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Planning Section
South Dublin County Council
County Hall
Tallaght
Dublin 24
D24 A3XC

18th June 2021

Our Ref. CHC-XX-XX-CO-C-00001

RE: PLANNING PRMISSION FOR 24 NO. RESIDENTIAL UNITS AT BALLYROAN HOUSE, RATHFARNHAM, D14

To whom it concerns,

The above development previously received planning permission for development under Planning Reg. Ref. SD17A/0064 / ABP Reg. Ref. PL06S.249209.

It is now intended to apply for planning permission for a slightly amended layout as referenced on the enclosed application plans and documents.

We note that the civil engineering design requirements in terms of all Engineering Services meet the requirements demanded by this new application layout and therefore the principals outlined in the previous reports and drawings, appended to this covering letter, are deemed appropriate.

The proposals applicable to this application are in essence a minor amendment to the previously Granted Permission and are reflected on the appended drawings, noting that the design philosophy of the previously granted development has not changed.

We note that an updated confirmation of Feasibility (CoF) has been obtained from Irish Water and indicates network capacity in excess of that demanded by this development proposal, and is appended for reference.

If you have any queries in relation to the foregoing or if you require any further information, please do not hesitate to contact the undersigned.

Yours Sincerely,

MICHAEL HODNETT Dip Struct Eng, BSc(Eng), CEng, MIStructE, MIEI

Director

For Corrigan Hodnett Consulting Ltd.

cc Mr David Leyden – Homeland BRH Ltd. – Architect & Applicant Rep.

Encl. - CHC Drawing Issue Sheet;

- CHC Drawings referenced in Drawing Issue Sheet;
- CHC Engineering Services Report;
- Confirmation of Feasibility from Irish Water.

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Schedule of documents

Client: Homeland BRH Ltd.

Job Title: Ballyroan House, Rathfarnham, D14

Day 23 | Month 06 | Year 21

Drawing Number	Drawing Title	Size	Sheets	Revisions	Rev
CHC-XX-XX-CO-C-00001	Cover Letter & Reports	A4	74	P01	P01
CHC-00-GR-DR-C-00104	Roads Layout and Details	A1	1	P01	P01
CHC-00-GR-DR-C-00200	Drainage Layout	A1	1	P01	P01
CHC-00-GR-DR-C-00300	Watermain Layout	A1	1	P01	P01

Suitability: S1=Coord, S2=Info, S4=Planning, D2=Tender, D3=Compliance, A1=Const, CR=As Const — S4 — Current Rev

Recipient	For attention of	Quantity Issued (Full size / reduced) (E=Email)
Brock McClure	L McEllin	10

Issued to full design team through the common data environment

Issued by: NN

If any document referenced in this schedule is not received, CHC to be notified.

Template document reference number : CHC-XX-XX-SH-S/C-00001

Paul Corrigan

Unit 84
Omni Park SC
Santry
Dublin 9
Co. Dublin

21 December 2020

Re: CDS20008020 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 37 units at Ballyroan House, Ballyroan Heights, Co. Dublin

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Ballyroan House, Ballyroan Heights, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	OUTCOME OF PRE-CONNECTION ENQUIRY THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

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

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Engineering Services Report

Project:

Ballyroan House, Rathfarnham, Dublin 14

Client:

Homeland Projects Limited

CHC

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DETAILS, CONTROL & ISSUE LOG

CHC

Civil and Structural Consulting Engineers

Client Details:	**HOMELAND PROJECTS LIMITED**
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CHC Project Supervisor:	**PAUL CORRIGAN**
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1	Paul Corrigan	17/02/2017	Michael Hodnett	17/02/2017

NOTICE

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1. INTRODUCTION

Corrigan Hodnett Consulting have been appointed by the Client, Homeland Projects Limited, to prepare the engineering elements of a planning application for a development at Ballyroan House, Rathfarnham, Dublin 14.

The site is a brownfield site located in Rathfarnham and is accessed off Ballyroan Heights which is a local road serving an existing residential development (Ballyroan Heights and Elkwood) which is off Ballyroan Road, Regional Road R817. The following co-ordinates fall within the site boundary;

	X/Easting	Y/Northing
ITM Co-ordinates	713052	727684
Irish Grid Co-ordinates	313125	227656

The total site area amounts to 10038.5 square metres. The site is a brownfield site occupied by an existing protected structure and a number of outhouses. ***Figure 1*** following details the location of the proposed development site which is within the administrative jurisdiction of South Dublin County Council.

