0.170 4 0.240 0 0.240 0 0.050 min T //hr) (m) 4.62	Slope (1:X) 29.9 22.0 21.0 48.5 170.6 80.4 47.5 20.0	I.Area (ha) 0.078 0.078 0.039 0.039 0.078 0.078 0.000 0.000 Ne (m) 0.744 0.314	T.H. (mins) 5.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	Base Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 Results T E Base Flow (1/s) 0.0 0.0	k (mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 Foul (1/s)	HYD SECT	DIA (mm) 225 225 225 225 225 225 225 201 201 201 201 201 201 201 201 201 201	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui Cap (1/s)	Design to \$\frac{4}{5}\$
(m) 1.000 42.800 1.001 51.200 1.002 25.200 1.003 55.100 2.000 29.00 1.004 19.29 1.005 11.40 1.006 1.00 PN Ro	# Fall (m) # 1.430 # 2.327 # 1.200 # 1.137 0 0.170 4 0.240 0 0.250 # 1.	Slope (1:X) 29.9 22.0 21.0 48.5 170.6 80.4 47.5 20.0	I.Area (ha) 0.078 0.078 0.039 0.039 0.078 0.078 0.000 0.000 Ne S/IL E (m) 0.744 0.314 0.987	T.H. (mins) 5.00 0.00 0.00 0.00 5.00 0.00 0.00 0.0	Base Flow (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Results T E Base Flow (1/s) 0.0 0.0	k (mm) 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.000	HYD SECT	DIA (mm) 225 225 225 225 225 225 200 0.9 1.8 2.3	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Vel (m/s) 2.40 2.80 2.87	/Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui Cap (1/s) 95.4 111.4	Design to \$\frac{3}{2} to \$\fr
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Orma	Consu	lting	Engineers	8					Page	2	
	nd Hou	se		L	ANDS A	T MILL/MA	RSH ROAL)			
Uppe	r Ormo	nd Qu	ay	DE	BFL RE	F: 170092			1	CO 1	
Dubl	in 7			NE	NETWORK C4 Designed by DCG Checked by DMW Micro Drainage						
Date	07/10	/2019	12:17	De							
File	CATCH	MENT	C4 04.010.	201 Ch							
Inno	vyze			Ne	etwork	2018.1					
				Manhole :	Schedu	les for C	4				
MH	МН	MH	МН	MH	Ĭ.	Pipe Out		I	Pipes In		Ĩ
Name	CL (m)	Depth (m)	Connection	Diem.,L*W	PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	(mm)	(mm)
40	32.169	1.425	Open Manhol	e 1200	1.000	30.744	225				
39	30.810	1.496	Open Manhol	e 1200	1.001	29.314	225	1.000	29.314	22	5
38	28.500	1.513	Open Manhol	e 1200	1.002	26.987		1.001		22	5
37	27.180	1.393	Open Manhol		1.003			1.002	25.787	22	5
			Open Manhol	1	1	24.820					
36	26.300	1.650	Open Manhol	.e 1200	1.004	24.650	225		24.650		
	Go Site	2.00000	58 080000 3	6 1000000	10 000			2.000		7.5	
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	VEN 200 M		Open Manhol	9390	1.006		225		24.170	-612	20
0	26.500	2.380	Open Manhol	.e 0		OUTFALL		1.006	24.120	22	
		e Headi Sewage Num N	ot Start Lev loss Coeff (e per hectar der of Input fumber of Oni mber of Offi	Global) 0.5 e (1/s) 0.0 t Hydrograph line Control	00 00 15 0 Nu 15 1 Nu	omber of Sto	Run utput Int rage Stru me/Area Di	Time erval octures agrams	(mins) (mins)	60	
				Synthetic	Rainf	all Detai	<u>ls</u>				
		R	ainfall Mode	1		FSR	Profi	le Typ	e Summer		
	Re	turn Pe	eriod (years		272	2	Cv (Summer	0.750		
			Regio M5-60 (mm	n Scotland		eland 5.000 Storm			0.840		
				• 6		0.281		-			
			Ratio	R	100						
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DBFL Consulting Engineers		Page 3
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 NETWORK C4	Mirco
Date 07/10/2019 12:17 File CATCHMENT C4 04.010.201	Designed by DCG Checked by DMW	Drainage
Innovyze	Network 2018.1	

Online Controls for C4

Hydro-Brake® Optimum Manhole: 0, DS/PN: 1.006, Volume (m³): 1.7

Unit Reference MD-SHE-0071-2000-0705-2000 Design Head (m) 0.705 Design Flow (1/s) 2.0 Flush-Flor Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 71 Invert Level (m) 24.170 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200

 Control
 Points
 Head (m)
 Flow (1/s)

 Design Point (Calculated)
 0.705
 2.0

 Flush-Flo™
 0.208
 2.0

 Kick-Flo®
 0.451
 1.6

 Mean Flow over Head Range
 1.7

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

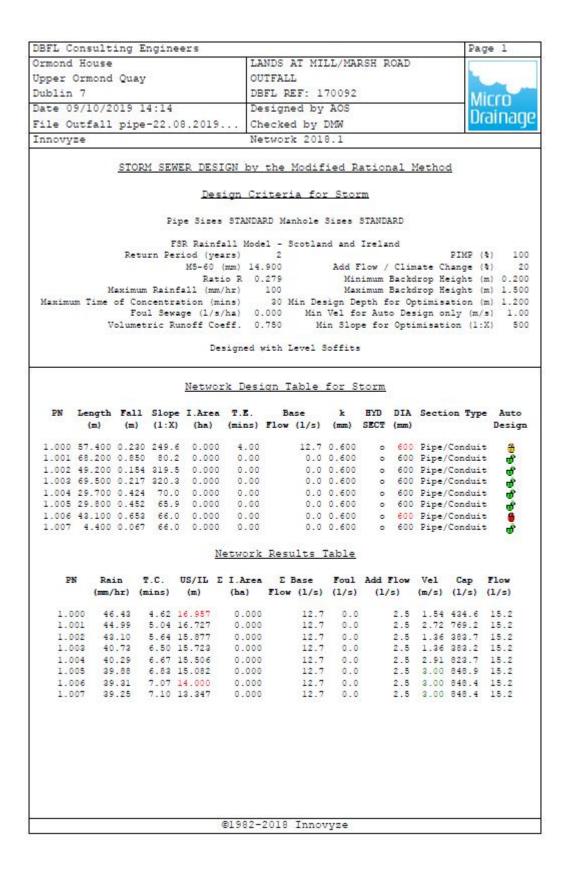
Depth (m) Flow	(1/s) D	epth (m)	Flow (1/s)	Depth (m) B	Plow (1/s)	Depth (m)	Flow (1/s)
0.100	1.8	1.200	2.5	3.000	3.9	7.000	5.8
0.200	2.0	1.400	2.7	3.500	4.2	7.500	6.0
0.300	2.0	1.600	2.9	4.000	4.4	8.000	6.2
0.400	1.8	1.800	3.1	4.500	4.7	8.500	6.4
0.500	1.7	2.000	3.2	5.000	4.9	9.000	6.6
0.600	1.9	2.200	3.4	5.500	5.2	9.500	6.7
0.800	2.1	2.400	3.5	6.000	5.4		
1.000	2.3	2.600	3.6	6.500	5.6	8	

DBFL C	onsult	ing Engi	neers						Pa	ge 4
Ormond	House			I	ANDS AT	MILL/MA	ARSH	ROAD		
Jpper	Ormond	Quay		I	BFL REF	: 170092	2			
Dublin	7			N	NETWORK	C4			100	
Date 0	7/10/2	019 12:1	7	1	Designed	by DCG				IILI U
File C	ATCHME	NT C4 04	.010.20	1 c	hecked k	ov DMW			U	rainago
Innovy					Network					
м	Summ	Areal Redi Hot Sta: Headloss Co ewage per I Number of Number o Number o Rainfo	uction F Start () rt Level oeff (Gl hectare : Input P of Onliv f Offliv all Mode Regio 5-60 (mm	Simu actor 1. mins) (mm) obal) 0. (1/s) 0. Sydrograp ne Contro e Contro Synthetil n Scotla	cs by Mai clation Cr 000 Add 0 0 500 Flow 000 ohs 0 Numb ols 1 Numb ols 0 Numb ic Rainfal and and Ir	ximum Le riteria Mitional I MADD Fac per Perso ber of St ber of Ti ber of Re 11 Detail FSR reland Cv	Flow - ctor * Ir con per corage me/Ar sal Tir s Rati (Summ	(Rank 1) % of Tota 10m³/ha 8 hlet Coeffi Day (1/pe Structures a Diagrams me Controls o R 0.281 her) 0.750 her) 0.840	l Flow (torage ; ecient (r/day) (s l s 0	0.000 2.000 0.800
		Margin fo	r Flood	Analysis	- 100	Coarse		VD Status (ia <mark>Status</mark> (
			Profile n(s) (min (s) (yea:	Analysis (s) ns) l	Timestep OTS Status	p Coarse s ON	Inert	Summer and 40, 360, 48 720, 96 1,	OFF 1 Winter	
PN	Retu US/MH	Duration arn Period Climate	Profile n(s) (min (s) (year Change	Analysis (s) (s) (s) (e) Climate	Timestep DTS Status 15, 30, 60	p Coarse 5 ON 0, 120, 1	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water ow Level
8558	Retu US/MH Name	Duration urn Period Climate Storm	Profile n(s) (min (s) (year Change Return Period	Analysis (s) ns) (e) Climate Change	Timestep DTS Status 15, 30, 60	p Coarse 5 ON 0, 120, 1	E (Y)	Summer and 40, 360, 48 720, 96 1,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water ow Level (m)
1.000	Retu US/MH Name	Duration urn Period Climate Storm	Profile n(s) (min (s) (yea Change Return Period	Analysis (s) ns) (e) Climate Change +10e	Timestep DTS Status 15, 30, 60	p Coarse 5 ON 0, 120, 1	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water Devel (m) 30.824
1.000	US/MH Name 40 39	Duration urn Period Climate Storm 15 Winter 15 Winter	Profile n(s) (min (s) (yea Change Return Period 100 100	Analysis (s) ns) (e) Climate Change +100 +100	Timestep DTS Status 15, 30, 60	p Coarse 5 ON 0, 120, 1	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water ow Level (m) 30.824 29.426
1.000 1.001 1.002	US/MH Name 40 39 38	Duration urn Period Climate Storm	Profile n(s) (min (s) (year Change Return Period 100 100	Analysis (s) ns) (e) Climate Change +10e +10e +10e	Timestep DTS Status 15, 30, 60 First (Surchar	p Coarse s ON 0, 120, 1 (X) Firs	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water Level (m) 30.824 29.426 27.120
1.000 1.001 1.002 1.003	US/MH Name 40 39 38 37	Duration arn Period Climate Storm 15 Winter 15 Winter 15 Winter	Profile n(s) (mix Change Return Period 100 100 100	Analysis [(s) ns) (limate Change +108 +108 +108 +108	Timestep DTS Status 15, 30, 60	p Coarse con	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water (m) 30.824 29.426 27.120 26.687 25.833
1.000 1.001 1.002 1.003 2.000	US/MH Name 40 39 38 37 36-1 36	Duration urn Period Climate Storm 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter	Profile n(s) (mix Change Return Period 100 100 100 100 100	Analysis [(s) ns) [(e) Climate Change +10e +10e +10e +10e +10e +10e	Timester DTS Status 15, 30, 60 First (Surchar 30/15 Win 30/15 Sur 30/15 Sur	Coarse CN	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water CW Level (m) 30.824 29.426 27.120 26.687
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1.000 1.001 1.002 1.003 2.000 1.004 1.005	US/MH Name 40 39 38 37 36-1 36 35	Duration urn Period Climate Storm 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter 15 Winter	Profile n(s) (min (s) (yea Change Return Period 100 100 100 100 100 100	Analysis [(s) ns) [(e) Climate Change +10e +10e +10e +10e +10e +10e +10e +10	Timester DTS Status 15, 30, 60 First (Surchar 30/15 Win 30/15 Sur 30/15 Sur	p Coarse s ON 0, 120, 1 (X) Firs rge Fl	E (Y)	Summer and 40, 360, 48 720, 96 1, 10,	OFF Ninter 10, 600, 50, 1440 30, 100 10, 10	Water Level (m) 30.824 29.426 27.120 26.687 25.832 25.766 24.934
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DBFL Consulting Engineers		Page 5
Ormond House Upper Ormond Quay Dublin 7	LANDS AT MILL/MARSH ROAD DBFL REF: 170092 NETWORK C4	
Date 07/10/2019 12:17	Designed by DCG	Desipose
File CATCHMENT C4 04.010.201	Checked by DMW	Drainage
Innovyze	Network 2018.1	

Summary of Critical Results by Maximum Level (Rank 1) for C4

		Surcharged	Flooded			Pipe		
	US/MH	Depth	Volume	Flow /	Overflow	Flow		Level
PN	Name	(m)	(m²)	Cap.	(1/s)	(1/s)	Status	Exceeded
1.006	0	0.467	0.000	0.06		2.0	SURCHARGED	



DBFL	Consu	lting	Engineers						Page	2	
Ormon	d Hou	se		LA	NDS A	T MILL/M	ARSH ROA	D			
Upper	Ormo	nd Qu	ay	OU	TFALL						
Dubli	n 7			DE	DBFL REF: 170092 MICCO						
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Innov	yze			Ne	twork	2018.1			(3)	-	
			<u>M</u>	anhole Sc	hedul	es for St	orm				
MH	MH	МЕ	МЕ	МЕ	1	Pipe Out		1	Pipes In		ł
Name 0	CL (m)	Depth	Connection	10.00	PN		Diameter	PN		200	Backdrop
	-	(m)		(mm)		Level (m)	(mm)		Level (m)	(mm)	(mm)
508 1	19.880	2.923	Open Manhole	1500	1.000	16.957					
F-60 10		1000	Open Manhole	1,745,646	1.001	16.727	600	1.000	16.727	600	
200		43377.00	Open Manhole		1.002			1.001		3500	
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0.000		100000000000000000000000000000000000000	Open Manhole		1.004			1.003		6.00	
200		100	Open Manhole		1.005			1.004		200	1
			Open Manhole	1	1	14.000		1.005			1
			Open Manhole		1.007			1.006			1
500 1	15.000	1.720	Open Manhole	. 0		OUTFALL		1.007	13.280	600	
				@1 CO 2	2010	Innovyze					

Appendix D

OPERATION AND MAINTENANCE OF SUDS FEATURES

HYDRO-BRAKE® FLOW CONTROL MAINTENANCE AND SAFETY DATA SHEET

MAINTENANCE

Normally, little maintenance is required as there are no moving parts within the Hydro-Brake[®] Flow Control. Experience has shown that if blockages occur they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. Hydro-Brake[®] Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. The smaller type conical units, below the minimum recommended size, are also supplied with roding facilities or vortex suppressor pipes as standard.

Following installation of the Hydro-Brake⁶ Flow Control it is vitally important that any extraneous material i.e. Building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced please do not hesitate to contact the company so that an investigation may be made.

Hydro-Brake[®] Flow Controls are typically manufactured from grade 304 Stainless Steel which has an estimated life span in excess of the design life of drainage systems.

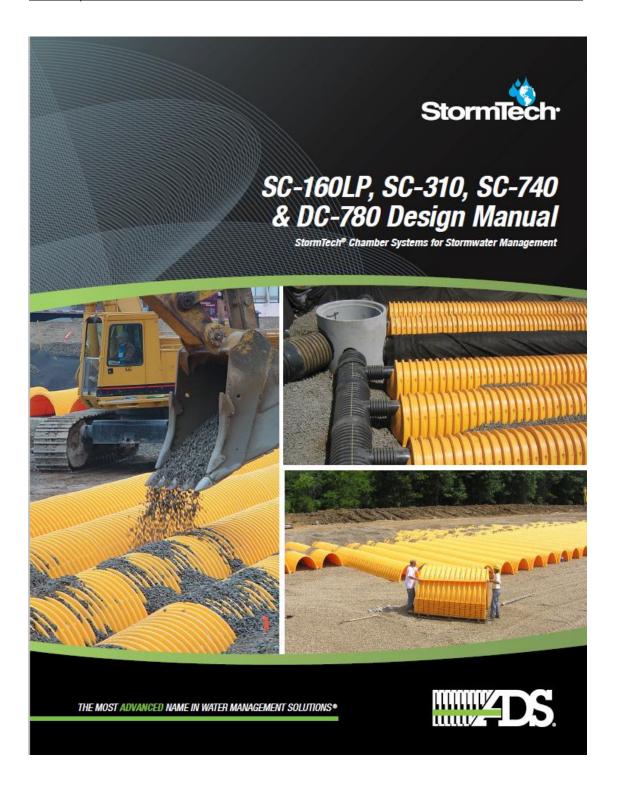


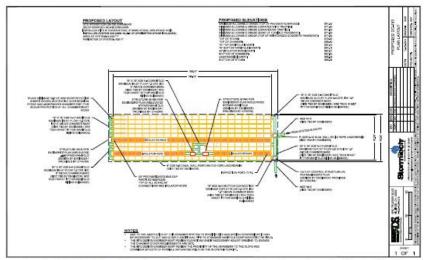


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The StormTech Technical Services Department assists design professionals in specifying StormTech storm water systems. This assistance includes the layout of chambers to meet the engineer's volume requirements and the connections to and from the chambers. The Technical Department can also assist converting and cost engineering projects currently specified with ponds, pipe, concrete and other manufactured storm water detention/retention products. Please note that it is the responsibility of the design engineer to ensure that the chamber bed layout meets all design requirements and is in compliance with applicable laws and regulations governing this project.



This manual is exclusively intended to assist engineers in the design of subsurface stormwater systems using StormTech chambers.

Call StormTech at 860.529.8188 or 888.892.2694 or visit our website at www.stormtech.com for technical and product information.

^{*} For MC-3500 and MC-4500 designs, please refer to the MC-3500/MC-4500 Design Manual.

1.0 Introduction

1.1 INTRODUCTION

StormTech stormwater management systems allow storm water professionals to create more profitable, environmentally sound developments. Compared with other subsurface systems, StormTech systems offer lower overall installed cost, superior design flexibility and enhanced performance. Applications include commercial, residential, agricultural and highway drainage.

StormTech has invested over \$10 million and many years in the development of StormTech chambers. These innovative products exceed the rigorous requirements of the standards governing the design of thermoplastic structures.