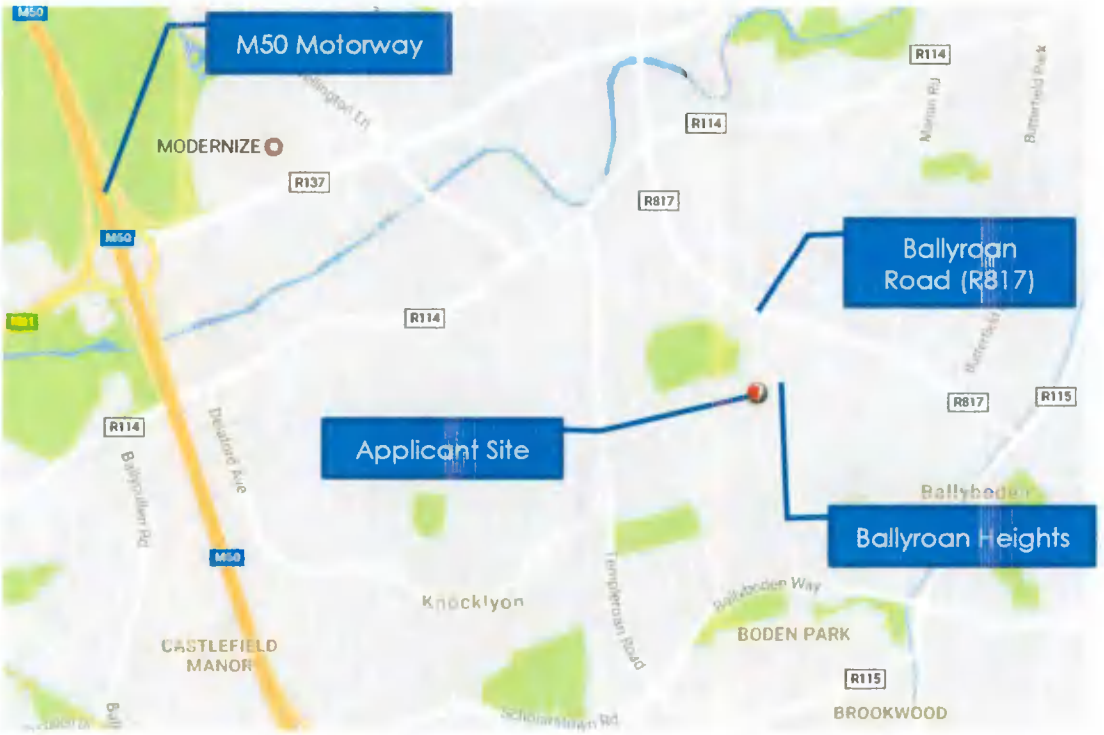


Figure 1 – Ballyroan House Development Site

The existing protected structure on the site is in use as a private residential dwelling and the outhouses are in commercial use.

The proposed development comprises a refurbishment of the existing protected structure with modifications and renovations to convert it into 3no. residential units, and a further 20no. dwellings comprised of a mix of detached, semi-detached and terraced units.

The planning application will also include proposals to confirm the adequacy of access, roads and drainage infrastructure and water supply for the site. It is estimated that, should the development progress, the construction will be completed and the development fully occupied by mid 2018.

The site is located in an urban area and the surrounding areas are comprised primarily of residential developments, see **Figure 2** following.

Figure 2 – Ballyroan House Development Site – Local Context

2. PURPOSE OF REPORT

This report has been prepared as part of a planning application to develop the Ballyroan House site and addresses the engineering aspects of the planning application. The report has been prepared and compiled by reviewing available data from Local Authority sources and national bodies, i.e. South Dublin County Council and the Design Team. This report addresses:

- Stormwater Drainage;
- Foul Water Drainage;
- Potable Water Supply;
- Traffic and Transportation;

All design calculations will be in accordance with:

- Local Authority requirements;
- BS EN 752 – Drainage Outside Buildings;
- The Building Regulations – Technical Guidance Document 'H';
- Recommendations for Site Development Works for Housing Areas, Dept. of Environment, 1998;
- Office of Public Works, The Planning System and Flood Risk Management, December2009.

Other elements of the application pertaining to landscaping, planning or architectural issues are covered by the respective members of the design team.

3. STORM WATER DRAINAGE

3.1 The development site falls within the administrative jurisdiction of South Dublin County Council. In order to apply best practice principles for storm water design, the Greater Dublin Strategic Drainage Study (GDSDS) recommendations have been adopted for design purposes to ensure that the storm water drainage proposals for the development comply with national and regional guidelines. The stormwater network serving the development has been designed in accordance with GDSDS requirements and the design calculations are included in ***Appendix B***.

3.2 In order to comply with the GDSDS requirements, any proposed development must ensure that a comprehensive sustainable urban drainage system, SuDS, is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, storm water volumes from extreme storm events up to a 1 in 100 year storm event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability). Any new development must have the physical capacity to retain storm water volumes as directed under the Greater Dublin Strategic Drainage Strategy and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate. A further component of the SuDS protocols is to increase the overall water quality of surface water runoff before it enters a natural watercourse or into a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of storm water quality.

3.3 A number of systems are available to comply with this protocol. These have been assessed using the Site Evaluation tool on the www.Irishsuds.com website. For the proposed development, it is proposed that the following systems will be used:

Attenuation Storage will be provided to ensure that there is adequate attenuation storage for limited discharge surface water volumes. The current proposal details that the attenuation storage will take to the form of underground Stormtech modular storage system for events up to, and including, the 1.0% AEP rainfall event. Details of the Tank are included in ***Appendix A***.

Permeable Paving will be provided beneath all car parking areas which will act as the first level of treatment from runoff from parked vehicles. Permeable paving is also proposed at the shared surface area at the south east of the site. In curtilage parking spaces will be constructed as Load Class 2 permeable paving and all other permeable paving proposed will be constructed as Load Class 4.