1.2 THE GOLD STANDARD IN STORMWATER MANAGEMENT

The advanced designs of StormTech chambers were created by implementing an aggressive research, development, design and manufacturing protocol. StormTech chamber products establish the new gold standard in stormwater management through:

- Collaborations with experts in the field of buried plastic structures and polyolefin materials
- The development and utilization of new testing methods and proprietary test methods
- The use of thermoformed prototypes to verify engineering models, perform in-ground testing and install observation sites
- The investment in custom-designed, injection molding equipment
- The utilization of polypropylene and polyethylene as manufacturing materials
- The design of molded-in features not possible with traditional thermoformed chambers

Section 3.0 of this design manual, Structural Capabilities, provides a detailed description of the research, development and design process.

Many of StomTech's unique chamber features can benefit a site developer, stormwater system designer, and installer. Where applicable, StormTech Product Specifications are referenced throughout this design manual. If StormTech's unique product benefits are important to a stormwater system design, consider including the applicable StormTech Product Specifications on the site plans. This can prevent substitutions with inferior products. Refer to Section 14.0, StormTech Product Specifications.

1.3 PRODUCT QUALITY AND DESIGN TO INTERNATIONAL STANDARDS

StormTech chambers are designed to meet the full scope of design requirements of Section 12.12 of the AASHTO LRFD Bridge Design Specifications and produced to the requirements of the American Society of Testing Materials (ASTM) International specifications F2418 (polypropylene chambers) and F2922 (polyethylene chambers).

StormTech chambers provide the full AASHTO safety factors for live loads and permanent earth loads. The two ASTM standards mentioned previously are linked to the AASHTO LRFD Bridge Design Specifications Section 12.12 design standard. Both ASTM standards require that the safety factors included in the AASHTO guidance are achieved as a prerequisite to meeting either ASTM F2418 or ASTM F2922. StormTech chambers are also designed in accordance with ASTM F2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers" which provides specific guidance on how to design thermoplastic chambers in accordance with AASHTO Section 12.12. These standards provide both the assurance of product quality and safe structural design.

For non-proprietary specifications for public bids that ensure high product quality and safe design, consider including the specification in Section 15.0 Chamber Specifications for Contract Documents.

1.4 TECHNICAL SUPPORT FOR PLAN REVIEWS

StormTech's in-house technical support staff is available to review proposed plans that incorporate StormTech chamber systems. They are also available to assist with plan conversions from existing products to StormTech. Not all plan sheets are necessary for StormTech's review. Required sheets include plan view sheet(s) with design contours, cross sections of the stormwater system including catch basins and drainage details.

When specifying StormTech chambers it is recommended that the following items are included in project plans: StormTech chamber system General Notes, applicable StormTech chamber illustrations and StormTech chamber system Product Specifications. These items are available in various formats and can be obtained by contacting StormTech at 1-860-529-8188 or may be downloaded at www.stormtech.com.

StormTech's plan review is limited to the sole purpose of determining whether plans meet StormTech chamber systems' minimum requirements. It is the ultimate responsibility of the design engineer to assure that the stormwater system's design is in full compliance with all applicable laws and regulations. StormTech products must be designed and installed in accordance with StormTech's minimum requirements.

SEND PLANS TO:

E-mail: info@stormtech.com.

Call StormTech at 860.529.8188 or 888.892.2694 or visit our website at www.stormtech.com for technical and product information.

2.0 Product Information



2.1 PRODUCT APPLICATIONS

StormTech chamber systems may function as stormwater detention, retention, first-flush storage, or some combination of these. The StormTech chambers can be used for commercial, municipal, industrial, recreational, and residential applications especially for installations under parking lots and commercial roadways.

One of the key advantages of the StormTech chamber system is its design flexibility. Chambers may be configured into beds or trenches of various sizes or shapes. They can be centralized or decentralized, and fit on nearly all sites. Chamber lengths enhance the ability to develop on both existing and pre-developed projects. The systems can be designed easily and efficiently around utilities, natural or man-made structures and any other limiting boundaries.

2.2 CHAMBERS FOR STORMWATER DETENTION

Chamber systems have been used effectively for storm water detention for over 15 years. A detention system temporarily holds water while it is released at a defined rate through an outlet. While some infiltration may occur in a detention system, it is often considered an environmental benefit and a storage safety factor. Over 70% of StormTech's installations are non-watertight detention systems. There are only a few uncommon situations where a detention system might need to limit infiltration: the subgrade soil's bearing capacity is significantly affected by saturation such as with expansive clays or karst soils, and; in sensitive aquifer areas where the depth to groundwater does not meet local guidelines. Adequate pretreatment could eliminate concerns for the latter case. A thermoplastic liner may be considered for both situations to limit infiltration.

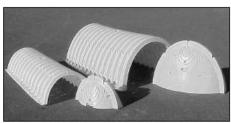
2.3 STONE POROSITY ASSUMPTION

A StormTech chamber system requires the application of clean, crushed, angular stone below, between and above the chambers. This stone serves as a structural component while allowing conveyance and storage of stormwater. Storage volume examples throughout this Design Manual are calculated with an assumption that the stone has an industry standard porosity of 40%. Actual stone porosity may vary. Contact StormTech for information on calculating storm water volumes with varying stone porosity assumptions.

2.4 CHAMBER SELECTION

Primary considerations when selecting between the SC-160LP, SC-310, SC-740 and DC-780 chambers are the depth to restrictive layer, available area for subsurface storage, cover height and outfall restrictions.

The StormTech SC-160LP chamber shown on page 4 is the smallest of the chamber family and has been optimized to fit in the shallowest of applications. This extra low profile chamber allows for storage of 1.01 ft⁸/ft² (0.3m⁹/m⁹) [minimum] of storage.



The SC-310 and SC-740 chambers and end plates.



StormTech systems can be integrated into retrofit and new construction projects.

The StormTech SC-310 chamber shown on page 6 is ideal for systems requiring low-rise and wide-span solutions. This low profile chamber allows the storage of large volumes, 1.3 ft³/ft² (0.40 m³/m²) [minimum], at minimum depths.

Like the Stormtech SC-310, the StormTech SC-310-3 found on page 8 allows for a design option for sites with both limited cover and limited space. With only 3" of spacing between the chambers, the SC-310-3 still provides 1.3 ft⁹/ft² (0.40 m⁹/m⁹) [minimum] of storage.

The StormTech SC-740 chamber shown on page 10 optimizes storage volumes in relatively small footprints. By providing 2.2 ft³/ft² (0.67 m³/m²) [minimum] of storage, the SC-740 chambers can minimize excavation, backfill and

The DC-780 chamber shown on page 12 has been developed for those applications which exceed the maximum 8 ft (2.44 m) burial depth of the SC-740 and SC-310 chambers. The DC-780 is a modified version of the SC-740 allowing it to reach a maximum burial depth of 12 ft (3.66 m). The design of the DC-780 chamber, like other StormTech chambers, is designed and manufactured in accordance with the AASHTO LRFD Bridge Design Specifications as well as ASTM F 2418 and ASTM F 2787 ensuring structural adequacy for deeper systems.

The end corrugations of the DC-780 chamber have not been modified in order to allow connections to the SC-740 chamber. This will allow hybrid systems utilizing both chambers in one system design.

Call StormTech at 860.529.8188 or 888.892.2694 or visit our website at www.stormtech.com for technical and product information.

3

StormTech SC-160LP Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for commercial and municipal applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

The SC-160LP chamber was developed for infiltration and detention in shallow cover applications

- . Only 14" (350 mm) required from top of chamber to bottom of pavement
- Only 12" (300 mm) tall
- Installs toe to toe—no additional spacing between rows

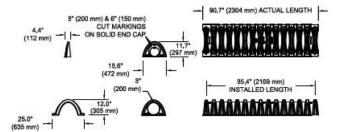
StormTech SC-160LP (not to scale)

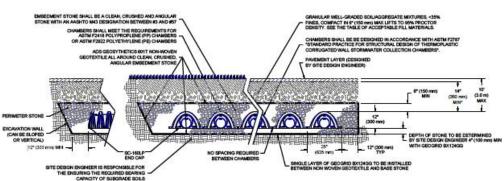
Nominal Chamber Specifications

Size (LxWxH)	85.4" x 25.0" x 12.0" (2170 x 635 x 305 mm)
Chamber Storage	6.85 ft ³ (0.19 m ³)
Min. Installed Storage*	15.0 ft ³ (0.42 m ³)
Weight	24.0 lbs. (10.9 kg)

*Assumes 6° (150 mm) stone above, 4" (100 mm) below and stone between chambers with 40% stone porosity







"MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 20" (\$10 mm).

THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

4 Call StormTech at 860.529.8188 or 888.892.2694 or visit our website at www.stormtech.com for technical and product information.



SC-160LP Cumlative Storage Volumes per chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 4" (100 mm) Stone Base Under Chambers.

Depth of Water in ystem Inches (mm)		e Chamber e ft² (m²)	Total System Cumulative Storage ft ³ (m ³)
22 (559)	A	6.85 (0.194)	14.98 (0.424)
21 (533)	-	6.85 (0.194)	14.49 (0.410)
20 (508)	Stone	6.85 (0.194)	14.00 (0.396)
19 (483)	Cover	6.85 (0.194)	13.50 (0.382)
18 (457)		6.85 (0.194)	13.01 (0.368)
17 (432)	*	6.85 (0.194)	12.51 (0.354)
16 (406)		6.85 (0.194)	12.02 (0.340)
15 (381)		6.80 (0.193)	11.49 (0.325)
14 (356)		6.67 (0.189)	10.92 (0.309)
13 (330)		6.38 (0.181)	10.25 (0.290)
12 (305)		5.94 (0.168)	9.49 (0.269)
11 (279)		5.40 (0.153)	8.67 (0.246)
10 (254)		4.78 (0.135)	7.81 (0.221)
9 (229)		4.10 (0.116)	6.91 (0.196)
8 (203)		3.36 (0.095)	5.97 (0.169)
7 (178)		2.58 (0.073)	5.01 (0.142)
6 (152)		1.76 (0.050)	4.02 (0.114)
5 (127)	100	0.89 (0.025)	3.01 (0.085)
4 (102)	*	0 (0)	1.98 (0.056)
3 (76)	Stone	0 (0)	1.48 (0.042)
2 (51)	Foundation	0 (0)	0.99 (0.028)
1 (25)	*	0 (0)	0.49 (0.014)

Note: Add 0.49 ft³ (0.014 m³) of storage for each additional inch (25 mm) of stone foundation.

Amount of Stone Per Chamber

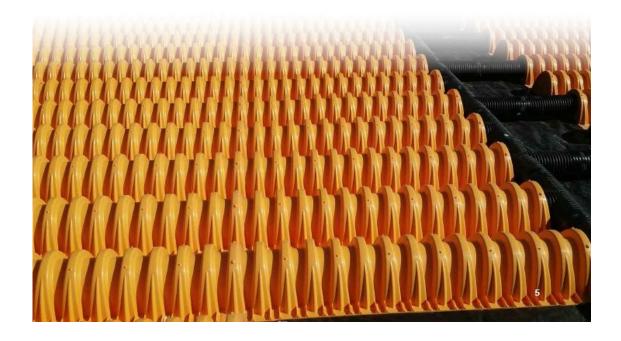
ENGLISH TONS (yds²)	Stone Foundation Depth		
		87	8"
StormTech SC-160LP	1.1 (0.8)	1.2 (0.9)	1.3 (0.9)
METRIC KILDGRAMS (III*)	100 mm	150 mm	200 mm
StormTech SC-160LP	952 (0.7)	1,074 (0.8)	1,197 (0.8)

Note: Assumes 6" (150 mm) of stone above and only embedment stone between chambers.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	4" (100)	8" (200)	12" (300)	
StormTech SC-160LP	1.4 (1.1)	1.6 (1.2)	1.8 (1.3)	

Note: Assumes no row separation and 14° (350 mm) of cover. The volume of excavation will vary as depth of cover increases.



StormTech SC-310 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

StormTech SC-310 Chamber (not to scale) Nominal Chamber Specifications

85.4° x 34.0° x 16.0° (2170 x 864 x 406 mm)
14.7 ft ³ (0.42 m ³)
31.0 ft ³ (0.88 m ³)
37.0 lbs (16.8 kg)

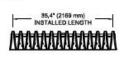
"Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.

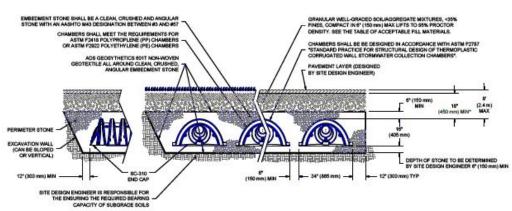
Shipping

41 chambers/pallet 108 end caps/pallet 18 pallets/truck









"MINIMAIN COVER TO BOTTOM OF PLEXIBLE PAVEMENT. FOR UMPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 34" (800 mm).
THE INSTALLED CHAMBER SYSTEM SHAPE PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LIFT BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.



SC-310 CUMLATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in ystem inches (mm)	Cumulative Chambe Storage ft ³ (m ³)	r Total System Cumulative Storage ft ⁵ (m²)
28 (711)	14.70 (0.41	6) 31.00 (0.878)
27 (696)	14.70 (0.41	6) 30.21 (0.855)
26 (680)	Stone 14.70 (0.41	6) 29.42 (0.833)
25 (610)	Cover 14.70 (0.41	6) 28.63 (0.811)
24 (609)	14.70 (0.41	6) 27.84 (0.788)
23 (584)	14.70 (0.41	6) 27.05 (0.766)
22 (559)	14.70 (0.41	6) 26.26 (0.748)
21 (533)	14,64 (0.41	5) 25.43 (0.720)
20 (508)	14.49 (0.41	0) 24.54 (0.695)
19 (483)	14.22 (0.40	3) 23.58 (0.668)
18 (457)	13.68 (0.38	7) 22.47 (0.636)
17 (432)	12.99 (0.36	8) 21.25 (0.602)
16 (406)	12.17 (0.34	5) 19.97 (0.566)
15 (381)	11.25 (0.31	9) 18.62 (0.528)
14 (356)	10.23 (0.29	0) 17.22 (0.488)
13 (330)	9.15 (0.26	0) 15.78 (0.447)
12 (305)	7.99 (0.22	7) 14.29 (0.425)
11 (279)	6.78 (0.19	2) 12.77 (0.362)
10 (254)	5.51 (0.15	6) 11.22 (0.318)
9 (229)	4.19 (0.11	9) 9.64 (0.278)
8 (203)	2.83 (0.08	1) 8.03 (0.227)
7 (178)	1.43 (0.04	1) 6.40 (0.181)
6 (152)	*	0 4.74 (0.134)
5 (127)		0 3.95 (0.112)
4(102)	Stone Foundation	0 3.16 (0.090)
3 (76)	Some Foundation	0 2.37 (0.067)
2 (51)		0 1.58 (0.046)
1 (25)	*	0 0.79 (0.022)

Note: Add 0.79 ft³ (0.022 m²) of storage for each additional inch. (25 mm) of stone foundation.

Storage Volume Per Chamber ft⁸ (m³)

	Bare Chamber Storage ft³ (m²)		hamber and S dation Depth i	
		8 (150)	12 (300)	18 (450)
StormTech SC-310	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

Note: Assumes 6" (150 mm) of stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

	Stor	e Foundation D	epth
IGLISH TONS (yds²)		12"	18"
StormTech SC-310	2.1 (1.5 yd²)	2.7 (1.9 yd²)	3.4 (2.4 yd²)
ETRIC KILOGRAMS (ISP)	150 mm	300 mm	450 mm
StormTech SC-310	1,830 (1.1 m²)	2,490 (1.5 m²)	2,990 (1.8 m²

Volume Excavation Per Chamber yd3 (m3)

	Stone Foundation Depth		
	0° (150 mm)	12" (300 mm)	18" (450 mm)
StormTech SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as the depth of the cover increases.



StormTech SC-310-3 Chamber

The proven strength and durability of the SC-310-3 Chamber allows for a design option for sites where limited cover, limited space, high water table and escalated aggregate cost are a factor. The SC-310-3 has a minimum cover requirement of 16" (400 mm) to bottom of flexible pavement and reduces the spacing requirement between chambers by 50% to 3" (76 mm). This provides a reduced footprint overall, reduces aggregate needed, and allows the designer to offer a traffic bearing application yet comply with water table separation regulations. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending

the service life of these practices.

StormTech SC-310-3 Chamber (not to scale) Nominal Chamber Specifications

Size (Lx W x H)	85.4° x 34.0° x 16.0° (2,170 x 864 x 406 mm)
Chamber Storage	14.7ft ³ (0.42 m ³)
Min. Installed Storage*	29.3 ft ³ (0.83 m ³)
Weight	37.0 lbs (16.8 kg)

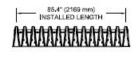
"Assumes 6" (150 mm) stone above and below chambers, 3" (76 mm) row spacing and 40% stone porosity.

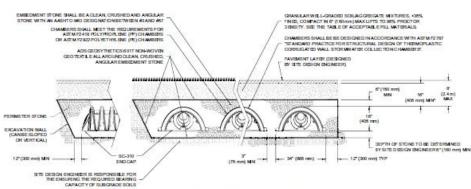
Shipping

41 chambers/pallet 108 end caps/pallet 18 pallets/truck









MINIMUM COVER TO BOTTOM OF FLEXUELE PAVEMENT. FOR UNPAVED IN STALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (800 mm).

THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LIFTD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.



SC-310-3 CUMLATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6"

(150 mm) Stone Base Under Chambers.