Limiting discharges to ensure that discharge rates are maintained at a specified greenfield runoff rate. A discharge rate of 6.0 l/s was determined for the site.

A ***class 1 by-pass separator*** will be provided as the first second level for the entirety of the site catchment.

3.4 It is proposed to provide a Sustainable Drainage System (SuDS) in accordance with the Greater Dublin Strategic Drainage Study Regional Drainage Policy Volume 2 - New Development (GDSDS-RDP Volume 2). Specific design requirements for SuDS components are established by the Construction Industry Research and Information Association's publication CIRIA C697-SuDS Manual (C697).

3.5 The site has a catchment area of 1.004Ha of which 0.46Ha is hardstanding. Storm flows will be attenuated to the requirements of GDSDS and comply with the criteria detailed in ***Table 1*** below.

3.6 There are several specific requirements in relation to surface water drainage which must be adhered to as part of any development in areas where the GDSDS is required. Volume 2 of the GDSDS, titled Regional Drainage Policies – Volume 2 New Developments sets out the criteria for new developments. Table 1 following extract from Volume 2 of the GDSDS sets out the specific criteria for new developments;

Criteria	Sub-criterion	Return Period (Years)	Design Objective
Criterion 1 River water quality protection	1.1	<1	Interception storage of at least 5mm, and preferably 10mm, of rainfall where runoff to the receiving water can be prevented.
	1.2	<1	Where initial runoff from at least 5mm of rainfall cannot be intercepted, treatment of runoff (treatment volume) is required. Retention pond (if used) to have minimum pool volume equivalent to 15mm rainfall.
Criterion 2 River regime protection	2.1	1	Discharge rate equal to 1 year greenfield site peak runoff rate or 2l/s/ha, whichever is the greater. Site critical duration storm to

Criteria	Sub-criterion	Return Period (Years)	Design Objective
			be used to assess attenuation storage volume.
	2.2	100	Discharge rate equal to 1 in 100 year greenfield site peak runoff rate. Site critical duration storm to be used to assess attenuation storage volume.
Criterion 3 Level of service (flooding) for the site	3.1	30	No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical.
	3.2	100	No internal property flooding. Planned flood routing and temporary flood storage accommodated on site for short high intensity storms. Site critical duration events.
	3.3	100	No internal property flooding. Floor levels at least 500mm above maximum river level and adjacent onsite storage retention.
	3.4	100	No flooding of adjacent urban areas. Overland flooding managed within the development.
Criterion 4 River flood protection (criterion 4.1, or 4.2 or 4.3 to be applied)	4.1	100	"Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.
	4.2	100	Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events.

Criteria	Sub-criterion	Return Period (Years)	Design Objective
			100year, 6 hour duration storm to be used for assessment of the additional volume of runoff
	4.3	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.

Table 1 – Extract from GDSDS – Criteria for New Developments

3.7 Criterion 1 – River Water Quality Protection

The drainage solution proposed for the development contains a range of treatment methods for surface water prior to discharge to ensure river water quality protection. The design complies with Sub-criterion 1.1 as the drainage solution proposed includes interception of 10mm of surface water from the first flush of storm events. The 10mm interception proposed is based on the entire site area, including soft standing. Therefore, the volume provided is in excess of the preferred 10mm requirement set down in the GDSDS as rainfall on soft standing areas will infiltrate to ground.

As interception storage is to be provided in accordance with Sub-Criterion 1.1 of the GDSDS, retention storage is not required for the first 10mm rainfall of storm events (in accordance with Sub-criterion 1.2. Therefore, the proposals satisfy Criteria 1.

3.8 Criterion 2 – River Regime Protection

The discharge rate stipulated in Sub-criterion 2.1 requires a limited discharge equivalent to '1 year greenfield site peak runoff rate or 2l/s/ha, whichever is the greater'. The site area amounts to 1.004 Ha. The calculated greenfield runoff rate for the site is 1.9 l/s for the 1 year event, 4.9 l/s for the 30year event and 6.0 l/s for the 100 year event and these values have been adopted for design purposes as stipulated in Sub-criterion 2.1. Therefore the proposals satisfy Criteria 2. Details of the Greenfield Runoff Calculations are included in ***Appendix B***.

3.9 Criterion 3 – Level of Service (Flooding) for the Site

The proposed stormwater discharge from the site is to the existing 225mm diameter storm sewer located adjacent to the northern boundary on Ballyroan Heights. The

proposed drainage layout and attenuation arrangements are shown on CHC drawing number ***16-052-C200***. The water services records received from South Dublin County Council are included in ***Appendix D***.

3.9.1 Sub-criterion 3.1

The performance of the proposed drainage system in 30-year return period storm events has been analysed. The analyses show that no flooding will occur in 30-year return period storm events.

3.9.2 Sub-criterion 3.2

The performance of the proposed drainage system in 100-year return period storm events has been analysed. The analyses show that no flooding is expected in the 100-year return period storm event. The topography of the site ensures that, in the event of a network failure, the natural flood route for the water is from the south of the site to the north and no property flooding will occur.

3.9.3 Sub-criterion 3.3

The site demonstrates a variance in levels falling from the south (rear of the site) to the north (towards the entrance). The lowest level occurs at the existing vehicular entrance to the north of the site with a level of 67.00metres and the highest level is at the extreme south of the site with a level of 78.00metres.

The maximum water level in the proposed attenuation will not have an effect on the proposed buildings. All proposed buildings are at least 500mm above the design 100-year water level in the attenuation facility for their relative catchments, in accordance with the requirements of Sub-Criterion 3.3.

3.9.4 Sub-criterion 3.4

The performance of the proposed drainage system in the 100-year return period storm events has been analysed. The analyses show that no flooding is expected in the 100-year return period storm event. No off-site overland flow is expected in the 100-year return period storm event.

3.10 Criterion 4 – River Flood Protection

In accordance with sub-criterion 4.3, runoff from the site will be limited to the greenfield runoff level. By limiting the runoff to this flow rate, the GDSDS-RDP Volume 2, Appendix E Section E2.4 states that this ensures 'that sufficient stormwater runoff retention is

achieved to protect the river during extreme events'. Attenuation storage is provided for the 100-year return period storm event in the proposed underground Stormtech or similar storage attenuation facility. Control of runoff rates will be achieved through the use of vortex control devices (e.g. Hydrobrake), which reduce the risk of blockage present with other flow control devices. Calculations of attenuation volume are included in ***Appendix C***.

4. FOUL WATER DRAINAGE

4.1 The site is currently served by an existing septic tank system due to the age of the buildings currently onsite and the minimal flows currently discharging.

4.2 There is an existing 225mm diameter foul sewer flowing east along Ballyroan Heights to the north of the site adjacent to the existing site entrance. It is proposed to connect the development to this network via a new manhole to be constructed on the existing soul sewer. Details of the proposed connection are shown on ***CHC Drawing Number 16-052-C200***. Foul Drainage Calculations are included under ***Appendix E***. The water services records received from South Dublin County Council are included in ***Appendix D***.

4.3 All drainage within the individual plots is private therefore the Building Regulations Part H is applied. The foul drainage pipes used within these areas range from 100-150mm PVC-U and have minimum and maximum falls of 1/60 and 1/150 respectively.

4.4 Foul drainage for all other areas shall be in accordance with the Irish Water Construction Details and individual connections from each unit will be made to the main sewer network within the site.

5. POTABLE WATER SUPPLY

5.1. The site is currently serviced by a connection off the existing 4" water main on Ballyroan Heights. Refer water services records received from South Dublin County Council included in ***Appendix D***.

.5.2 The proposed development is to be connected to the existing water main on Ballyroan Heights. A bulk water metre will be installed at the entrance to the site and facilities for a individual water metres for each unit will be installed to ensure that these works are complete in the event that the scheme is handed over to Irish Water in the future.

5.3. In accordance with best practice, new water saving devices (low water usage appliances, rainwater harvesting tanks and aerated taps etc.) will be fitted as standard into the proposed new units.

5.5. CHC drawing number ***16-004-C300*** details the proposed new potable water layout. All works are to be compliant with the Irish Water Specifications.

6. TRAFFIC AND TRANSPORTATION

6.1. Overview

The development is located off Ballyroan Heights which provides ready access to Ballyroan Road and onwards to the M50. There are a number of high capacity regional roads within close proximity to the site which permeate through the surrounding areas and northwards towards the city centre. As such the development is well services from a road network perspective.

The existing road width of the metalled surface of Ballyroan Heights averages approximately 6.0metres. The existing surface is concrete and has a number of trench reinstatements which would be expected given the age of the Ballyroan Heights and Elkwood housing estates. Ballyroan Heights is kerbed on both sides and has a 2.0m footpath and 1.6m grassed verge on both sides. All units accessed off Ballyroan Heights have in-curtilage parking provision although cars can be observed parking on road as parking is unregulated.

Due to the nature of Ballyroan Heights it is considered that traffic volumes on the road are small and it is primarily used by local traffic. A speed limit of 50kph applies to Ballyroan Heights for its full extents but this may change in the future as 30kph speed limits are adopted in areas such as this which are primarily residential and have a school in proximity

The development site has a single access point onto the public road at Ballyroan Heights and it is proposed to utilise this access (with upgrading works) to service the developed site.

6.2. Access & Sightlines

The proposed development is to be accessed from Ballyroan Heights, using the existing vehicular entrance to the site. As part of the development, the access and parking arrangements will be regularised to optimise the parking area and prevent vehicle conflict within the site.

The access sightlines for the development are detailed on CHC drawing number ***16-052-C103***. The sightline requirements for new urban developments are set out in the Design Manual for Urban Roads and Streets, specifically sections 4.4.4 and 4.4.5. Ballyroan Heights forms a junction with Elkwood Estate 36.0m to the west of the proposed access which is visible from the proposed access. The sightline requirements of 45.0m (as stipulated in Table 4.2 of DMURS) is achieved to the east. An 'x' setback

distance of 2.4m has been adopted for design purposed in accordance with section 4.4.5 of DMURS.

6.2. Parking

Parking provision is in accordance with development plan standards. Each unit has 2no. spaces per unit. The parking provision for all units is in-curtilage, with the exception of the terraced units which have a single space provided in-curtilage and a single allocated space provided opposite the terraces.