Depth of Water in ystem Inches (mm)	Cumulative Storage		Total System Cumulative Storage ft³ (m²)
28 (711)	A .	14.70 (0.416)	29.34 (0.831)
27 (686)	3	14,70 (0.416)	28.60 (0.810)
26 (660)	Stone	14.70 (0.416)	27.87 (0.789)
25 (635)	Cover	14.70 (0.416)	27.14 (0.769)
24 (610)		14.70 (0.416)	26.41 (0.748)
23 (584)	*	14.70 (0.416)	25.68 (0.727)
22 (559)		14.70 (0.416)	24.95 (0.707)
21 (533)	1	4.64 (0.415)	24.18 (0.685)
20 (508)	1	4.49 (0.410)	23.36 (0.661)
19 (483)	1	4.22 (0.403)	22.47 (0.636)
18 (457)	1	3.68 (0.387)	21.41 (0.606)
17 (432)	1	2.99 (0.368)	20.25 (0.573)
16 (406)	1	2.17 (0.345)	19.03 (0.539)
15 (381)	1	11.25 (0.319)	17.74 (0.502)
14 (356)	1	0.23 (0.290)	16.40 (0.464)
13 (330)		9.15 (0.260)	15.01 (0.425)
12 (305)		7.99 (0.226)	13.59 (0.385)
11 (279)		6.78 (0.192)	12.13 (0.343)
10 (254)	3	5.51 (0.156)	10.63 (0.301)
9 (229)		4.19 (0.119)	9.11 (0.258)
8 (203)		2.83 (0.080)	7.56 (0.214)
7 (178)		1.43 (0.041)	5.98 (0.169)
6 (152)	A	0 (0)	4.39 (0.124)
5 (127)		0 (0)	3.66 (0.104)
4 (102)	Stone	0 (0)	2.93 (0.083)
3 (76)	Foundation	0 (0)	2.19 (0.062)
2 (51)		0 (0)	1.46 (0.041)
1 (25)	-	0 (0)	0.73 (0.021)

Note: Add 0.73 ft³ (0.021 m³) of storage for each additional inch (25 mm) of stone foundation

Storage Volume Per Chamber ft⁸ (m³)

	Barn Chamber Storage ft ² (m ²)		hamber and S dation Depth i	
		6 (150)	12 (300)	18 (450)
SC-310-3 Chamber	14.7 (0.42)	29.3 (0.83)	33.7 (0.95)	38.1 (1.08)

Note: Assumes 6° (150 mm) of stone above chambers, 3" (76 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

AND DESCRIPTION OF THE PARTY OF	Stor	e Foundation D	iopth
ENGLISH TONS (yds*)	8"	12"	16"
SC-310-3	1.9 (1.4)	2.5 (1.8)	3.1 (2.2)
METRIC KILOGRAMS (m²)	150 mm	300 mm	450 mm
SC-310-3	1,724 (1.0)	2,268 (1.3)	2,812 (1.7)

Note: Assumes 6" (150 mm) of stone above and and 3" (76 mm) row spacing.

Volume Excavation Per Chamber yd3 (m3)

	Stone Foundation Depth		
	8 (150)	12 (300)	18 (450)
SC-310-3	2.6 (2.0)	3.0 (2.0)	3.4 (2.6)

Note: Assumes 3" (76 mm) of row separation and 6" (150 mm) of stone above the chambers and 16" (400 mm) of cover. The volume of excavation will vary as depth of cover increases



StormTech SC-740 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a costeffective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

StormTech SC-740 Chamber (not to scale) **Nominal Chamber Specifications**

85.4" x 51.0" x 30.0" (2,170 x 1,295 x 762 mm) Size (Lx W x H) Chamber Storage 45.9 ft3 (1.30 m3) 74.9 ft3 (2.12 m3) Min. Installed Storage 74.0 lbs (33.6 kg) Weight

*Assumes 8" (150 mm) stone above, below and between chambers and 40% stone porosity.

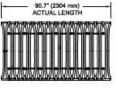
Shipping

30 chambers/pallet

60 end caps/pallet

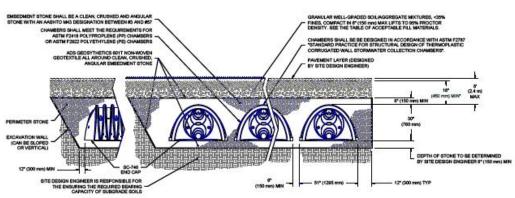
12 pallets/truck











THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LAFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.



SC-740 CUMLATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6"

(150 mm) Stone Base Under Chambers.

Depth of Water in ystem Inches (mm)	Cumulative Chamber Storage ft ¹ (m ²)	Total System Cumulativ Storage ft³ (m²)
42 (1067)	45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone 45.90 (1.300)	72.64 (2.057)
39 (991)	Cover 45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (940)	45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1,269)	62.97 (1.783)
31 (787)	44.01 (1.246)	61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1,365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	1.85 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37,47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	A 0(0)	6.76 (0.191)
5 (127)	0 (0)	5.63 (0.160)
4 (102)	Stone 0 (0)	4.51 (0.128)
3 (76)	Foundation 0 (0)	3.38 (0.096)
2 (51)	0 (0)	2.25 (0.064)
1 (25)	V 0(0)	1,13 (0.032)

Note: Add 1.13 ft¹ (0.032 m²) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft3 (m3)

	Bare Chamber Storage ft ² (m²)		hamber and S idation Depth	
		8 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

Calculated winds	Stor	e Foundation D	lepth
ENGLISH TONS (yds²)	e"	12"	18"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m²)	150 mm	300 mm	450 mm
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6° (150 mm) of stone above and between chambers.

Volume Excavation Per Chamber yd3 (m3)

	St	one Foundation D	epth
	8 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.



StormTech DC-780 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

- · 12' (3.6 m) Deep Cover Applications
- Designed in accordance with ASTM F2787 and produced to meet the ASTM 2418 product standard.
- AASHTO safety factors provided for AASHTO Design Truck (H2O and deep cover conditions.)



90,7* (2304 mm) ACTUAL LENGTH

StormTech DC-780 Chamber (not to scale) Nominal Chamber Specifications

 Size (Lx W x H)
 85.4" x 51.0" x 30.0" (2169 x 1295 x 762 mm)

 Chamber Storage
 46.2 ft³ (1.30 m²)

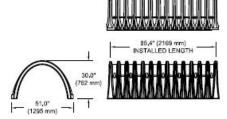
 Min. Installed Storage*
 78.4 ft³ (2.2 m²)

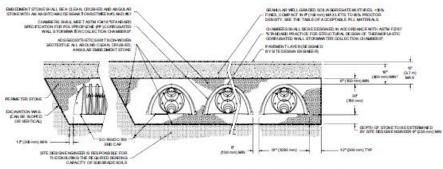
*Assumes 9" (230 mm) stone below, 6" (150 mm) stone above, 6" (150 mm) row spacing and 40% stone porosity.

Shipping

24 chambers/pallet 60 end caps/pallet

12 pallets/truck





"MINIMUM CONFIRTO BIOTOMICE PLEASE PAYEMENT. FOR UNPAYED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, NORE ASE COVER TO 24° (NO min).

THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LIFTD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.



DC-780 Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 9" (230 mm) Stone Base Under Chambers.

Depth of Water in		tive Chamber	Total System Cumulative
System inches (mm)	Stora	ge ft² (m²)	Storage ft³ (m³)
45 (1,143)	A	46.27 (1.310)	78.47 (2.222)
44 (1,118)	_	46.27 (1.310)	77.34 (2.190)
43 (1,092)	Stone	46.27 (1.310)	76.21 (2.158)
42 (1,067)	Cover	46.27 (1.310)	75.09 (2.126)
41 (1,041)		46.27 (1.310)	73.96 (2.094)
40 (1,016)	*	46.27 (1.310)	72.83 (2.062)
39 (991)	1	48.27 (1.310)	71.71 (2.030)
38 (965)		46.21 (1.309)	70.54 (1.998)
37 (940)	1	46.04 (1.304)	69.32 (1.963)
36 (914)		45.76 (1.296)	68.02 (1.926)
35 (889)		45.15 (1.278)	66.53 (1.884)
34 (864)	-	44.34 (1.255)	64.91 (1.838)
33 (838)		43.38 (1.228)	63.21 (1.790)
32 (813)		42.29 (1.198)	61.43 (1.740)
31 (787)	1	41.11 (1.164)	59.59 (1.688)
30 (762)		39.83 (1.128)	57.70 (1.634)
29 (737)	T.	38.47 (1.089)	55.76 (1.579)
28 (711)		37.01 (1.048)	53.76 (1.522)
27 (686)		35.49 (1.005)	51.72 (1.464)
26 (660)		33.90 (0.960)	49.63 (1.405)
25 (635)		32.24 (0.913)	47.52 (1.346)
24 (610)		30.54 (0.865)	45.36 (1.285)
23 (584)	4	28.77 (0.815)	43.18 (1.223)
22 (559)		26.96 (0.763)	40.97 (1.160)
21 (533)		25.10 (0.711)	38.72 (1.096)
20 (508)		23.19 (0.657)	36.45 (1.032)
19 (483)		21.25 (0.602)	34.16 (0.967)
18 (457)	-	19.26 (0.545)	31.84 (0.902)
17 (432)		17.24 (0.488)	29.50 (0.835)
16 (406)		15.19 (0.430)	27.14 (0.769)
15 (381)		13.10 (0.371)	24.76 (0.701)
14 (356)		10.98 (0.311)	22.36 (0.633)
13 (330)	N.	8.83 (0.250)	19.95 (0,565)
12 (305)		6.66 (0.189)	17.52 (0.496)
11 (279)		4.46 (0.126)	15.07 (0.427)
10 (254)		2.24 (0.064)	12.61 (0.357)

Depth of Water in System Inches (mm)	Cumulative Cha Storage ft ² (n		Total System Cumulative Storage ft ³ (m ³)
9 (229)	A	0 (0)	10.14 (0.287)
8 (203)		0 (0)	9.01 (0.255)
7 (178)		0 (0)	7.89 (0.223)
6 (152)	Leave Constitution	0 (0)	6.76 (0.191)
5 (127)	Stone Foundation	0 (0)	5.63 (0.160)
4 (102)	9	0 (0)	4.51 (0.128)
3 (76)		0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)	*	0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of Storage for Each Additional Inch (25 mm) of Stone Foundation.

Storage Volume Per Chamber ft3 (m3)

	Bare Chamber		Chamber and St Indation Depth in	
	Storage ft² (m²)	9" (230 mm)	12° (300 mm)	18" (450 mm
DC-780 Chamber	78.4 (2.2)	78.4 (2.2)	81.8 (2.3)	88.6 (2.5)

Note: Assumes 40% porosity for the stone, the bare chamber volume, 6" (150 mm) of stone above, and 6" (150 mm) row spacing.

Amount of Stone Per Chamber

	Stone Foundation Depth										
ENGLISH TONS (yds')	1 1 97/	12"	18"								
DC-780 Chamber	4.2 (3.0)	4.7 (3.3)	5.6 (3.9)								
METRIC KILOGRAMS (m²)	230 mm	300 mm	450 mm								
DC-780 Chamber	3.810 (2.3)	4,264 (2.5)	5,080 (3.0)								

Note: Assumes 9" (150 mm) of stone above, and between chambers.

Volume Excavation Per Chamber yd3 (m3)

	S	tone Foundation De	pth
	9" (230 mm)	12" (300 mm)	18" (450 mm)
DC-780 Chamber	5.9 (4.5)	6.3 (4.8)	6.9 (5.3)

Note: Assumes 6" (150 mm) separation between chamber rows and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.



2.0 Product Information

2.5 STORMTECH CHAMBERS

StormTech chamber systems have unique features to improve site optimization and reduce product waste. The SC-160LP, SC-310, SC-740, and DC-780 chambers can be cut at the job site in approximately 6.5" (165 mm) increments to shorten a chamber's length. Designing and constructing chamber rows around site obstacles is easily accomplished by including specific cutting instructions or a well placed "cut to fit" note on the design plans. The last chamber of a row can be cut in any of its corrugation's valleys. An end cap placed into the trimmed corrugation's crest completes the row. The trimmed-off piece of a StormTech chamber may then be used to start the next row. See Figure 4.

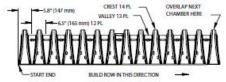
To assist the contractor, StormTech chambers are molded with simple assembly instructions and arrows that indicate the direction in which to build rows. Rows are formed by overlapping the next chamber's "Start End" corrugation with the previously laid chamber's "Grant Corrugation. Two people can safely and efficiently form rows of chambers without complicated connectors, special tools or heavy equipment.

Product Specifications: 2.2, 2.4, 2.5, 2.9 and 3.2.

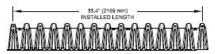
FIGURE 4 - Distance Between Corrugations (not to scale)

SC-740 Chamber CREST 14 PL CR

SC-310 Chamber



SC-160LP Chamber



2.6 STORMTECH END CAPS

The StormTech end cap has features which make the chamber system simple to design, easy to build and more versatile than other products. StormTech end caps can be easily secured within any corrugation's crest. A molded-in handle makes attaching the end cap a oneperson operation. Tools or fasteners are not required.

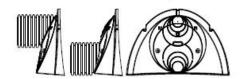
StormTech end caps are required at each end of a chamber row to prevent stone intrusion (two per row). The SC-740 and DC-780 end caps will accept up to a 24" (600 mm) HDPE inlet pipe. The SC-310 end cap will accept up to a 12" (300 mm) HDPE inlet pipe. The SC-160LP will accept either a 6" or 8" (150 mm or 200 mm) HDPE inlet Pipe. See Figure 5.

Product Specifications: 3.1, 3.2, 3.3 and 3.4



FIGURE 5 - Chamber End Caps (not to scale)

SC-740 / DC-780 End Cap



SC-740/DC-780 CHAMBER FABRICATED END CAP (TOP AND BOTTOM FEED)
PIPES SIZES RANGE FROM 6" (150 mm) TO 24" (500 mm)

SC-310 End Cap



SC-310 CHAMBER FABRICATED END CAP (TOP AND BOTTOM FEED) PIPES SIZES RANGE FROM 5" (150 mm) TO 12" (300 mm) (INVERTS VARY WITH PIPE SIZE)

SC-160LP End Cap



3.0 Structural Capabilities





3.1 STRUCTURAL DESIGN APPROACH

When installed per StormTech's minimum requirements, StormTech products are designed to exceed American Association of State Highway and Transportation Officials (AASHTO) LRFD recommended design factors for Earth loads and Vehicular live loads. AASHTO Vehicular live loads (previously HS-20) consist of two heavy axle configurations, that of a single 32 (142 kN) kip axle and that of tandem 25 (111 kN) kip axles. Factors for impact and multiple presences of vehicles ensure a conservative design where structural adequacy is assumed for a wide range of street legal vehicle weights and axle configurations.

Computer models of the chambers under shallow and deep conditions were developed. Utilizing design forces from computer models, chamber sections were evaluated using AASHTO procedures that consider thrust and moment, and check for local buckling capacity. The procedures also considered the time-dependent strength and stiffness properties of polypropylene and polyethylene. These procedures were developed in a research study conducted by the National Cooperative Highway Research Program (NCHRP) for AASHTO, and published as NCHRP Report 438 Recommended LRFD Specifications for Plastic Pipe and Culverts. Product Specifications: 2.12.

StormTech does not recommend installing StormTech products underneath buildings or parking garages. When specifying the StormTech products in close proximity to buildings, it is important to ensure that the StormTech products are not receiving any loads from these structures that may jeopardize the long term performance of the chambers.



3.2 FULL SCALE TESTING

After developing the StormTech chamber designs, the chambers were subjected to rigorous full-scale testing. The test programs verified the predicted safety factors of the designs by subjecting the chambers to more severe load conditions than anticipated during service life. Capacity under live loads and deep fill was investigated by conducting tests with a range of cover depths. Monitoring of long term deep fill installations has been done to validate the long term performance of the StormTech products.

3.3 INDEPENDENT EXPERT ANALYSIS

StormTech worked closely with the consulting firm Simpson Gumpertz & Heger Inc. (SGH) to develop and evaluate the SC-160LP, SC-310, SC-740 and DC-780 chamber designs. SGH has world-renowned expertise in the design of buried drain age structures. The firm was the principal investigator for the NCHRP research program that developed the structural analysis and design methods adopted by AASHTO for thermoplastic culverts. SGH conducted design calculations and computer simulations of chamber performance under various installation and live load conditions. They worked with StormTech to design the full-scale test programs to verify the structural capacity of the chambers. SGH also observed all full-scale tests and inspected the chambers after completion of the tests. SGH continues to be StormTech's structural consultant.

3.0 Structural Capabilities



3.4 INJECTION MOLDING

To comply with both the structural and design requirements of AASHTO's LRFD specifications and ASTM F2787 as well as the product requirements of ASTM F2418 or ASTM F2922, StormTech uses proprietary injection molding equipment to manufacture the chambers and end caps.

In addition to meeting structural goals, injection molding allows StormTech to design added features and advantages into StormTech's parts including:

- · Precise control of wall thickness throughout parts
- Precise fit of joints and end caps
- · Molded-in inspection port fitting
- · Molded-in handles on end caps
- Molded-in pipe guides with blade starter slots
- Repeatability for Quality Control (See Section 3.6)

Product Specifications: 2.1, 3.1 and 3.3

3.5 POLYPROPYLENE AND POLYETHYLENE RESIN

StormTech chambers are injection molded from polypropylene and polyethylene. Polypropylene and polyethylene chambers are inherently resistant to chemicals typically found in stormwater run-off. StormTech chambers maintain a greater portion of their structural stiffness through higher installation and service temperatures.

StormTech polypropylene and polyethylene are virgin materials specially designed to achieve a high 75-year creep modulus that is necessary to provide a sound long-term structural design. Since the modulus remains high well beyond the 75-year value, StormTech chambers can exhibit a service life in excess of 75 years.



3.6 QUALITY CONTROL

StormTech chambers are manufactured under tight quality control programs. Materials are routinely tested in an environmentally controlled lab that is verified every six months via the external ASTM Proficiency Testing Program. The chamber material properties are measured and controlled with procedures following ISO 9001:2000 requirements.

Statistical Process Control (SPC) techniques are applied during manufacturing. Established upper and lower control limits are maintained on key manufacturing parameters to maintain consistent product. Product Specifications: 2.13 and 3.6

4.0 Foundation for Chambers



4.1 FOUNDATION REQUIREMENTS

StormTech chamber systems and embedment stone may be installed in various native soil types. The subgrade bearing capacity and chamber cover height determine the required depth of clean, crushed, angular stone for the chamber foundation. The chamber foundation is the clean, crushed, angular stone placed between the subgrade soils and the feet of the chamber.

As cover height increases (top of chamber to top of finished grade) the chambers foundation requirements increase. Foundation strength is the product of the subgrade soils bearing capacity and the depth of clean, crushed, angular stone below the chamber foot. Table 1 for the SC-160LP, Table 2 for the SC-740 and SC-310, Table 3 for the SC-310-3, and Table 4 for the DC-780 specify the required minimum foundation depth for varying cover heights and subgrade bearing capacities.

4.2 WEAKER SOILS

For sub-grade soils with allowable bearing capacity less than 2000 pounds per square foot [(2.0 ksf) (96 kPa)], a geotechnical engineer should evaluate the specific conditions. These soils are often highly variable, may contain organic materials and could be more sensitive to moisture. A geotechnical engineer's recommendations

may include increasing the stone foundation, improving the bearing capacity of the sub-grade soils through compaction, replacement, or other remedial measures including the use of geogrids. The use of a thermoplastic liner may also be considered for systems installed in subgrade soils that are highly affected by moisture. The project engineer is responsible for ensuring overall site settlement is within acceptable limits. A geotechnical engineer should always review installation of StormTech chambers on organic soils.