6.3. Vehicle Manoeuvring

A vehicle swept path analysis has been carried out on the scheme layout and is shown on ***CHC drawing 16-052-C102***. The kerb return radii at the development access junction is 5.50metres which is the minimum required to facilitate a refuse vehicle turning manoeuvre. The radii at the turning hear at the rear of the site are similarly informed by the vehicle swept path analysis results.

6.4. Internal Road Network

The internal road network has been designed in accordance with the requirements of DMURs and TD9/11. Due to the constraints inherent in the topography of the site it has been necessary to provide an access road gradient of 7.0% which is substantially lower than the existing access road gradient. Mr. Adrian Barrett of South Dublin County Council was consulted in meeting of 6th February 2017 regarding the proposed layout and gradients and was satisfied that, given the level differences within the site, the design proposals are satisfactory from a roads and transportation perspective.

6.5. Road Surfacing

The majority of the development access road is to be constructed with a PMSMA surface and details of the makeup are shown on ***CHC drawing 16-052-C103***. There is also a proposed permeable shared surface area adjacent to the terraced units which is to be surfaced with a Load Class 4 Permeable paved brick/block surfacing. Details of the makeup are shown on ***CHC drawing 16-052-C103***. Pedestrian crossings are to be raised ramps and the pedestrian crossing in front of the existing protected structure will have an approved coloured 14mm stone chip (HRA). Details of the areas with different surface finishes are shown on ***CHC drawing 16-052-C100***.

7. FLOODING

7.1 As part of the due diligence on the site, the OPW website was consulted in an effort to determine if the site of the immediate surrounding area was subject to flooding or if there was any historical evidence of flooding in the immediate area.

7.2 The OPW report is included in ***Appendix F*** and confirms that there are no records of flooding in the immediate vicinity of the site.

8. CONCLUSIONS AND RECOMMENDATIONS

8.0. This report has been prepared as part of a planning application submission for a residential development at Ballyroan House, Rathfarnham, Dublin 14.

8.1 The site is currently in residential and commercial use. The proposed development comprises a refurbishment of the existing protected structure with modifications and renovations to convert it into 3no. residential units, and a further 20no. dwellings comprised of a mix of detached, semi-detached and terraced units to include all associated site works. It is estimated that, should the development progress, the construction will be completed and the development fully occupied by mid 2018.

8.2 The development site falls within the administrative jurisdiction of South Dublin County Council. The Greater Dublin Strategic Drainage Study (GDSDS) recommendations have been adopted as a best practice guide design standards for the scheme and will thus are required to be implemented and incorporated into the surface water drainage design solution for the development site. The proposed surface water design complies with the specific requirements of the GDSDS. The proposed surface water discharge is to the existing surface water sewer on Ballyroan Heights to the immediate north of the site, via an attenuated outflow. The relevant SUDS measures have been incorporated into the surface water drainage solution design for the development site.

8.3 The development generated wastewater from the site is proposed to be discharged to the existing 225mm diameter foul sewer on Ballyroan Heights to the immediate north of the site.

8.4 The potable water supply for the development is proposed to be taken from the existing watermain on Ballyroan Heights.

8.5 The proposed access to the site is via the existing main vehicular access at the north of the site. Based on the road characteristics, it is considered that the achievable sightlines are acceptable in accordance with DMURS requirements.

8.6 The roads network within the site is compliant with TD9/11 and DMURS and meetings with representatives of South Dublin County Council have confirmed that the proposals are acceptable in principle.

8.7 The engineering aspects of the scheme are compliant with regional and national guidelines and the enclosed documents confirm this fact. There are no apparent issues outstanding regarding the engineering aspects of the planning application. As such,

we submit that, the development as proposed has been designed in accordance with best practice and the relevant standards.

8.8 Further to consulting the OPW flood database, it is confirmed that there are no records of any flood events which impact the subject site.

We trust that this is satisfactory to you but should you have any queries on this Report, please do not hesitate to contact the undersigned.

Yours Sincerely,

PAUL CORRIGAN NCEA Civil Eng, BSc (Hons) Civil Eng, Pg Cert Civil Eng, AEng, MIEI
Director
For Corrigan Hodnett Consulting

APPENDIX A:

Proposed Attenuation Tank System

StormTech®

Detention • Retention • Water Quality

A division of ADS

Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

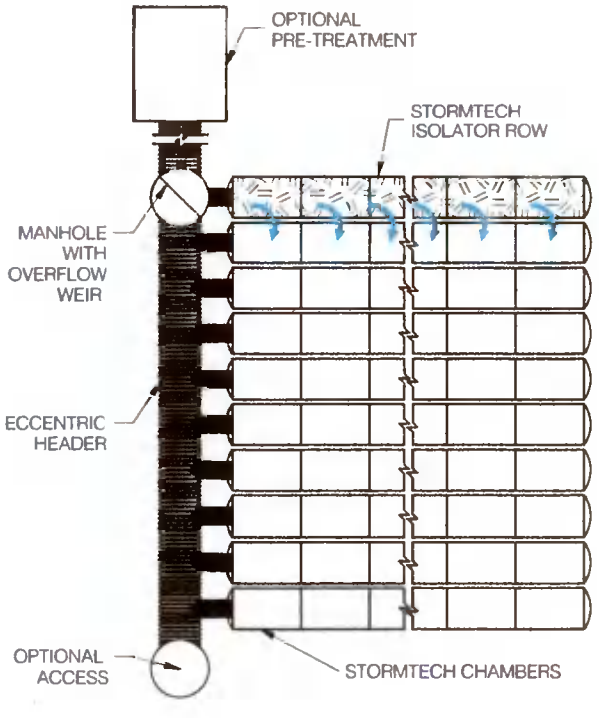
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