4.3 CHAMBER SPACING OPTION

No spacing is required between the SC-160LP chambers. StormTech requires a minimum of 6" (150 mm) clear spacing between the feet of chambers rows for the SC-310, SC-740 and DC-780 chambers. However, increasing the spacing between chamber rows may allow the application of StormTech chambers with either less foundation stone or with weaker subgrade soils. This may be a good option where a vertical restriction on site prevents the use of a deeper foundation. Contact StormTech's Technical Service Department for more information on this option. In all cases, StormTech recommends consulting a geotechnical engineer for subgrade soils with a bearing capacity less than 2.0 ksf (96 kPa).

TABLE 1 - SC-160LP Bearing Capacity Table

(Assumes no spacing)

Minimum Required Foundation Depth in Inches (mm)

ATTICK OF			10 III				Minim	um Bearin	g Resid	nce for S	ervice La	ads ksi (k	Pa)					<i>(</i> 2)	
Cover Hgt. ft. (m)	4.4-3.8 (211 to 182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3,1 (148)	3.0	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (129)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (95)
1.0 (0.31)	3 (75)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)
1.2 (0.46)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)
1.5 (0.46)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)
2.0 (0.61)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	6 (150)	6 (150)	6 (150)
2.5 to 9 (0.76 to 2.74)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)
9.5 (2.89)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	6 (150)
10.0 (3.05)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	3 (75)	6 (150)	6 (150)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

4.0 Foundations for Chambers

TABLE 2 - SC-310 and SC-740 Minimum Required Foundation Depth in inches (millimeters)

lover								Minimu	m Requi	ed Bear	ng Resid	lance fo	r Servica	Loads i	est (MPa)							
et m	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3,4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (138)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (†15)	23 (110)	2.2 (105)	2.1 (101)	2.0 (96)
1.5 0.46)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375											
2.0 0.61)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375
2.5 0.76)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450
3.0 (0.91)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450
3.5 (1.07)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	18 (450)	18 (450)	21 (550
4.0 1.22)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	18 (450)	18 (450)	21 (55)							
4.5 1.37)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	18 (450)	18 (450)	21 (550							
5.0 1.52)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (55)							
5.5 1.68)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (55)
6.0 1.83)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (308)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (550)	21 (55)
6.5 1.98)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	24 (600
7.0 2.13)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600
7.5 2.30)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (550)	21 (550)	24 (800)	27 (67)
8.0	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	(300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

¹⁸ Call StormTech at 860.529.8188 or 888.892.2694 or visit our website at www.stormtech.com for technical and product information.

4.0 Foundations for Chambers



TABLE 3 - SC-310-3 Minimum Required Foundation Depth in inches (millimeters)

Descri			Minin	um Requi	ed Searing	Resistance	for Servic	e Loads ksi	(MPa)		
Ngt ft (m)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
1.5 (0.46)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)
2.0 (0.61)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (306)	15 (375)	15 (375)
2.5 (0.76)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)
3,0 (0.91)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)
3.5 (1.07)	6 (150)	9 (230)	9 (230)	9 (230)	12 (300)						
4.0 (1.22)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)						
4.5 (1.37)	6 (150)	9 (230)	9 (230)	9 (230)							
5.0 (1.52)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)						
5.5 (1.68)	6 (150)	9 (230)	9 (230)	9 (230)	12 (300)						
6.0 (1.83)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)
6.5 (1.98)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)
7.0 (2.13)	6 (150)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)
7.5 (2.30)	6 (150)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	12 (306)	12 (300)	12 (300)
8.0 (2.44)	6 (150)	6 (150)	6 (150)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture condition expected under a stormwater system.

Table 4 – DC-780 Minimum Required Foundation Depth in inches (millimeters)

					_				_			-55		- 22								
Cover								Minimu	n Regui	ed Bean	ng Resis	lance fo	r Servici	Loads I	esf (ldPa)							
Hall II.	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	26	2.5	2.4	2.3	2.2	2.1	2.0
Boll	12,0	(182)	(107)	(162)	am	ma	(100)	(sea)	(156)	(120)	100	(144)	(138)	(134)	(129)	(124)	(120)	(110)	(110)	(105)	(163)	100
8.5 (2.59)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	24 (600)	24 (600)	27 (675)	30 (750)
9.0 (2.74)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27 (675)	30 (750)
9.5 (2.90)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27 (675)	30 (750)	33 (825)
10.0 (3.05)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27 (875)	30 (750)	33 (825)	36 (900)
10.5 (3.20)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27 (675)	30 (750)	30 (750)	33 (825)	36 (900)
11.0 (3.35)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	36 (900)	39 (975)
11.5 (3.50)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	36 (900)	39 (975)	42 (1050)
12.0 (3.66)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (550)	21 (550)	21 (550)	24 (600)	24 (600)	27 (675)	30 (750)	30 (750)	33 (825)	36 (900)	39 (975)	42 (1050)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

5.0 Cumulative Storage Volumes

Tables 4, 5, 6 and 7 provide cumulative storage volumes for the SC-160LP, SC-310, SC-740 and DC-780 chamber systems. This information may be used to calculate a detention/retention system's stage storage volume. A spreadsheet is available at www.stormtech.com in which the number of chambers can be input for quick cumulative storage calculations. Product Specifications: 1.1, 2.2, 2.3, 2.4, and 2.6

Table 4 - SC-160LP Cumulative Storage Volumes Per Chamber Assumes 40% Stone Porosity. Calculations are Based Upon a 4" (100 mm) Stone Base Under the Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³(m²)	Total System Cumulative Storage ft*(m*)
22 (559)	6.85 (0.194)	14.98 (0.424)
21 (533)	6.85 (0.194)	14.49 (0.410)
20 (508)	Stone 6.85 (0.194)	14.00 (0.396)
19 (483)	Cover 6.85 (0.194)	13.50 (0.382)
18 (457)	6.85 (0.194)	13.01 (0.368)
17 (432)	V 6.85 (0.194)	12.51 (0.354)
16 (406)	6.85 (0.194)	12.02 (0.340)
15 (381)	6.80 (0.193)	11.49 (0.325)
14 (356)	6.67 (0.189)	10.92 (0.309)
13 (330)	6.38 (0.181)	10.25 (0.290)
12 (305)	5.94 (0.168)	9.49 (0.269)
11 (279)	5.40 (0.153)	8.67 (0.246)
10 (254)	4.78 (0.135)	7.81 (0.221)
9 (229)	4.10 (0.116)	6.91 (0.196)
8 (203)	3.36 (0.095)	5.97 (0.169)
7 (178)	2.58 (0.073)	5.01 (0.142)
6 (152)	1.76 (0.050)	4.02 (0.114)
5 (127)	0.89 (0.025)	3.01 (0.085)
4 (102)	↑ 0 (0)	1.98 (0.056)
3 (76)	Stone 0 (0)	1.48 (0.042)
2 (51)	Foundation 0 (0)	0.99 (0.028)
1 (25)	¥ 0(0)	0.49 (0.014)

Note: Add $0.49\,\mathrm{fl}^2$ $(0.014\,\mathrm{m}^2)$ of storage for each additional inch (25 mm) of stone foundation.

Table 5 - SC-310 Cumulative Storage Volumes Per Chamber Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under the Chambers.

Depth of Water	Cumulative	Total System
in System Inches (mm)	Chamber Storage ff* (m²)	Cumulative Storage ft* (m²)
28 (711)	14.70 (0.416)	31.00 (0.878)
27 (686)	14.70 (0.416)	30.21 (0.855)
26 (680)	Stone 14.70 (0.416)	29.42 (0.833)
25 (635)	Cover 14.70 (0.416)	28.63 (0.811)
24 (610)	14.70 (0.416)	27.84 (0.788)
23 (584)	14.70 (0.416)	27.05 (0.766)
22 (559)	14.70 (0.416)	26.26 (0.748)
21 (533)	14.64 (0.415)	25.43 (0.720)
20 (508)	14.49 (0.410)	24.54 (0.695)
19 (483)	14.22 (0.403)	23.58 (0.668)
18 (457)	13.68 (0.387)	22.47 (0.636)
17 (432)	12.99 (0.368)	21.25 (0.602)
16 (406)	12.17 (0.345)	19.97 (0.566)
15 (381)	11.25 (0.319)	18.62 (0.528)
14 (356)	10.23 (0.290)	17.22 (0.488)
13 (330)	9.15 (0.260)	15.78 (0.447)
12 (305)	7.99 (0.227)	14.29 (0.425)
11 (279)	6.78 (0.192)	12.77 (0.362)
10 (254)	5.51 (0.156)	11.22 (0.318)
9 (229)	4.19 (0.119)	9.64 (0.278)
8 (203)	2.83 (0.081)	8.03 (0.227)
7 (178)	1.43 (0.041)	6.40 (0.181)
6 (152)	A 0	4.74 (0.134)
5 (127)	0	3.95 (0.112)
4 (102)	Stone 0	3.16 (0.090)
3 (76)	Foundation 0	2.37 (0.067)
2 (51)	0	1.58 (0.046)
1 (25)	₩ 0	0.79 (0.022)

Note: Add 0.79 ft^a (0.022 m²) of storage for each additional inch (25 mm) of stone foundation.

²⁰ Call StormTech at 860.529.8188 or 888.892.2694 or visit our website at www.stormtech.com for technical and product information.

5.0 Cumulative Storage Volumes



Table 6 - SC-740 Cumulative Storage Volumes Per Chamber Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under the Chambers.

Table 7 - DC-780 Cumulative Storage Volumes Per Chamber Assumes 40% Stone Porosity. Calculations are Based Upon a 9" (230 mm) Stone Base Under the Chambers.

Depth of Water in System	Cumulative Chamber Storage	Total System Cumulative Storage	Depth of Water in System	Cha
Inches (mm)	fit (mt)	ft' (m²)	inches (mm)	Ottes
42 (1067)	45.90 (1.300)	74.90 (2.121)	45 (1143)	
41 (1041)	45.90 (1.300)	73.77 (2.089)	44 (1118)	1 T
40 (1016)	Stone 45.90 (1.300)	72.64 (2.057)	43 (1092)	Stone
39 (991)	Cover 45.90 (1.300)	71.52 (2.025)	42 (1067)	Cover
38 (965)	45.90 (1.300)	70.39 (1.993)	41 (1041)	
37 (948)	¥ 45.90 (1.300)	69.26 (1.961)	40 (1016)	
36 (914)	45.90 (1.300)	68.17 (1.929)	39 (991)	
35 (889)	45.85 (1.298)	66.98 (1.897)	38 (965)	4
34 (864)	45.69 (1.294)	65.75 (1.862)	37 (948)	4
33 (838)	45.41 (1.286)	64.46 (1.825)	36 (914)	4
32 (813)	44.81 (1.269)	62.97 (1.783)	35 (889)	4
31 (787)	44.01 (1.246)	61.36 (1.737)	34 (864)	4
30 (762)	43.06 (1.219)	59.66 (1.689)	33 (838)	4
29 (737)	41.98 (1.189)	57.89 (1.639)	32 (813)	4
28 (711)	40.80 (1.155)	56.05 (1.587)	31 (787)	4
27 (686)	39.54 (1.120)	54.17 (1.534)	30 (762)	3
26 (660)	38.18 (1.081)	52.23 (1.479)	29 (737)	3
25 (635)	36.74 (1.040)	50.23 (1.422)	28 (711)	3
24 (610)	35.22 (0.977)	48.19 (1.365)	27 (686)	3
23 (584)	33.64 (0.953)	46.11 (1.306)	26 (660)	3
22 (559)	31.99 (0.906)	44.00 (1.246)	25 (635)	3
21 (533)	30.29 (0.858)	41.85 (1.185)	24 (610)	3
20 (508)	28.54 (0.808)	39.67 (1.123)	23 (584)	2
19 (483)	26.74 (0.757)	37.47 (1.061)	22 (559)	2
18 (457)	24.89 (0.705)	35.23 (0.997)	21 (533)	2
17 (432)	23.00 (0.651)	32.69 (0.939)	20 (508)	2
16 (406)	21.06 (0.596)	30.68 (0.869)	19 (483)	2
15 (381)	19.09 (0.541)	28.36 (0.803)	18 (457)	1
14 (356)	17.08 (0.484)	26.03 (0.737)	17 (432)	1
13 (330)	15.04 (0.426)	23.68 (0.670)	16 (406)	1
12 (305)	12.97 (0.367)	21.31 (0.608)	15 (381)	1
11 (279)	10.87 (0.309)	18.92 (0.535)	14 (356)	1
10 (254)	8.74 (0.247)	16.51 (0.468)	13 (330)	8
9 (229)	6.58 (0.186)	14.09 (0.399)	12 (305)	- 6
8 (203)	4.41 (0.125)	11.66 (0.330)	11 (279)	4
7 (178)	2.21 (0.063)	9.21 (0.264)	10 (254)	2
6 (152)	0	6.76 (0.191)	9 (229)	
5 (127)	0	5.63 (0.160)	8 (203)	-
4 (102)	Stone 0	4.51 (0.125)	7 (178)	
3 (76)	Foundation 0	3.38 (0.095)	6 (152)	0
2 (51)	0	2.25 (0.064)	5 (127)	Stone
1 (25)	0	1.13 (0.032)	4 (102)	roun
te: Add 1.13 ft ³ (0.0 mm) of stone four	32 m ³) of storage for each	h additional inch	3 (76)	
randy or same rout	nuairoth		2 (51)	

46.27 (1.310) 78.47 (2.222) 46.27 (1.310) 77.34 (2.190) 46.27 (1.310) 76.21 (2.158) 46.27 (1.310) 75.09 (2.126) 46.27 (1.310) 73.96 (2.094) 46.27 (1.310) 72.83 (2.062) 46.27 (1.310) 71.71 (2.030) 46.21 (1.309) 70.54 (1.998) 46.04 (1.304) 69.32 (1.963) 45.76 (1.296) 68.02 (1.926) 66.53 (1.884) 45.15 (1.278) 44.34 (1.255) 64.91 (1.838) 43.38 (1.228) 63.21 (1.790) 42.29 (1.198) 61.43 (1.740) 41.11 (1.164) 59.59 (1.688) 57.70 (1.634) 39.83 (1.128) 38.47 (1.089) 55.76 (1.579) 37.01 (1.048) 53.76 (1.522) 35.49 (1.005) 51.72 (1.464) 33.90 (0.960) 49.63 (1.405) 32.24 (0.913) 47.52 (1.346) 30.54 (0.865) 45.36 (1.285) 28.77 (0.815) 43.18 (1.223) 40.97 (1.160) 26.96 (0.763) 38.72 (1.096) 25.10 (0.711) 23.19 (0.657) 36.45 (1.032) 21.25 (0.602) 34.16 (0.967) 19.26 (0.545) 31.84 (0.902) 17.24 (0.488) 29.50 (0.835) 15.19 (0.430) 27.14 (0.769) 13.10 (0.371) 24.76 (0.701) 10.98 (0.311) 22.36 (0.633) 8.83 (0.250) 19.95 (0.565) 6.66 (0.189) 17.52 (0.496) 4.46 (0.126) 15.07 (0.427) 2.24 (0.064) 12.61 (0.357) 10.14 (0.287) 9.01 (0.255) 0 7.89 (0.223) 0 0 6.76 (0.191) 0 5.63 (0.160) ndation 0 4.51 (0.128) 0 3.38 (0.096) 0 2.25 (0.064) 1 (25) 0 1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

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6.0 Required Materials/Row Separation

6.1 CHAMBER ROW SEPARATION

StormTech SC-740, SC-310 and DC-780 chambers must be specified with a minimum 6" (150 mm) space between the feet of adjacent parallel chamber rows. No spacing is required between the SC-160LP chambers. Increasing the space between rows is acceptable. This will increase the storage volume due to additional stone voids.

6.2 STONE SURROUNDING CHAMBERS

Refer to Table 8 for acceptable stone materials. StormTech requires clean, crushed, angular stone below, between and above chambers as shown in Figure 6. Acceptable gradations are listed in Table 8. Subrounded and rounded stone are not acceptable.

6.3 GEOTEXTILE SEPARATION REQUIREMENT

A non-woven geotextile that meets AASHTO M288 Class 2 Separation requirements must be applied as a separation layer to prevent soil intrusion into the clean, crushed, angular stone as shown in Figure 6. The geotextile is required between the clean, crushed, angular stone and the subgrade soils, the excavation's sidewalls and the fill materials. The geotextile should completely envelope the clean, crushed, angular stone. Overlap adjacent geotextile rolls per AASHTO M288 separation guidelines. Contact StormTech for a list of acceptable geotextiles.

6.4 FILL ABOVE CHAMBERS

Refer to Table 8 and Figure 6 for acceptable fill material above the 6" (150 mm) of clean, crushed, angular stone. Minimum and maximum fill requirements for the SC-160LP, SC-740, SC-310 and DC-780 chambers are shown in Figure 6 below. StormTech requires a minimum of 24" (600 mm) of fill in non-paved installations where rutting from vehicles may occur. Table 8 provides details on soil class and compaction requirements for suitable fill materials.

Table 8 - Acceptable Fill Materials

	Material Location	Description	AASHTO Material Classifications	Compaction / Density Requirement
D	Final Fill: Fill material for layer 'D' starts from the top of the 'C' layer to the bottom of the flexible pavement to unpaved finished grade above. Note that pavement subbase may be part of the 'D' layer.	Any soil/rock material, native soits, or per Engineer's plans. Check plans for pavement subgrade requirements	N/A	Prepare per site design Engineer's plans. Paved installations may have stringent material and preparation requirements.
С	Initial Filt Fill material for layer 'C' starts form the top of the embedment stone ('B' Layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be a part of the 'C' layer.	Granular well-graded soil/ aggregate mixtures, <35% fines or processed aggregate Most povement subbase materials can be used in lieu of this layer	AASHTO M145' A-1, A-2-4, A-3 OR AASHTO M43' 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin Compactions after 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max lifts to a min. 95% proctor density for well graded material and 95% relative Density for processed aggregate materials. Roller grass vehicle weight not to exceed 12,000 lbs (53 kN). Dymamic force not to exceed 20,000 lbs (89 kN)
В	Embedment stone: Fill surrounding the chambers from the foundation stone ('A' layer) to the 'C' layer above	Clean, crushed, angular stone, nominal size distribution between %-2 inch (20-50 mm)	AASHTO M145° 3,357, 4, 467, 5, 56, 57	No compaction required.
A	Foundation stone: Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone, nominal size distribution between %-2 inch (20-50 mm)	AASHTO M145° 3, 357, 4, 467, 5, 56, 57	Plate compact or roll to achieve a flat surface. 23

- Please Note:

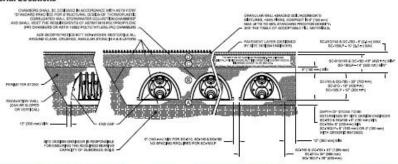
 1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 Stone would state: "clean, crushed, angular No. 4 (AASHTO MAS) Stone".

 2. StomTech compaction requirements are met for "A" location materials when placed and compacted in 6" (150 mm) (MAX) Lifts using two full coverages with a vibratory compactor.

 3. Where infiltration surfaces may be compromised by compaction, for standard design load conditions, a flat surface may be achieved by raking of dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 6 - Fill Material Locations

Once layer 'C' is placed any soil/ material can be placed in layer 'D' up to the finished grade. Most pavement subbase soils car be used to replac the materials requirements of requirements of layer 'C' or 'D' at the design engineer's discretion.



7.0 Inletting the Chambers



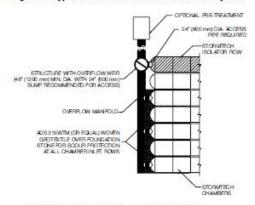
The design flexibility of a StormTech chamber system includes many inletting possibilities. Contact StormTech's Technical Service Department for guidance on designing an inlet system to meet specific site goals.

7.1 TREATMENT TRAIN

A properly designed inlet system can ensure good water quality, easy inspection and maintenance, and a long system service life. StormTech recommends a treatment train approach for inletting an underground stormwater management system under a typical commercial parking area. Treatment train is an industry term for a multi-tiered water quality network. As shown in Figure 7, a StormTech recommended inlet system can inexpensively have tiers of treatment upstream of the StormTech chambers:

Tier 1 – Pre-treatment (BMP) Tier 2 - StormTech Isolator® Row Tier 3 - Enhanced Treatment (BMP)

Figure 7 - Typical StormTech Treatment Train Inlet System



7.2 PRE-TREATMENT (BMP) - TREATMENT TIER 1

In some areas pre-treatment of the stormwater is required prior to entry into a stormwater system. By treating the stormwater prior to entry into the system, the service life of the system can be extended, pollutants such as hydrocarbons may be captured, and local regulations met. Pre-treatment options are often described as a Best Management Practice or simply a BMP.

Pre-treatment devices differ greatly in complexity, design and effectiveness. Depending on a site's characteristics and treatment goals, the simple, least expensive pretreatment solutions can sometimes be just as effective as the complex systems. Options include a simple deep sumped manhole with a 90° bend on its outlet, baffle boxes, swirl concentrators, and devices that combine these processes. Some of the most effective pretreatment options combine engineered site grading with vegetation such as bio-swales or grassy strips.

The type of pretreatment device specified as the first level of treatment up-stream of a StormTech chamber system can vary greatly throughout the country and from site-to-site. It is the responsibility of the design engineer to understand the water quality requirements and design a stormwater treatment system that will satisfy local regulators and follow applicable laws. A design engineer should apply their understanding of local weather conditions, site topography, local maintenance requirements, expected service life, etc. to select an appropriate stormwater pre-treatment system.

7.3 STORMTECH ISOLATOR ROW - TREATMENT TIER 2 StormTech has a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance. The StormTech Isolator Row is a row of standard StormTech chambers surrounded with appropriate filter fabrics and connected to a manhole for easy access. This application basically creates a filter/detention basin that allows water to egress through the surrounding filter fabric while sediment is trapped within. It may be best to think of the Isolator Row as a first-flush treatment device. First-Flush is a term typically used to describe the first 1/2" to 1" (13-25 mm) of rainfall or runoff on a site. The majority of stormwater pollutants are carried in the sediments of the firstflush, therefore the Isolator Row is an effective component of a treatment train.

The StormTech Isolator Row should be designed with a manhole with an overflow weir at its upstream end. The diversion manhole is multi-purposed. It can provide access to the Isolator Row for both inspection and maintenance and acts as a diversion structure. The manhole is connected to the Isolator Row with a short length of 8" (200mm) pipe for the SC-160LP chambers, 12" (300 mm) pipe for the SC-310 chamber and 24" (600 mm) pipe for the SC-740 and DC-780 chambers. These pipes are connected to the Isolator Row with an 8" (200mm) precored end cap for the SC-160LP, a 12" (300 mm) fabricated end cap for the SC-310 chamber and a 24" (600 mm) fabricated end cap for the SC-740 and DC-780 chambers. The overflow weir typically has its crest set between the top of the chamber and its midpoint. This allows storm water in excess of the Isolator Row's storage/conveyance capacity to bypass into the chamber system through the downstream manifold system

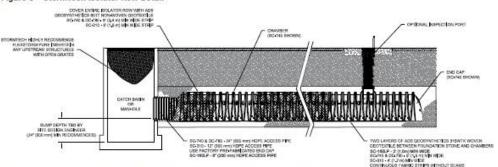
Specifying and installing proper geotextiles is essential for efficient operation and to prevent damage to the system during the JetVac maintenance process. In a typical configuration, two strips of woven geotextile that meet AASHTO M288 Class 1 requirements are required between the chambers and the stone foundation. This strong filter fabric traps sediments and protects the stone base during maintenance. A strip of non-woven AASHTO M288 Class 2 geotextile is draped over the Isolator chamber row. This 6-8 oz. (217-278 g/m2) nonwoven

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7.0 Inletting the Chambers

Figure 8 - StormTech Isolator Row Detail



Note: Non-woven geotextile over DC-780 Isolator Row chambers is not required.

filter fabric prevents sediments from migrating out of the chamber perforations while allowing modest amounts of water to flow out of the Isolator Row. Figure 8 is a detail of the Isolator Row that shows proper application of the geotextiles. Contact StormTech for a table of acceptable geotextiles.



Inspection is easily accomplished through the upstream manhole or optional inspection ports. Maintenance of an Isolator Row is fast and easy using the JetVac process through the upstream manhole. Section 12.0 explains the inspection and maintenance process in more detail.

Isolator Rows can be sized to accommodate either a water quality volume or a water quality flow rate requirement. The use of filter fabric around the Isolator Row chambers allows stormwater to egress out of the row during and between storm events. The rate of egression for design is dependent upon the chamber model and sediment accumulation on the geotextile. Contact StormTech's Technical Services Department for more information on Isolator Row sizing.

7.4 ENHANCED TREATMENT (BMP) - TREATMENT TIER 3

As regulations have become more stringent, requiring higher levels of containment removal, water quality systems may be required to treat higher flow rates, greater volumes or to provide a higher level of filtration or other more sophisticated treatment process. StormTech systems can easily be configured with enhanced treatment techniques located either upstream or downstream of the retention or detention chamber system. Located upstream of an infiltration bed, between the pretreatment device and the Isolator Row, enhanced treatment provides a high level of contaminant removal which protects groundwater or better preserves the infiltration surface. Located downstream of detention, enhanced treatment provides a higher level of contaminant removal prior to discharge to a receiving body.

Enhanced treatment BMPs are normally applied where specific regulations and specific water quality product approvals are in place. StormTech works closely with providers of enhanced treatment technologies to meet local requirements.

7.5 TREATMENT TRAIN CONCLUSION

The treatment train is a highly effective water-quality approach that may not add significant cost to a StormTech system being installed under commercial parking areas. The StormTech Isolator Row adds a significant level of treatment, easy inspection and maintenance, while maintaining storage volume credit for the cost of a modest amount of geotextile. Finally where higher levels of treatment are required, StormTech can integrate other technologies into the treatment train to provide the most cost effective treatment approach. This treatment train concept provides three levels of treatment, inspection and maintenance upstream and downstream of the StormTech detention/retention bed.

7.0 Inletting the Chambers



7.6 OTHER INLET OPTIONS

While the three-tiered treatment train approach is the recommended method of inletting StormTech chambers for typical under-commercial parking applications, there are other effective inlet methods that may be considered. For instance, Isolator Rows, while adding an inexpensive level of confidence, are not always necessary. A header system with fewer inlets can be designed to further minimize the cost of a StormTech system. There may be applications where stormwater pre-treatment may not be necessary at all and the system can be inlet directly from the source. Contact StormTech's Technical Service Department to discuss inlet options.

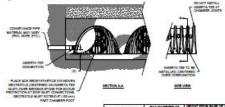
7.7 LATERAL FLOW RATES

The embedment stone surrounding the StormTech chambers allows the rapid conveyance of stormwater between chamber rows. Stormwater will rise and fall evenly within a bed of chambers. A single StormTech SC-740 chamber is able to release or accept stormwater at a rate of at least 0.5 cfs (14.2 l/s) through the surrounding stone.

7.8 INLETTING PERPENDICULAR TO A ROW OF CHAMBERS WITH INSERTA TEE

There is an easy, inexpensive method to perpendicularly inlet a row of chambers. Simply connect the inlet directly to the chamber with an Inserta Tee. Figure 9 shows a typical detail along with the standard sizes offered for each chamber model.

Figure 9 - Inserta Tee Side Detail



NOTE: SIDE INSERTA TEES CANNOT BE USED ON SC-160LP CHAMBERS

7.9 MAXIMUM INLET PIPE VELOCITIES TO PREVENT SCOURING OF THE STONE FOUNDATION

The primary function of the inlet manifold is to convey and distribute flows to a sufficient number of rows in the chamber bed such that there is ample conveyance capacity to pass the peak flows without creating an unacceptable backwater condition in upstream piping or scour the foundation stone under the chambers.

Manifolds are connected to the end caps either at the top or bottom of the end cap. High inlet flow rates from either connection location produce a shear scour potential of the

foundation stone. Inlet flows from top inlets also produce impingement scour potential. Scour potential is reduced when standing water is present over the foundation stone. However, for safe design across the wide range of applications, StormTech assumes minimal standing water at the time the design flow occurs.

To minimize scour potential, StomTech recommends the installation of woven scour protection fabric at each inlet row. This enables a protected transition zone from the concentrated flow coming out of the inlet pipe to a uniform flow across the entire width of the chamber for both top and bottom connections. Allowable flow rates for design are dependent upon: the elevation of inlet pipe, foundation stone size and scour protection. An appropriate scour protection geotextile is installed from the end cap to at least 10.5' (3.2 m) for the SC-310, SC-740 and DC 780 chambers for both top and bottom feeding inlet pipes.

See StormTech's Tech Sheet #7 for guidance on manifold sizing. ADS's Technical Services department can also assist with sizing inlet manifolds for the StormTech chamber systems.

Table 9A – Standard Distances from Base of Chamber to Invert of Inlet and Outlet Manifolds on StormTech End Caps

THE PROPERTY OF THE PROPERTY O	C-160LP END	THE RESERVE OF THE PERSON NAMED IN	THE REAL PROPERTY.
PIPE DIA.	INV. (IN)	INV. (FT)	INV. (MM
6" (150mm)	0.66	0.05	16
8" (200mm)	0.80	0.07	20
8" (200mm) Cored	0.96	0.08	24

	PIPE DIA.	INV. (IN)	INV. (FT)	INV. (MM)
	6" (150 mm)	5.8	0.48	146
ğ	8" (200 mm)	3.5	0.29	88
	10" (250 mm)	1.4	0.12	37
5	6" (150 mm)	0.5	0.04	12
2	8" (200 mm)	0.6	0.05	15
ВОТТОМ	10" (250 mm)	0.7	0.06	18
-	12" (750 mm)	0.9	0.08	24

SC-740 / DC-780 ENDCAPS				
	PIPE DIA.	INV. (IN)	INV. (FT)	INV. (MM)
	6" (150 mm)	18.5	1.54	469
	8" (200 mm)	16.5	1.38	421
20	10" (250 mm)	14.5	1.21	369
F	12" (300 mm)	12.5	1.04	317
	15" (375 mm)	9	0.75	229
	18" (450 mm)	5	0.42	128
	6" (150 mm)	0.5	0.04	12
	8" (200 mm)	0.6	0.05	15
8	10" (250 mm)	0.7	0.06	18
BOTTOM	12" (750 mm)	1.2	0.10	30
8	15" (900 mm)	1.3	0.11	34
	18" (1050 mm)	1.6	0.13	40
	24" (1200 mm)	0.1	0.01	3

"See StormTech's Tech Sheet #7 for manifold sizing guidance"

8.0 Outlets for Chambers

8.0 OUTLETS FOR STORMTECH CHAMBER SYSTEMS

The majority of StormTech installations are detention systems and have some type of outlet structure. An outlet manifold is generally designed to ensure that peak flows can be conveyed to the outlet structure.

To drain the system completely, an underdrain system is located at or below the bottom of the foundation stone. Some beds may be designed with a pitched base to ensure complete drainage of the system. A grade of ½% is usually satisfactory.

An outlet pipe may be located at a higher invert within a bed. This allows a designed volume of water to infiltrate while excess volumes are outlet as necessary. This is an excellent method of recharging groundwater, replicating a site's pre-construction hydraulics.

Depending on the bed layout and inverts, outlet pipes should be placed in the embedment stone along the bed's perimeter as shown in Figures 10 and 11. Solid outlet pipes should also be used to penetrate the StormTech end caps at the designed outlet invert as shown in Figure 12. An Isolator Row should not be directly penetrated with an outlet pipe. For systems requiring higher outlet flow rates, a combination of connections may be utilized as shown in Figure 13.

In detention and retention applications the discharge of water from the stormwater management system is determined based on the hydrology of the area and the hydraulic design of the system. It is the design engineer's responsibility to design an outlet system that meets their hydraulic objectives while following local laws and regulations.

Table 9B – Maximum Outlet Flow Rate Capacities from StormTech Manifolds

OUTLET FLOW			
PIPE DIA.	FLOW (CFS)	FLOW (L/S)	
6" (150 mm)	0.4	11.3	
8" (200 mm)	0.7	19.8	
10" (250 mm)	1.0	28.3	
12" (300 mm)	2.0	56.6	
15" (375 mm)	2.7	76.5	
18" (450 mm)	4.0	113.3	
24" (600 mm)	7.0	198.2	
30" (750 mm)	11.0	311.5	
36" (900 mm)	16.0	453.1	
42° (1050 mm)	22.0	623.0	
48" (1200 mm)	28.0	792.9	

Figure 10 - Underdrain Parallel

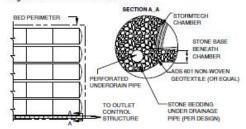


Figure 11 - Underdrain Perpendicular

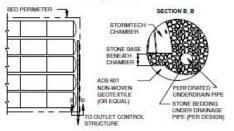


Figure 12 - Outlet Manifold

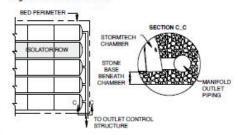
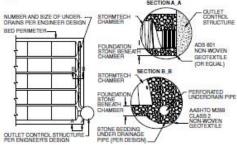


Figure 13 - Combination Outlet



9.0 Other Considerations



9.1 EROSION CONTROL

Erosion and sediment control measures must be integrated into the plan to protect the stormwater system both during and after construction. These practices may have a direct impact on the system's infiltration performance and longevity. Vegetation, temporary sediment barriers (silt fences, hay bales, fabric-wrapped catch basin grates), and strategic stormwater runoff management may be used to control erosion and sedimentation. StormTech recommends the use of pipe plugs on the inlet pipe until the system is in service.

9.2 SITE IMPROVEMENT TECHNIQUES

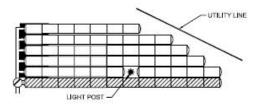
When site conditions are less than optimal, StormTech recognizes many methods for improving a site for construction. Some techniques include the removal and replacement of poor materials, the use of engineered subgrade materials, aggregates, chemical treatment, and mechanical treatments including the use of geosynthetics. StormTech recommends referring to AASHTO M 288 guidelines for the appropriate use of geotextiles.

StormTech also recognizes geogrid as a potential component of an engineered solution to improve site conditions or as a construction tool for the experienced contractor. StormTech chamber systems are compatible with the use of geosynthetics. The use of geosynthetics or any other site improvement method does not eliminate or modify any of StormTech's requirements. It is the ultimate responsibility of the design engineer to ensure that site conditions are suitable for a StormTech chamber system.

9.3 CONFORMING TO SITE CONSTRAINTS

StormTech chambers have the unique ability to conform to site constraints such as utility lines, light posts, large trees, etc. Rows of chambers can be ended short or interrupted by placing an end cap at the desired location, leaving the required number of chambers out of the row to get by the obstruction, then starting the row of chambers again with another end cap. See Figure 14 for an example.

Figure 14 - Ability to Conform to Site Constraints



9.4 LINERS

StormTech chambers offer the distinct advantage and versatility that allow them to be designed as an open bottom detention or retention system. In fact, the vast majority of StormTech installations and designs are open bottom detention systems. Using an open bottom system enables treatment of the storm water through the underlying soils and provides a volume safety factor based on the infiltrative capacity of the underlying soils.

In some applications, however, open bottom detention systems may not be allowed. StormTech's Tech Sheet #2 provides guidance for the design and installation of thermoplastic liners for detention systems using StormTech chambers. The major points of the memo are:

- Infiltration of stormwater is generally a desirable stormwater management practice, often required by regulations. Lined systems should only be specified where unique site conditions preclude significant infiltration.
- Thermoplastic liners provide cost effective and viable means to contain stormwater in StormTech subsurface systems where infiltration is undesirable.
- PVC and LLDPE are the most cost effective, installed membrane materials.
- Enhanced puncture resistance from angular aggregate on the water side and from protrusions on the soil side can be achieved by placing a non-woven geotextile reinforcement on each side of the geomembrane.
 A sand underlayment in lieu of the geotextile reinforcement on the soil side may be considered when cost effective.
- StormTech does not design, fabricate, sell or install thermoplastic liners. StormTech recommends consulting with liner professionals for final design and installation advice.

Figure 15 - Chamber bed placed around light post.



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10.0 System Sizing

For quick calculations, refer to the Site Calculator on StormTech's website at www.stormtech.com.

10.1 SYSTEM SIZING

The following steps provide the calculations necessary to size a system. If you need assistance determining the number of chambers per row or customizing the bed configuration to fit a specific site, call StormTech's Technical Services Department at 1-888-892-2694.

 Determine the amount of storage volume (V_s) required.

It is the design engineer's sole responsibility to determine the storage volume required by local codes.