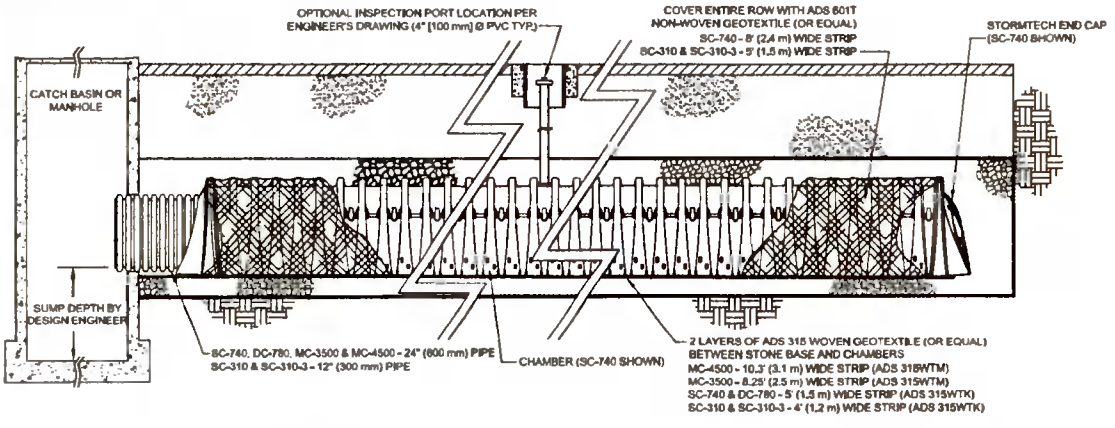
2.2 MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

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

Maintenance is accomplished with the JetVac process. 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, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 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

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

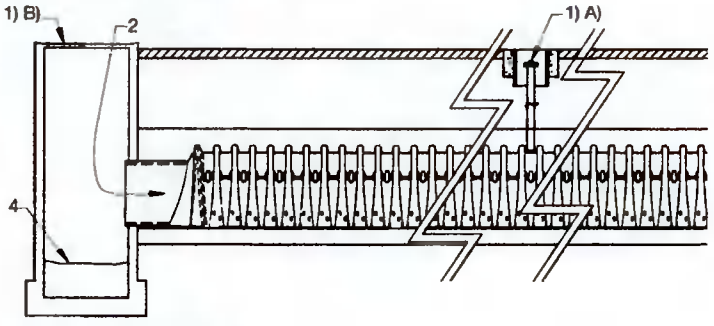
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry

2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps. lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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#11011 03/16

APPENDIX B:

Greenfield Runoff Calculations

Stormwater Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	1.000	Urban	0.000
SAAR (mm)	852	Region Number	Ireland Greater Dublin

Results l/s

QBAR Rural	2.3
QBAR Urban	2.3
Q100 years	6.0
Q1 year	1.9
Q30 years	4.9
Q100 years	6.0

Corrigan Hodnett Consulting Civil &	
Structual Engineers Unit 84 Omni Park SC Santry Dublin 9	
Date 16/02/2017 17:03	Designed by USER
File 16-052_Drainage Design_20170216.1.MDX	Checked by
XP Solutions	Network 2016.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	74.046	1.050	Open Manhole	1200	S1.000	72.996	300				
S2	74.575	1.643	Open Manhole	1200	S1.001	72.932	300	S1.000	72.932	300	
S3	74.700	1.883	Open Manhole	1200	S1.002	72.817	300	S1.001	72.817	300	
S4	73.861	2.278	Open Manhole	1200	S1.003	71.583	300	S1.002	72.753	300	1170
S5	73.800	2.282	Open Manhole	1200	S2.000	71.518	300				
S6	73.018	1.500	Open Manhole	1200	S1.004	71.518	300	S1.003	71.518	300	
								S2.000	71.518	300	
S7	72.160	2.644	Open Manhole	1200	S1.005	69.516	300	S1.004	71.110	300	1594
S8	70.949	1.500	Open Manhole	1200	S1.006	69.449	300	S1.005	69.449	300	
S9	70.339	1.500	Open Manhole	1200	S1.007	68.839	300	S1.006	68.839	300	
S10	70.089	2.809	Open Manhole	1200	S1.008	67.280	300	S1.007	68.589	300	1309
S11	68.811	1.531	Open Manhole	1200	S1.009	67.280	225	S1.008	67.280	300	
S12	66.952	0.302	Open Manhole	1200	S1.010	66.650	225	S1.009	66.650	225	
S	67.140	0.760	Open Manhole	1200		OUTFALL		S1.010	66.380	225	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	Add Flow / Climate Change (%)	10
M5-60 (mm)	16.200	Minimum Backdrop Height (m)	0.000
Ratio R	0.257	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	150	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.072	4-8	0.397	8-12	0.017