TABLE 10 - Storage Volume Per Chamber

	Bare Chamber Storage	Chamber and Stone Foundation Depth in. (mm)		3.00
	ft³ (m³)	6 (150)	12 (300)	18 (450)
SC-160LP	6.85 (0.19)	15.0 (0.42)	17.9 (0.51)	20.9 (0.59)
SC-310	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)
SC-740	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)
	ft³ (m³)	9 (230)	12 (300)	18 (450)
DC-780	46.2 (1.3)	78.4 (2.2)	81.8 (2.3)	88.6 (2.5)

Note: Assumes 40% porosity for the stone plus the chamber volume.

2) Determine the number of chambers (C) required.

To calculate the number of chambers needed for adequate storage, divide the storage volume (V_s) by the volume of the selected chamber, as follows: $C = V_s$ / Volume per Chamber

3) Determine the required bed size (S).

To find the size of the bed, multiply the number of chambers needed (C) by either:

StormTech SC-160LP bed area per chamber = 14.8 ft² (1.3 m²)

StormTech SC-310 bed area per chamber = 23.7 ft² (2.2 m²)

StormTech SC-740 / DC-780 bed area per chamber = 33.8 ft² (3.1 m²)

 $S = (C \ x \ bed \ area \ per \ chamber) + \\ [1 \ foot \ (0.3 \ m) \ x \ bed \ per inneter \ in \ feet \ (meters)]$ NOTE: It is necessary to add one foot (0.3 m) around the perimeter of the bed for end caps and working space.

 Determine the amount of clean, crushed, angular stone (Vst) required.

TABLE 11 - Amount of Stone Per Chamber

ENGLISH tons (yd²)	Stone Foundation Depth		
	6"	12"	18"
SC-160LP	1.2 (0.9)	1.6 (1.2)	1.9 (1.4)
SC-310	2.1 (1.5)	2.7 (1.9)	3.4 (2.4)
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC kg (m³)	150 mm	300 mm	450 mm
SC-160LP	1088 (0.7)	1452 (0.9)	1724 (1.0)
SC-310	1830 (1.1)	2490 (1.5)	2990 (1.8)
SC-740	3450 (2.1)	4170 (2.5)	4490 (3.0)
ENGLISH tons (yd³)	9"	12"	18"
DC-780	4.2 (3.0)	4.7 (3.3)	5.6 (3.9)
METRIC kg (m²)	230 mm	300 mm	450 mm
DC-780	3810 (2.3)	4264 (2.5)	5080 (3.0)

Note: Assumes 6" (150 mm) of stone above, and between chambers. For SC-310, SC-740 and DC-780 Chambers only.

To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) by the selected weight of stone from Table 11. NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

- 5) Determine the volume of excavation (Ex) required.
- 6) Determine the area of filter fabric (F) required.

TABLE 12 - Volume of Excavation Per Chamber

	Stone Foundation Depth yd³ (m³)			
	6" (150 mm)	12" (300 mm)	18" (450 mm)	
SC-160LP	1.5 (1.1)	1.8 (1.3)	2.1 (1.5)	
SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)	
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)	
	9" (230 mm)	12" (300 mm)	18" (450 mm)	
DC-780	5.9 (4.5)	6.3 (4.8)	6.9 (5.3)	

Note: Assumes 6" (150 mm) of separation between chamber rows (no spacing for the SC-160LP) and 18" (450 mm) of cover. The volume of excavation will vary as the depth of the cover increases.

Each additional foot of cover will add a volume of excavation of 1.3 yds¹ (1.0 m²) per SC-740 / DC-780, 0.9 yds3 (0.7 m3) per SC-310 chamber and 0.55 yds¹ (0.4m²) per SC-160LP chamber.

The bottom and sides of the bed and the top of the embedment stone must be covered with ADS 601 (or equal) a non-woven geotextile (filter fabric). The area of the sidewalls must be calculated and a 2 foot (0.6 m) overlap must be included where two pieces of filter fabric are placed side-by-side or end-to-end. Geotextiles typically come in 15 foot (4.6 m) wide rolls.

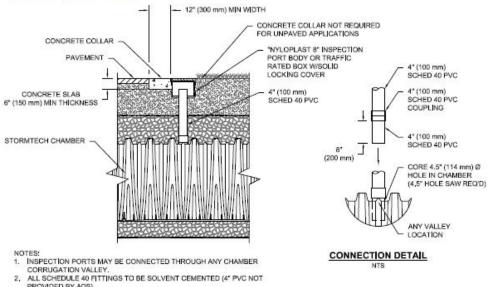
7) Determine the number of end caps (Ec) required.

Each row of chambers requires two end caps. $E_c = number$ of rows x 2

11.0 Detail Drawings

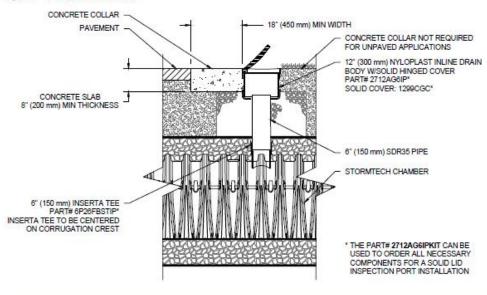


Figure 16 - 4" Inspection Port Detail



PROVIDED BY ADS).

Figure 17 - 6" Inspection Port Detail



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11.0 Detail Drawings

Figure 18 - Under Drain Detail

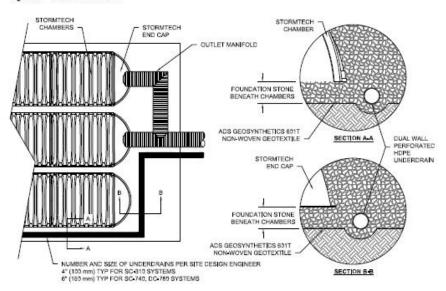
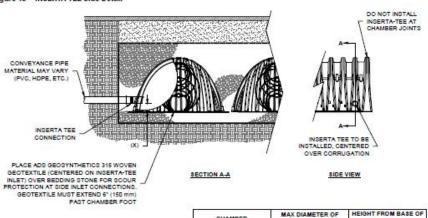


Figure 19 - INSERTA TEE Side Detail



INSERTA TEE	CHAMBER (X)
6" (150 mm)	4" (100 mm)
10" (250 mm)	4" (100 mm)
10" (250 mm)	4" (100 mm)
	6" (150 mm) 10" (250 mm)

NOTE: INSERTA TEE FITTINGS AVAILATED ATTEMPT OF THE PROPERTY OF THE FITTINGS AVAILATED AS SOLVENT WELD, INCONTACT STORMTECH FOR MORE INFORMATION.

NOTE: SIDE INSERTA TEES CANNOT BE USED ON SC-160LP CHAMBERS.

12.0 Inspection and Maintenance



12.1 ISOLATOR ROW INSPECTION

Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a confined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3" (76 mm), cleanout is required.

A StormTech Isolator Row should initially be inspected immediately after completion of the site's construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site's owner. Once in normal service, a StormTech Isolator Row should be inspected bi-annually until an understanding of the sites characteristics is developed. The site's maintenance manager can then revise the inspection schedule based on experience or local requirements.

12.2 ISOLATOR ROW MAINTENANCE

JetVac maintenance is recommended if sediment has been collected to an average depth of 3" (76 mm) inside the Isolator Row. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combination vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" (1143 mm) are best. The JetVac process shall only be performed on StormTech Rows that have AASHTO class 1 woven geotextile over the foundation stone (ADS 315ST or equal).



Looking down the Isolator Row



A typical JetVac truck (This is not a StormTech product.)







Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products).

12.0 Inspection & Maintenance

STORMTECH ISOLATOR™ ROW - STEP-BY-STEP MAINTENANCE PROCEDURES

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

- i. Remove lid from floor box frame
- ii. Remove cap from inspection riser
- Using a flashlight and stadia rod, measure depth of sediment
- iv. If sediment is at, or above, 3" (76 mm) depth proceed to Step 2. If not proceed to Step 3.

B) All Isolator Rows

- Remove cover from manhole at upstream end of Isolator Row
- Using a flashlight, inspect down Isolator Row through outlet pipe
 - Follow OSHA regulations for confined space entry if entering manhole
 - Mirrors on poles or cameras may be used to avoid a confined space entry
- If sediment is at or above the lower row of sidewall holes [approximately 3" (76 mm)] proceed to Step 2. If not proceed to Step 3.

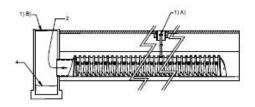
Step 2) Clean out Isolator Row using the JetVac process

- A) fixed floor cleaning nozzle with rear facing nozzle spread of 45" (1143 mm) or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required during letting

Step 3) Replace all caps, lids and covers

Step 4) Inspect and clean catch basins and manholes upstream of the StormTech system following local guidelines.

Figure 20 - StormTech Isolator Row (not to scale)



12.3 ECCENTRIC PIPE HEADER INSPECTION

Theses guidelines do not supercede a pipe manufacturer's recommended I&M procedures. Consult with the manufacturer of the pipe header system for specific I&M procedures. Inspection of the header system should be carried out quarterly. On sites which generate higher levels of sediment more frequent inspections may be necessary. Headers may be accessed through risers, access ports or manholes. Measurement of sediment may be taken with a stadia rod or similar device. Cleanout of sediment should occur when the sediment volume has reduced the storage area by 25% or the depth of sediment has reached approximately 25% of the diameter of the standard.

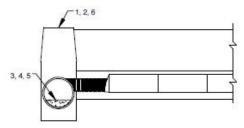
12.4 ECCENTRIC PIPE MANIFOLD MAINTENANCE

Cleanout of accumulated material should be accomplished by vacuum pumping the material from the header. Cleanout should be accomplished during dry weather. Care should be taken to avoid flushing sediments out through the outlet pipes and into the chamber rows.

Eccentric Header Step-by-Step Maintenance Procedures

- 1. Locate manholes connected to the manifold system
- 2. Remove grates or covers
- 3. Using a stadia rod, measure the depth of sediment
- If sediment is at a depth of about 25% pipe volume or 25% pipe diameter proceed to step 5. If not proceed to step 6.
- Vacuum pump the sediment. Do not flush sediment out inlet pipes.
- 6. Replace grates and covers
- 7. Record depth and date and schedule next inspection

Figure 21 - Eccentric Manifold Maintenance



Please contact StormTech's Technical Services Department at 888-892-2894 for a spreadsheet to estimate cleaning intervals.

13.0 General Notes



- StormTech ("StormTech") requires installing contractors to use and understand StormTech's latest Installation Instructions prior to beginning system installation.
- Our Technical Services Department offers installation consultations to installing contractors. Contact our Technical Service Representatives at least 30 days prior to system installation to arrange a preinstallation consultation. Our representatives can then answer questions or address comments on the StormTech chamber system and inform the Installing contractor of the minimum installation requirements before beginning the system's construction. Call 860-529-8188 to speak to a Technical Service Representative or visit www.stormtech.com to receive a copy of our Installation Instructions.
- 3. StormTech's requirements for systems with pavement design (asphalt, concrete pavers, etc.): Minimum cover for the SC-740, DC-780 and SC-310 chambers is 18" (457 mm) not including pavement, Minimum cover for the SC-160LP chamber is 14" (350 mm); Maximum cover for the SC-740 and SC-310 chambers is 96" (2.4 m) including pavement design; Maximum cover for the SC-160LP chamber is 10' (3.0 m); Maximum cover for the DC-780 chamber is 10' (3.0 m); Maximum cover for the DC-780 chamber is 12' (3.6 m) including pavement design. For installations that do not include pavement, where rutting from vehicles may occur, minimum required cover is 24" (610 mm), maximum cover is as stated above.
- The contractor must report any discrepancies with the bearing capacity of the chamber foundation materials to the design engineer.

- AASHTO M288 Class 2 non-woven geotextile (filter fabric) must be used as indicated in the project plans.
- Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of StormTech's Installation Instructions.
- Backfilling over the chambers must follow requirements as indicated in the most current version of StormTech's Installation Instructions.
- 8. The contractor must refer to StormTech's Installation Instructions for a Table of Acceptable Vehicle Loads at various depths of cover. This information is also available at StormTech's website: www.stormtech.com. The contractor is responsible for preventing vehicles that exceed StormTech's requirements from traveling across or parking over the stormwater system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.
- The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.
- STORMTECH PRODUCT WARRANTY IS LIMITED. Contact StormTech for warranty information.

14.0 StormTech Product Specifications

1.0 GENERAL

1.1 StomTech chambers are designed to control storm water runoff. As a subsurface retention system, StomTech chambers retain and allow effective infiltration of water into the soil. As a subsurface detention system, StormTech chambers detain and allow for the metered flow of water to an outfall.

2.0 CHAMBER PARAMETERS

- 2.1 The Chamber shall be injection molded of an impact modified polypropylene or polyethylene copolymer to maintain adequate stiffness through higher temperatures experienced during installation and service.
- 2.2 The nominal chamber dimensions of the StormTech SC-740 and DC-780 shall be 30.0" (762 mm) tall, 51.0" (1295 mm) wide and 90.7" (2304 mm) long. The nominal chamber dimensions of the StormTech SC-310 shall be 16.0" (406 mm) tall, 34.0" (864 mm) wide and 90.7" (2304 mm) long. SC-160LP shall be 12"(305mm) tall, 25" (635 mm) wide and 90.7" (2304mm) long. The installed length of a joined chamber shall be 85.4" (2169 mm).
- The chamber shall have a continuously curved section profile.
- 2.4 The chamber shall be open-bottomed.
- 2.5 The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be created. The overlapping corrugation joint system shall be effective while allowing a chamber to be trimmed to shorten its overall length.
- 2.6 The nominal storage volume of all StormTech chambers includes the volume of the clean, crushed, angular stone with an assumed 40% porosity. The nominal storage volume of a joined StormTech SC-740 chamber shall be 74.9 ft3 (2.1 m3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 2.2 ft⁸/ft² (0.67 m⁸/m²). The nominal storage volume of a joined StormTech DC-780 chamber shall be 78.4 ft3 (2.2 m3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 2.3 ft⁹/ft² (0.70 m3/m2). The nominal storage volume of a joined StormTech SC-310 chamber shall be 31.0 ft⁸ (0.88 m3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 1.3 ft3/ft2 (0.40 m3/m2). The nominal storage volume of a joined StormTech SC-160LP chamber shall be 15 ft3 (0.42 m3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 1.0 ft3/ft3 (0.30 m3/m3).

- 2.7 The SC-740 and SC-310 chambers shall have forty eight orifices penetrating the sidewalls to allow for lateral conveyance of water.
- 2.8 The chamber shall have two orifices near its top to allow for equalization of air pressure between its interior and exterior.
- 2.9 The chamber shall have both of its ends open to allow for unimpeded hydraulic flows and visual inspections down a row's entire length.
- 2.10 The chamber shall have 14 corrugations.
- 2.11 The chamber shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, 2nd Edition, including Interim Specifications through 2001. Design live load shall be the AASHTO design truck. Design shall consider earth and live loads as appropriate for the minimum to maximum specified depth of fill.
- 2.12 The chamber shall be manufactured in an ISO 9001:2000 certified facility.

3.0 END CAP PARAMETERS

- 3.1 The end cap shall be designed to fit into any corrugation of a chamber, which allows: capping a chamber that has its length trimmed; segmenting rows into storage basins of various lengths.
- 3.2 The end cap shall have saw guides to allow easy cutting for various diameters of pipe that may be used to inlet the system.
- 3.3 The end cap shall have excess structural adequacies to allow cutting an orifice of any size at any invert elevation.
- 3.4 The primary face of an end cap shall be curved outward to resist horizontal loads generated near the edges of beds.
- The end cap shall be manufactured in an ISO 9001:2000 certified facility.

15.0 Chamber Specifications for Contract Documents

SC-160LP STORMTECH CHAMBER SPECIFICATIONS

- Chambers shall be Stormtech SC-160LP.
- Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene copolymers.
- Chambers shall meet the requirements of ASTM F2418-16A, "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers"
- Chamber rows shall provide continuous, unobstructed internal space with no internal supports that would impede flow or limit access for inspection.
- 5. The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO LFD bridge design specifications, Section 12.12, are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.
- Chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". Load configurations shall include: 1) instantaneous (<1 min) AASHTO design truck live load on minimum cover 2) maximum permanent (75-yr) cover load and 3) allowable cover with parked (1-week) asshto design truck.
- 7. Requirements for handling and installation:
 - To maintain the width of chambers during shipping and handling, chambers shall have integral, interlocking stacking lugs.

- To ensure a secure joint during installation and backfill, the height of the chamber joint shall not be less than 1.5".
- To ensure the integrity of the arch shape during installation, a) the arch stiffness constant as defined in section 6.2.8 of ASTM P2418 shall be greater than or equal to 400 lbs/in/in. And b) to resist softening during hot, sunny installation conditions, chambers shall be produced from light, reflective gold or yellow colors.
- Only chambers that are approved by the site design enginee will be allowed. The chamber manufacturer shall submit the following upon request to the site design engineer for approval before delivering chambers to the project site:
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the minimum required by ASTM F2787 and by AASHTO for thermoplastic pipe.
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the load factors specified in the AASHTO IRFD bridge design specifications, Section 12.12, are met. The 50 year creep modulus data specified in ASTM F2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.

Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.

SC-310 STORMTECH CHAMBER SPECIFICATIONS

- Chambers shall be Stormtech SC-310.
- Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene or polyethylene copolymers.
- Chambers shall meet the requirements of ASTM F2922 (polethylene) or ASTM F2418-16A (polypropylene), "Standard Specification for Corrugated Wall Stormwater Collection Chambers"
- Chamber rows shall provide continuous, unobstructed internal space with no internal supports that would impede flow or limit access for inspection.
- The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO IRFD bridge design specifications, Section 12.12, are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.
- Chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". Load configurations shall include: 1) instantaneous (<1 min) AASHTO design truck live load on minimum cover 2) maximum permanent (75-yr) cover load and 3) allowable cover with parked (1-week) AASHTO to design truck.
- 7. Requirements for handling and installation:
 - To maintain the width of chambers during shipping and handling, chambers shall have integral, interlocking stacking lugs.

- To ensure a secure joint during installation and backfill, the height of the chamber joint shall not be less than 2".
- To ensure the integrity of the arch shape during installation, a) the arch stiffness constant as defined in Section 6.2.8 of ASTM F2418 shall be greater than or equal to 400 lbs/in/in. And b) to resist softening during hot, sunny installation conditions, chambers shall be produced from light, reflective gold or yellow colors.
- Only chambers that are approved by the site design engineer will be allowed. The chamber manufacturer shall submit the following upon request to the site design engineer for approval before delivering chambers to the project site:
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the minimum required by ASTM F2787 and by AASHTO for thermoplastic pipe.
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the load factors specified in the AASHTO LRFD bridge design specifications.
 Section 12.12, are met. The 50 year creep modulus data specified in ASTM F2418 must be used as part of the aashto structural evaluation to verify long-term performance.

Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.

15.0 Chamber Specifications for Contract Documents

SC-740 STORMTECH CHAMBER SPECIFICATIONS

- Chambers shall be Stormtech SC-740
- Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene copolymers.
- Chambers shall meet the requirements of ASTM F2418-16A, "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers"
- Chamber rows shall provide continuous, unobstructed internal space with no internal supports that would impede flow or limit access for inspection.
- 5. The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD bridge design specifications, Section 12:12, are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.
- 6. Chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F2787, "Standard practice for structural design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". Load configurations shall include: 1) instantaneous (<1 min) AASHTO design truck live load on minimum cover 2) maximum permanent (75-yr) cover load and 3) allowable cover with parked (1-week) AASHTO design truck.</p>
- 7. Requirements for handling and installation:
 - To maintain the width of chambers during shipping and handling, chambers shall have integral, interlocking stacking lugs.

- To ensure a secure joint during installation and backfill, the height of the chamber joint shall not be less than 2".
- To ensure the integrity of the arch shape during installation, a) the arch stiffness constant as defined in Section 6.2.8 of ASTM F2418 shall be greater than or equal to 550 lbs/in/in. And b) to resist softening during hot, sunny installation conditions, chambers shall be produced from light, reflective gold or yellow colors.
- Only chambers that are approved by the site design enginee will be allowed. The chamber manufacturer shall submit the following upon request to the site design engineer for approval before delivering chambers to the project site:
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the minimum required by ASTM F2787 and by AASHTO for thermoplastic pipe.
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the load factors specified in the AASHTO LRDF bridge design specifications, Section 12.12, are met. The 50 year creep modulus data specified in ASTM F2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.

Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.

DC-780 STORMTECH CHAMBER SPECIFICATIONS

- Chambers shall be Stormtech DC-780.
- Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene copolymers.
- Chambers shall meet the requirements of ASTM F2418-16A, "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers"
- Chamber rows shall provide continuous, unobstructed internal space with no internal supports that would impede flow or limit access for inspection.
- 5. The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD bridge design specifications, Section 12:12, are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.
- 6. Chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". Load configurations shall include: 1) instantaneous (<1 min) ASHTO design truck live load on minimum cover 2) maximum permanent (75-yr) cover load and 3) allowable cover with parked (1-week) AASHTO design truck.</p>
- 7. Requirements for handling and installation:
 - To maintain the width of chambers during shipping and handling, chambers shall have integral, interlocking stacking lugs.

- To ensure a secure joint during installation and backfill, the height of the chamber joint shall not be less than 2".
- To ensure the integrity of the arch shape during installation, a) the arch stiffness constant as defined in Section 6.2.8 of ASTM F2418 shall be greater than or equal to 550 lbs/irv/in. And b) to resist softening during hot, surny installation conditions, chambers shall be produced from light, reflective gold or yellow colors.
- Only chambers that are approved by the site design engineer will be allowed. The chamber manufacturer shall submit the following upon request to the cite design engineer for approval before delivering chambers to the project site:
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the minimum required by ASTM F2787 and by AASHTO for thermoplastic pipe.
 - A structural evaluation sealed by a registered professional engineer that demonstrates that the load factors specified in the AASHTO LRFD bridge design specifications, Section 12.12, are met. The 50 year creep modulus data specified in ASTM F2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.

Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.

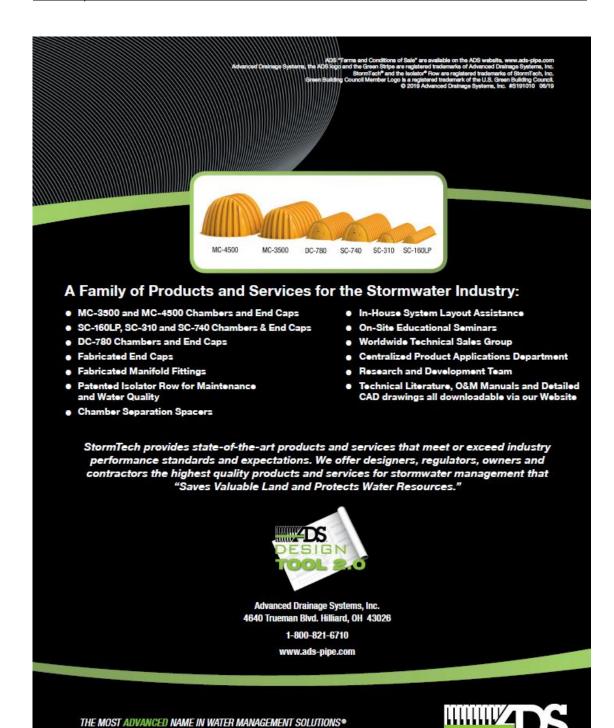


The SiteASSIST App enables ADS to take customer service and field support to unprecedented levels. With detailed instructions on proper installation techniques for StormTech chambers and supporting video animations, this tool is designed to insure installed performance.



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Detention basins will require ongoing regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities along with likely machinery requirements and typical annual costs – within the Maintenance Plan. The treatment performance of bioretention systems is dependent on maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic quidance.

Maintenance of detention basins is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a SuDS detention basin over and above what is necessary for standard public open space.

Maintenance responsibility for a basin should always be placed with an appropriate organisation. Adequate access should be provided to all detention basin areas for inspection and maintenance, including for appropriate equipment and vehicles. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

The major maintenance requirement for detention basins is usually mowing. Regular mowing in and around detention basins is only required along maintenance access routes, amenity areas (eg footpaths), across any embankment and across the main storage area. The remaining areas can be managed as 'meadow', unless additional management is required for landscape/amenity/recreational or aesthetic reasons.

Mowing should ideally retain grass lengths of 75-150 mm across the main "treatment" surface to assisting filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events. Longer lengths of vegetation may be appropriate, depending on the functionality of the component, and its associated design criteria and are not considered to pose a significant risk to functionality.

Shorter lengths may be required when recreational facilities form part of the basin, but in this case the basin will be dealing with exceedance flows only and not treatment.

Grass clippings should be disposed of off-site or outside the detention basin area to remove nutrients and pollutants. Where a detention basin has a small permanent pool at the outlet, its submerged and emergent aquatic vegetation should be managed as for ponds or wetlands. Plant management, to achieve the desired habitat effect, should be clearly specified in a maintenance schedule. All vegetation management activities should take account of the need to maximise biosecurity and prevent the spread of invasive species.

Occasionally sediment will need to be removed (eg once deposits exceed 25 mm in depth). Sediments excavated from a detention basin that receives runoff from residential or standard road and roof areas are generally not toxic or hazardous and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For runoff from busy streets with high vehicle traffic, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on-site if there is an appropriate safe and acceptable location to do so. Any damage due to sediment removal or

erosion and scour resulting from major events should be repaired and immediately reseeded or planted.

Table 1 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive, and some actions may not always be required. Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the detention basins should be monitored, and maintenance schedules adjusted to suit requirements.

Many of the specific maintenance activities for detention basins can be undertaken as part of a general landscape management contract and therefore, if landscape management is already required at site, should have marginal cost implications. If basins are implemented within private property, owners should be educated on their routine maintenance needs, and should understand the long-term Maintenance Plan and any legally binding maintenance agreement.

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Table 1 Operation and Maintenance requirements for Detention Basins

Maintenance Schedule	Required Action	Typical Frequency
	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
Regular Maintenance	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually
	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
Occasional Maintenance	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
	Repair erosion or other damage by reseeding or re-turfing	As required
Remedial Actions	Realignment of rip-rap	As required
Nemedial Actions	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Appendix E

Capacity Check of Proposed Piped Drains (Outfalls "B" & "C")



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Technical Note 170092-TN-003

Project:	SHD Colpe West	Prepared by:	Deirdre Walsh
Title:	Capacity Check of Piped Drains	Date:	11 th October 2019
Client:	Shannon Homes Drogheda	Job No:	170092

1.0 INTRODUCTION

This technical note is prepared to confirm that the proposed 900mm diameter pipe under the link street (immediately west of Colpe Road) has been appropriately sized. This pipe intercepts the existing open drain to the west of Colpe Road and through the commercial development approved under LB180820 before connecting to the culvert (to be upgraded) under Mill Road. This drain originally drained lands to the south west of the railway line, however following development of these lands the catchment area greatly reduced and runoff to this ditch greatly reduced also;

The estimated catchment discharging to the culvert under Mill Road is outlined in Figure 1 below:

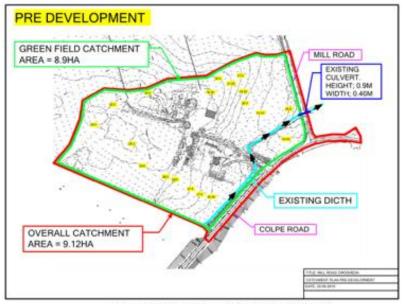


Figure 1: Catchment Plan for MIII Road Culvert - South East

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2.0 Estimation of Surface Water Runoff

• Estimation of Surface Water Runoff Pre-Development

The quantity of surface water runoff from the catchment to the culvert is estimated as follows:

Greenfield Runoff from Catchment using the FSR Method as follows:

Qbar from the undeveloped catchment is calculated using the Institute of Hydrology equation as follows:

Qbar (rural) = 0.00108 x AREA^{0.89} x SAAR^{1.17} x Soil^{2.17}

Where:

- Qbar (rural) is the mean catchment annual flow from a rural catchment in m³/s;
- AREA is the area of the catchment in km². For a catchment area less than 50ha, calculate Qbar for 50 ha and pro rata it;
- SAAR is the standard average annual rainfall;
- SOIL is the soil index, with 5 soil types used and SPR values (standard percentage runoff) applied to each soil type;
- Area = 50ha or 0.5km²;
- SAAR = 756mm
- The SPR values for the 5 soil types are as follows:

```
Soil 1 = 0.1; Soil 2 = 0.3; Soil 3 = 0.37; Soil 4 = 0.47; Soil 5 = 0.53;
```

A SPR value of 0.47 (Soil Type 4) is applied for the subject site. This is based on site specific soakaway testing, by GII, included as a standalone report, which indicated that the soil throughout the site are predominantly clay with generally no permeability. It should be noted that at planning stage Qbar was based on a conservative soil type of 3, however, soil type 4 is more representative of the existing runoff scenario:

- Qbar (rural) 50 ha = 0.00108 x (0.5)^{0.89} x (756)^{1.17} x (0.47)^{2.17}
- = 0.2641 m³/s or 264.1l/s for 50ha;
- 47.0l/s for 8.9ha site = Q_{bar} or 5.2l/s/ha

(ii) Runoff from Colpe Road and Mill Road

estimated using the modified rational method as follows:

Q (runoff, I/s) = 2.71 x Rainfall Intensity (mm/hr) x Impermeable Area (ha)

- Rainfall Intensity for 1% AEP (Annual event Probability)
- Impermeable Area
 - Western side of Colpe Road; 335m x 3.8m = 1273m²
 - Mill Road 181m x 5.6m = 1013.6m²
 - Total Impermeable Area = 2286.6m² = 0.22866ha

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(iii) Total Pre-Development Runoff for a 1 in 2-Year Return Period Event AEP Event

- = (Greenfield Runoff from Qbar) + Runoff from Colpe Road & Mill Road
- = 81.2 l/s

(refer to Microdrainage calculation in *Appendix A* - calculated by inputting Qbar as a baseflow and by inputting the impermeable areas of <u>Colpe</u> Road and Mill Road discharging to the culvert.

Climate change = 10%)

Estimation of Surface Water Runoff Post-Development

Post development, surface water runoff to this culvert from Catchment C (C1, C2, C3 & C4) is attenuated to Qbar, 14.64l/s for 4.649ha = 3.14l/s/ha including Coloe Road for up to a 1%AEP (Annual Event Probability). (Refer to Figure 2 below). This is significantly less than the existing scenario.

Taking the entire catchment area of 9.13ha, $Qbar = 9.13ha \times 3.14l/s/ha = 28.668l/s$, which is significantly less than the capacity of the culvert which is estimated as 177.8l/s.

Post development, the runoff to this pipe will be significantly reduced as the allowable outflow from the developed site for a 1% AEP event, is capped at Qbar (i.e. runoff from a 1 in 2.4 year return period).

3.0 CAPACITY OF 900MM DIAMETER PIPE UNDER LINK STREET

The capacity of the 900mm diameter pipe at a gradient of 1:500 = 887.1l/s - Figure 1.

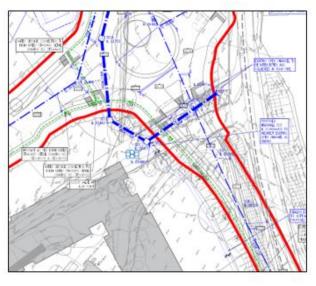


Figure 1: Extract of Site Services Plan (sheet 7) showing proposed piped drain

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The capacity of the 900mm diameter pipe at a gradient of 1:105 under Mill Road = 1945.3l/s - replacing the existing culvert with a backdrop. Refer to Figure 2.

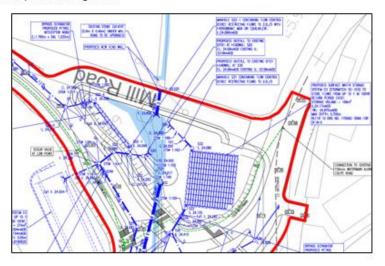


Figure 2: Extract of Site Services Plan (sheet 7) showing proposed upgrading of culvert under Mill Road

Refer to Appendix 'A' for calculations.

4.0 CAPACITY OF 600MM DIAMETER NEW SURFACE OUTFALL PIPE ON MILL ROAD - OUTFALL 'B'

Capacity of the 600mm outfall pipe = 848.5l/s. Refer to Appendix B for calculations.

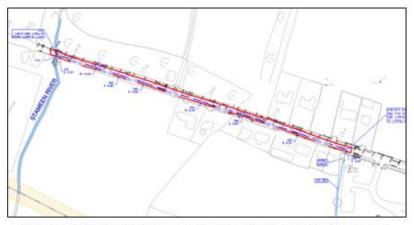


Figure 2: Extract of Surface Water Outfall Plan showing proposed surface water outfall pipe on Mill Road

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Appendix A – Surface Water Calculations For Pipe/ Culverted Drain - west of Colpe Road

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DBFL Con	sulting	Engin	eers						Pag	e 1
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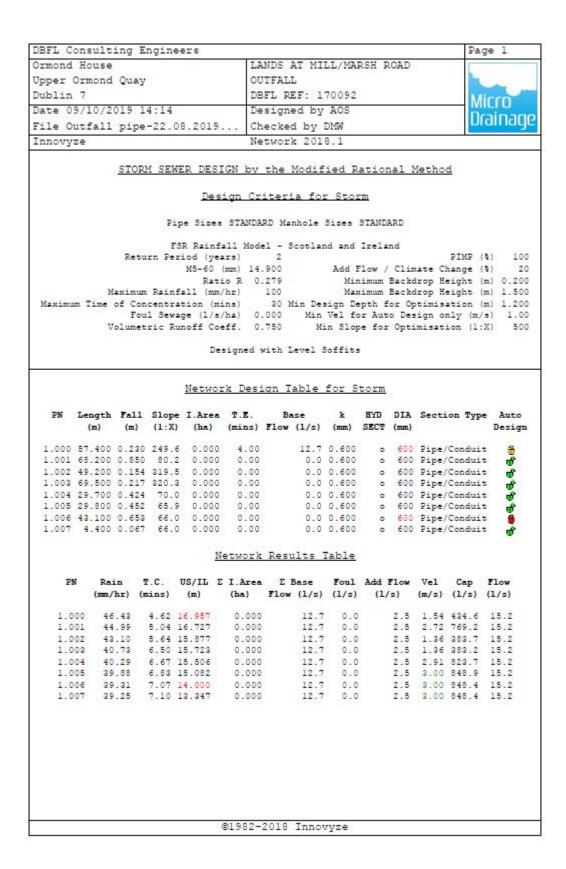
Appendix B – Surface Water Calculations