Total Area Contributing (ha) = 0.486

Total Pipe Volume (m³) = 14.690

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	15.704	0.064	245.4	0.059	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	28.193	0.115	245.2	0.082	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	15.555	0.064	243.0	0.073	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	16.031	0.065	246.6	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	61.84	4.26	72.996	0.059	0.0	0.0	1.0	1.00	70.6	10.9
S1.001	59.68	4.73	72.932	0.141	0.0	0.0	2.3	1.00	70.7	25.0
S1.002	58.58	4.99	72.817	0.214	0.0	0.0	3.4	1.00	71.0	37.3
S1.003	57.48	5.26	71.583	0.259	0.0	0.0	4.0	1.00	70.4	44.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	9.807	0.000	0.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	15.904	0.408	39.0	0.012	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	16.559	0.067	247.1	0.012	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	29.951	0.610	49.1	0.135	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	13.373	0.250	53.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	20.036	0.000	0.0	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	32.957	0.630	52.3	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	14.524	0.270	53.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	58.13	5.10	71.518	0.000	0.0	0.0	0.0	0.15	10.5	0.0
S1.004	62.61	4.10	71.518	0.000	1.0	0.0	0.1	2.53	178.6	1.0
S1.005	61.27	4.38	69.516	0.012	1.0	0.0	0.3	1.00	70.4	3.3
S1.006	60.25	4.60	69.449	0.147	1.0	0.0	2.5	2.25	159.0	27.4
S1.007	59.79	4.71	68.839	0.147	1.0	0.0	2.5	2.15	152.3	27.4
S1.008	51.61	6.95	67.280	0.203	1.0	0.0	2.9	0.15	10.5«	32.3
S1.009	61.64	4.30	67.280	0.000	6.0	0.0	0.5	1.81	72.1	6.0
S1.010	61.01	4.44	66.650	0.000	6.0	0.0	0.6	1.79	71.1	6.6

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	300	S1	74.046	72.996	0.750	Open Manhole	1200
S1.001	o	300	S2	74.575	72.932	1.343	Open Manhole	1200
S1.002	o	300	S3	74.700	72.817	1.583	Open Manhole	1200
S1.003	o	300	S4	73.861	71.583	1.978	Open Manhole	1200
S2.000	o	300	S5	73.800	71.518	1.982	Open Manhole	1200
S1.004	o	300	S6	73.018	71.518	1.200	Open Manhole	1200
S1.005	o	300	S7	72.160	69.516	2.344	Open Manhole	1200
S1.006	o	300	S8	70.949	69.449	1.200	Open Manhole	1200
S1.007	o	300	S9	70.339	68.839	1.200	Open Manhole	1200
S1.008	o	300	S10	70.089	67.280	2.509	Open Manhole	1200
S1.009	o	225	S11	68.811	67.280	1.306	Open Manhole	1200
S1.010	o	225	S12	66.952	66.650	0.077	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	15.704	245.4	S2	74.575	72.932	1.343	Open Manhole	1200
S1.001	28.193	245.2	S3	74.700	72.817	1.583	Open Manhole	1200
S1.002	15.555	243.0	S4	73.861	72.753	0.808	Open Manhole	1200
S1.003	16.031	246.6	S6	73.018	71.518	1.200	Open Manhole	1200
S2.000	9.807	0.0	S6	73.018	71.518	1.200	Open Manhole	1200
S1.004	15.904	39.0	S7	72.160	71.110	0.750	Open Manhole	1200
S1.005	16.559	247.1	S8	70.949	69.449	1.200	Open Manhole	1200
S1.006	29.951	49.1	S9	70.339	68.839	1.200	Open Manhole	1200
S1.007	13.373	53.5	S10	70.089	68.589	1.200	Open Manhole	1200
S1.008	20.036	0.0	S11	68.811	67.280	1.231	Open Manhole	1200
S1.009	32.957	52.3	S12	66.952	66.650	0.077	Open Manhole	1200
S1.010	14.524	53.8	S	67.140	66.380	0.535	Open Manhole	1200

Setting Out Information - True Coordinates (Storm)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
S1.000	S1	1200		713049.228	727668.081	
S1.001	S2	1200		713049.620	727652.382	
S1.002	S3	1200		713022.469	727644.791	
S1.003	S4	1200		713012.076	727656.364	
S2.000	S5	1200		713017.886	727664.640	
S1.004	S6	1200		713011.882	727672.394	
S1.005	S7	1200		713011.779	727688.298	
S1.006	S8	1200		713022.511	727700.909	
S1.007	S9	1200		713052.311	727703.908	
S1.008	S10	1200		713065.005	727708.114	
S1.009	S11	1200		713084.753	727704.729	
S1.010	S12	1200		713106.936	727729.102	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.010	S	1200		713118.316	727738.126	