For Proposed Surface Water Outfall Pipe on Mill Road

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Appendix F

FOUL SEWER NETWORK CALCULATIONS

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F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.120 66.000 49.400	0.082 0.100 0.212 0.359 0.147 0.109 0.017 0.178	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Hetwork	Res:	0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1	500 500 500 500 500 500 500	0 0 0 0 0	200 275 275 275 275 275 275 275 275	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi	uit	8 6666666
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F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.120 66.000 49.400	0.082 0.100 0.212 0.359 0.147 0.109 0.017 0.520	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Hetwork	Resi	0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1	500 500 500 500 500 500 500	0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 150	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi	uit	ි. මේ ප්ප්ප්ප්ප්ප්ප් මේ ප්ප්ප්ප්ප්ප්ප්
F1.001 F1.002 F1.003 F1.004 F1.005 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.000 49.400 PN US (0.082 0.100 0.212 0.359 0.147 0.109 0.0178 0.520	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Hetwork se E U	Resi	0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1	500 500 500 500 500 500 500 500 500 500 500 500	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 375	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi	uit	නෙක්විවිවිවිවිවි වි
F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.000 49.400 PN US (.000 26 .001 25 .002 25	0.082 0.100 0.212 0.359 0.147 0.097 0.178 0.520 6/IL E m)	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1 E Bar	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.12.0 182.0 Hetwork See E U	Resi	0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1 0.0 1	500 500 500 500 500 500 500 500 500 500 ble (mm)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 375	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /c	uit	⊕්⊕්රිල්ලිල්ලිල්ලිල්
F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.200 49.400 PN US (.000 26 .001 25 .002 25 .003 25	0.082 0.100 0.212 0.359 0.147 0.109 0.0178 0.520 0.520 0.520	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Metwork se E U L/s) 0.0 109 0.0 110 0.0 110	Resi	0.0 1 0.0 1	500 500 500 500 500 500 500 500 500 500 500 500 500 500 500	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 375	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /c	uit	**************************************
F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 61.20 66.000 49.400 PN US (.000 26 .001 25 .002 25 .003 25	0.082 0.100 0.212 0.359 0.147 0.109 0.017 0.178 0.520 S/IL E m) .037 .827 .745 .433	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Network Se E U L/s) 0.0 109 0.0 110 0.0 110 0.0 111	Resi mits: 48.0 04.0 60.0 74.0 72.0	0.0 1 0.0 0 0.0 0 0.0 0	500 500 500 500 500 500 500 500 500 500 500 500 500 500 500	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 375	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /c	uit	රි ජිවිතිවිතිවිතිවීම වී
F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.200 49.400 PN US (.000 26 .001 25 .002 25 .003 25	0.082 0.100 0.212 0.359 0.147 0.109 0.017 0.178 0.520 S/IL E m) .037 .827 .745 .433 .074	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1 0.000 0.000 0.000 0.000 0.000 0.000	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Metwork se E U L/s) 0.0 109 0.0 110 0.0 110	Resi 48.0 04.0 60.0 74.0 72.0 72.0	0.0 1 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0	500 500 500 500 500 500 500 500 500 500 500 500 500 500 500	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 375	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /c	uit	ස් ජීම් ජීම් ජීම් ජීම් ජීම් ජීම් ජීම් ජීම
F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 49.400 49.400 PN US .000 26 .001 25 .002 25 .003 25 .004 25 .005 25 .006 24	0.082 0.100 0.212 0.359 0.147 0.109 0.017 0.178 0.520 S/IL E (m) .037 .745 .645 .433 .927 .818	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Ietwork 0.0 109 0.0 110 0.0 110 0.0 110 0.0 111 0.0 112 0.0 112	Resi 48.0 04.0 60.0 74.0 72.0 00.0 00.0	0.0 1 0.0 0 0.0 0 0 0.0 0 0.0 0 0 0.0 0 0 0	500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 (e1 %) 66 85 85 80 77 77 77	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /c	wit	ජී ජී ජී ජී ජී ජී ජී ජී ජී ජී 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
F1.001 F1.002 F1.003 F1.004 F1.005 F1.006 F1.007 F1.008 F2.000	23.000 28.120 37.970 30.550 54.320 40.400 66.000 49.400 PN US .000 26 .001 25 .002 25 .003 25 .004 25	0.082 0.100 0.212 0.359 0.147 0.109 0.017 0.178 0.520 S/IL E (m) .037 .745 .645 .433 .927 .818	280.2 280.5 280.0 179.5 85.0 370.0 370.0 370.0 95.0 Area (ha) 1 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10948.0 56.0 56.0 14.0 98.0 0.0 28.0 0.0 112.0 182.0 Ietwork See E Ut/s) 0.0 109 0.0 110 0.0 110 0.0 111 0.0 111	Resi 48.0 04.0 60.0 74.0 72.0 00.0 00.0	0.0 1 0.0 0 0.0 0 0 0.0 0 0.0 0 0 0.0 0 0 0	500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500 500	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	300 375 375 375 375 375 375 375 375 375 (e1 %) 66 85 85 80 77 77 77	Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	/Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /Condi /c	wit	ජී ජී ජී ජී ජී ජී ජී ජී ජී ජී 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
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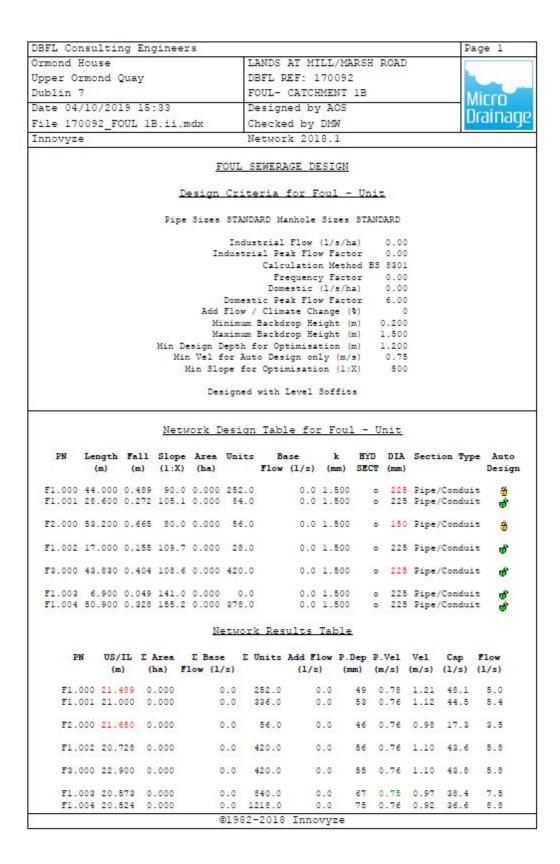
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F16	27.600	1.563	Open Manho	le 120	0 F1.000	26.037	300				
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F12	27.070	1.637	Open Manho	944	0 F1.004	25.433	375	F1.003	25.433	37	5
F6	27.500	2.426	Open Manho	le 135	0 F1.005	25.074	375	F1.004	25.074	37	5
F11	27.990	3.063	Open Manho	le 135	0 F1.006	24.927	375	F1.005	24.927	37	5
F10	28.460	3.642	Open Manho	le 135	0 F1.007	24.818	375	F1.006	24.818	37	5
F9	28.250	3.449	Open Manho	le 135	0 F1.008	24.801	375	F1.007	24.801	37	5
F8-2	27.110	1.120	Open Manho	le 120	0 F2.000	25.990	150	Manager Co.			"
F8-1	27.280	1.885	Open Manho	le 120	0 F2.001	25.395	225	F2.000	25.470	15	5
F8	27.590	3.067	Open Manho	le 135	0 F1.009	24.523	375	F1.008	24.623	37	5 100
			50					F2.001	24.673	22	5.
F7	27.650	3.141	Open Manho	le 135	0 F1.010	24.509	375	F1.009	24.509	37	5
F6	27.590	3.103	Open Manho	le 135	0 F1.011	24.487	375	F1.010	24.487	37	5
F5-3	27.080	0.960	Open Manho	le 120	0 F3.000	26.120	150				
F5-2	26.950	1.273	Open Manho	le 120	0 F3.001	25.677	225	F3.000	25.752	15	D
F5-1	27.170	2.020	Open Manho	le 120	0 F3.002	25.150	225	F3.001	25.150	22	5
F5	27.200	2.891	Open Manho	le 135	0 F1.012	24.309	375	F1.011	24.309	37	5
			155					F3.002	24.468	228	5 9
F4	27.000	2.768	Open Manho	le 135	0 F1.013	24.232	375	F1.012	24.232	37	5
F3	26.680	2.489	Open Manho	le 135	0 F1.014	24.191	375	F1.013	24.191	37	5
F2	26.790	2.636	Open Manho	le 135	0 F1.015	24.154	375	F1.014	24.154	37	5
F1	26.700	2.684	Open Manho	le 135	0 F1.016	24.016	375	F1.015	24.016	37	5
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F1.000 F1.001	(m) 7.300 80.600	(m) 0.104 0.971	Slope (1:X) 70.2 83.0	Area (ha) 0.000 0.000	Units 28.0 140.0	Be Flow	0.0 0.0	k (mm) 1.50	HY SE	D DII	A Sect) O Pipe 5 Pipe	/Condui	Design
F1.000 F1.001 F1.002	(m) 7.300	(m) 0.104 0.971 0.863	Slope (1:X) 70.2 83.0 90.0	Area (ha) 0.000 0.000	28.0 140.0 140.0	Bo Flow	0.0 0.0 0.0	k (mm) 1.50 1.50	HY SE	D DII CT (mm	A Sect) O Pipe 5 Pipe 5 Pipe	/Condui /Condui	Design t of t of
F1.000 F1.001 F1.002 F1.003	(m) 7.300 80.600 77.700	(m) 0.104 0.971 0.863 0.680	Slope (1:X) 70.2 83.0 90.0 90.0	Area (ha) 0.000 0.000 0.000 0.000	28.0 140.0 140.0 84.0	Bo Flow	0.0 0.0 0.0 0.0	k (mm) 1.50 1.50 1.50	BY SE	D DII OF (mar 0 15 0 22 0 22 0 22	A Sect) O Pipe 5 Pipe 5 Pipe 5 Pipe	/Condui	Design
F1.000 F1.001 F1.002 F1.003 F1.004	(m) 7.300 80.600 77.700 61.200 34.100	(m) 0.104 0.971 0.863 0.680 0.379	Slope (1:X) 70.2 83.0 90.0 90.0 90.0	Area (ha) 0.000 0.000 0.000 0.000 0.000	28.0 140.0 140.0 84.0	Bo Flow	0.0 0.0 0.0 0.0 0.0	k (mm) 1.50 1.50 1.50 1.50	BY SE	D DI: CT (mm 0 15 0 22 0 22 0 22	A Sect) 0 Pipe 5 Pipe 5 Pipe 5 Pipe 6 Pipe	/Condui /Condui /Condui /Condui	Design
F1.000 F1.001 F1.002 F1.003 F1.004	(m) 7.300 80.600 77.700 61.200 34.100	(m) 0.104 0.971 0.863 0.680 0.379	Slope (1:X) 70.2 83.0 90.0 90.0 90.0	Area (ha) 0.000 0.000 0.000 0.000 0.000	28.0 140.0 140.0 84.0 0.0	Bo Flow	0.0 0.0 0.0 0.0 0.0	k (mm) 1.50 1.50 1.50 1.50 1.50	EY SE	D DII CT (mm o 15 o 22 o 22 o 22 o 22	A Sect O Pipe 5 Pipe 5 Pipe 5 Pipe 5 Pipe 5 Pipe	/Condui /Condui /Condui /Condui /Condui	Design
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F1.000 F1.001 F1.002 F1.003 F1.004 F2.000 F2.001	(m) 7.300 80.600 77.700 61.200 34.100 89.800 81.000 44.800	(m) 0.104 0.971 0.863 0.680 0.379 1.056 0.810 0.427	Slope (1:X) 70.2 82.0 90.0 90.0 90.0 100.0 104.9	Area (ha) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	28.0 140.0 140.0 84.0 0.0 140.0 84.0	Bo	0.0 0.0 0.0 0.0 0.0 0.0 0.0	k (mm) 1.50 1.50 1.50 1.50 1.50 1.50	HY SE	D DIJ CT (mm 0 15 0 22 0 22 0 22 0 22 0 22	A Sect) 0 Pipe 5 Pipe 5 Pipe 5 Pipe 5 Pipe 5 Pipe 5 Pipe 5 Pipe	/Condui /Condui /Condui /Condui /Condui /Condui /Condui	Design
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F1.000 F1.001 F1.002 F1.003 F1.004 F2.000 F2.001 F2.002	(m) 7.300 80.600 77.700 61.200 34.100 89.800 81.000 44.800 57.400	(m) 0.104 0.971 0.863 0.680 0.379 1.056 0.810 0.427 0.442	Slope (1:X) 70.2 83.0 90.0 90.0 90.0 100.0 104.9	Area (ha) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Ng	Units 28.00 140.00 140.00 0.00 140.00 84.00 0.00 etwor	Bo Flow	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	k (mm) 1.50 1.50 1.50 1.50 1.50 1.50 1.50 1.50	EY SE	D DIJ CT (mm o 15 o 22 o 22 o 22 o 22 o 22 o 22	A Sect O Pipe Fipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe Vel	/Condui /Condui /Condui /Condui /Condui /Condui /Condui	Design
F1.000 F1.001 F1.002 F1.003 F1.004 F2.000 F2.001 F2.002	(m) 7.300 80.600 77.700 61.200 34.100 89.800 81.000 44.800 57.400	(m) 0.104 0.971 0.863 0.680 0.379 1.056 0.810 0.427 0.442 (IL Z iii) (1) 250 0	Slope (1:X) 70.2 83.0 90.0 90.0 90.0 100.0 104.9 129.9 Area ha) F.	Area (ha) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 E Baselow (1)	Units 28.0 140.0 140.0 84.0 0.0 140.0 84.0 0.0 0.0 0.0 0.0	Flow K Res Units	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	k (mm) 1.50 1.50 1.50 1.50 1.50 1.50 1.50 1.50	BY SE	D DIJ CT (mm o 15 o 22 o 22 o 22 o 22 o 22 o 22 o 22 o 2	A Sect O Pipe 5 Pipe Vel (m/s)	/Condui /Condui /Condui /Condui /Condui /Condui /Condui /Condui	Design t of t o
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DBFL Con	sultin	g Eng	ineers					Pa	ige 3	1	
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Upper Or	mond Q	uav		DBFL R	EF: 17	0092					
Dublin 7		-		FOUL-	CATCHM	ENT 1B					
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File 170	092 FC	UL 1B	.ii.mdx	Checke	d by Di	MW		U	rainage		
Innovyze				Networ							
			Manhole S	chedules	for Fo	oul - Uni	t			1	
ME Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)		Pipe Out	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backd (mm
F814-7	22.810	1.321	Open Manhole	1200	F1.000	21.489	225				
		- V-12-5-1-1	Open Manhole	16,000,000		21.000		F1.000	21.000	225	
			Open Manhole	1		21.650				1.11	
		7.00	Open Manhole	(6) (6) (6) (1)	F1.002			F1.001	20.728	225	
N-0-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	A STATE OF THE STA			0.700.00				F2.000		150	9
F814-4-1	26,250	3,350	Open Manhole	1200	F3.000	22.900	225	320333			
	TO BE STORY	100000000000000000000000000000000000000	Open Manhole	77.36.37%	F1.003			F1.002	20.573	225	
	14.000		open mannote	12.00		20.070	223	F3.000		225	
F814_2	24 720	4 206	Open Manhole	1200	F1 004	20.524	225	F1.003		225	- 7
			Open Manhole			22.900		11.000	20.024	220	
	1.1	4.0	Open Manhole	(C)		21.500					
	10000	M 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Open Manhole	200000000				F4.000	22.496	225	1
1014-2-1	23.490	2.007	Open Manhole	1200	F4.001	20.623	225	F5.000		150	15
										7-200	1
1814-2	28.950	3.754	Open Manhole	1200	F1.005	20.196	225	F1.004		95000	
									20.443	l	0.0
		4.806	Open Manhole			19.954			19.954	225	
F	0.000	00	Open Manhole	0		OUTFALL		F1.006	19.632	225	
Ē	0.000	la j	Open Manhole	0		OUTFALL		F1.006	19.632	225	
			©1	982-2018	Innov	/ze				1	

Appendix G

FOUL PUMPING STATION CALCULATIONS

(A) CALCULATION OF DESIGN FLOWS

IW Loading Standards = 446 I/dwelling/day Dwelling + Creche Equilvalent = 275 Units

Development Loading = 122,650.00 l/day

Total

Dry Weather Flow (DWF) = 122,650 I/day = 1.420 I/s

= 0.00142 m³/s = 122.65 m³/day

3 x DWF = 4.25868 l/s 6 x DWF = 8.51736 l/s

 Size of Existing Rising Main
 =
 100 mm dia

 Hydraulic gradient
 =
 1 in 85

 Capacity
 =
 7 l/s

 Velocity
 =
 0.833 m/s

Note: Capacity of existing pumps = 7 l/s

(B) DELIVERY HEAD

 Static Lift
 =
 3.2 m

 Hydraulic gradient
 =
 1 in 85

 Friction Loss in 280m long Rising Main
 =
 3.3 m

 Station Losses
 =
 3 m

Total Delivery Head Required = 9.5 m

(C) SEPTICITY IN RISING MAIN

Length of Rising Main=280 mVolume of Rising Main=2.20 m³Turnover per day=55.8 times/dayTime Interval between clearing of Main=0.43 hours=26 mins

(D) STORAGE REQUIREMENTS

Provide 12 hour storage = 61 m³

Appendix H

IRISH WATER STATEMENT OF DESIGN ACCEPTANCE & CONFIRMATION OF FEASIBILITY

UISCE EIREANN: IRISH WATER

Dermot Grogan DBFL Ormond House Upper Ormond Quay Dublin 7

8 October 2019

Uisce Éireann Bosca OP 448 Oifig Sheachacta na Cathrach Theat Cathair Chorcal

Irish Water PO Box 448, South City Delivery Office, Corli City

www.water.ie

Re: Design Submission for Strategic Housing Development at Colpe West, Drogheda, Co. Meath (the "Design Submission") / Connection Reference No: 4211898364

Dear Dermot,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form 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 (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "Self-Lay Works"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works

If you have any further questions, please contact your Irish Water representative:

Name: Fionán Ginty Phone: 01 8925734 Email: fginty@water.ie

Yours sincerely,

M Whyse Maria O'Dwyer

Connections and Developer Services

Stiúrthóirí / Directors: Cathal Marley (Chairman), Mall Geason, Eamon Gallen, Brendan Murphy, Michael G, O'Sullivan

Oifig Chláraithe / Registered Office: Teach Cohill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Cohvill House, 24-26 Talbot Street, Dublin 1, D01 NP86

Is cuideachta ghríomhaíochta ainmnithe atá faoi theorainn scalreanna é Uisce Éireann / Irich Water is a designated activity company. Irmited by chares.

Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

900E

Appendix A

Document Title & Revision

- 170092-3050 Rev.A
- 170092-3051 Rev.C
- 170092-3052 Rev.B
- 170092-3053 Rev.C
- 170092-3054 • 170092-3055
- 170092-3056
- 170092-3057
- 170092-3091
- 170092-3092
- 170092-3093
- 170092-3094
- 170092-3095

Standard Details/Code of Practice Exemption: N/A

For further information, visit www.water.ie/connections

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

Letter Ref: CUST17874

Dermot Grogan DBFL Ormond House Upper Ormond Quay Dublin 7



29-Dec-17

Dear Sir/Madam,

Re:

4211898364 pre-connection enquiry - Subject to contract | Contract denied Connection for 380 unit residential at Mill/Marsh Road, Drogheda, Co. Louth

Irish Water has reviewed your pre-connection enquiry in relation to at Mill/Marsh Road, Drogheda, Co. Louth water and wastewater connections 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.

Strategic Housing Development

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

A. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. B. You are

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

In order to accommodate the proposed water connection at the development, upgrade works are required to increase the capacity of the Irish Water network. Works to include upgrading approx 950m of 150mm pipework. Irish Water does not currently have any plans to carry out the works required to provide the necessary upgrade and capacity. Should you wish to have such upgrade works progressed, Irish Water will require you to provide a contribution of a relevant portion of the costs for the required upgrades, please contact Irish Water to discuss this further.

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 for Utilities.

If you have any further questions, please contact Fionán Ginty from the design team on 018925734 or email fginty@water.ie. For further information, visit www.water.ie/connections

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

September / Divertors Worder (Control Charmer) Vender Compositioned 17, control Charmer (Anna Marie)

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