Setting Out Information - Site Coordinates (Storm)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
S1.000	S1	1200		713049.228	727668.081	
S1.001	S2	1200		713049.620	727652.382	
S1.002	S3	1200		713022.469	727644.791	
S1.003	S4	1200		713012.076	727656.364	
S2.000	S5	1200		713017.886	727664.640	
S1.004	S6	1200		713011.882	727672.394	
S1.005	S7	1200		713011.779	727688.298	
S1.006	S8	1200		713022.511	727700.909	
S1.007	S9	1200		713052.311	727703.908	
S1.008	S10	1200		713065.005	727708.114	
S1.009	S11	1200		713084.753	727704.729	
S1.010	S12	1200		713106.936	727729.102	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.010	S	1200		713118.316	727738.126	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.059	0.059	0.059
1.001	User	-	100	0.082	0.082	0.082
1.002	User	-	100	0.073	0.073	0.073
1.003	User	-	100	0.045	0.045	0.045
2.000	-	-	100	0.000	0.000	0.000
1.004	User	-	100	0.012	0.012	0.012
1.005	User	-	100	0.012	0.012	0.012
1.006	User	-	100	0.045	0.045	0.045
	User	-	100	0.089	0.089	0.135
1.007	-	-	100	0.000	0.000	0.000
1.008	User	-	100	0.056	0.056	0.056
1.009	User	-	100	0.012	0.012	0.012
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.486	0.486	0.486

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.010	S	67.140	66.380	66.380	1200	0

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 Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.200	Storm Duration (mins)	30
Ratio R	0.257		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: SC, DS/PN: S1.004, Volume (m³): 3.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	71.518
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0
Flush-Flo™	0.205	0.8
Kick-Flo®	0.415	0.7
Mean Flow over Head Range	-	0.8

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 (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake Optimum® Manhole: S11, DS/PN: S1.009, Volume (m³): 3.1

Unit Reference	MD-SHE-0108-6000-1500-6000
Design Head (m)	1.500
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	67.280
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Hydro-Brake Optimum® Manhole: S11, DS/PN: S1.009, Volume (m³): 3.1

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	6.0
Flush-Flo™	0.448	6.0
Kick-Flo®	0.918	4.8
Mean Flow over Head Range	-	5.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	5.4	3.000	8.3	7.000	12.4
0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.8
0.300	5.8	1.600	6.2	4.000	9.5	8.000	13.2
0.400	6.0	1.800	6.5	4.500	10.1	8.500	13.6
0.500	6.0	2.000	6.9	5.000	10.6	9.000	14.0
0.600	5.9	2.200	7.2	5.500	11.1	9.500	14.4
0.800	5.4	2.400	7.5	6.000	11.5		
1.000	5.0	2.600	7.8	6.500	12.0		

Storage Structures for Storm

Tank or Pond Manhole: S6, DS/PN: S1.004

Invert Level (m) 71.518

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	135.0	1.000	135.0

Tank or Pond Manhole: S11, DS/PN: S1.009

Invert Level (m) 67.280

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	1.000	50.0	1.001	0.0

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
S1.000	S1	0.500
S1.001	S2	0.500
S1.002	S3	0.500
S1.003	S4	0.500
S2.000	S5	0.500
S1.004	S6	0.500
S1.005	S7	0.500
S1.006	S8	0.500
S1.007	S9	0.500
S1.008	S10	0.500
S1.009	S11	0.500
S1.010	S12	0.500

CASDeF Controller for Storm

PN	US/MH Name	Level Not Exceeded	Modify Control	Modify Pipe Size	Max Pipe Diameter	No. Pipe Failures	Add Storage	No. Storage Failures	Use CASDeF
S1.000	S1	74.046	Yes	No	900	0	Yes	0	Yes
S1.001	S2	74.575	Yes	No	1493	0	Yes	0	Yes
S1.002	S3	74.700	Yes	No	950	0	Yes	0	Yes
S1.003	S4	73.861	Yes	No	1350	0	Yes	0	Yes
S2.000	S5	73.800	Yes	No	1350	0	Yes	0	Yes
S1.004	S6	73.018	Yes	No	900	0	Yes	0	Yes
S1.005	S7	72.160	Yes	No	1350	0	Yes	0	Yes
S1.006	S8	70.949	Yes	No	1350	0	Yes	0	Yes
S1.007	S9	70.339	Yes	No	1350	0	Yes	0	Yes
S1.008	S10	70.089	Yes	No	1375	0	Yes	0	Yes
S1.009	S11	68.811	Yes	No	225	0	Yes	0	Yes
S1.010	S12	66.952	Yes	No	225	0	Yes	0	Yes

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
S1.000	S1	1.188	1.110	0.000	2.298
S1.001	S2	1.858	1.993	0.000	3.851
S1.002	S3	2.130	1.100	0.000	3.229
S1.003	S4	2.576	1.133	0.000	3.710
S2.000	S5	2.581	0.693	0.000	3.274
S1.004	S6	1.696	1.124	202.500	205.321
S1.005	S7	2.990	1.170	0.000	4.161
S1.006	S8	1.696	2.117	0.000	3.814
S1.007	S9	1.696	0.945	0.000	2.642
S1.008	S10	3.177	1.416	0.000	4.593
S1.009	S11	1.732	1.310	50.017	53.059
S1.010	S12	0.342	0.577	0.000	0.919
Total		23.662	14.690	252.517	290.869

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
S1.000	S1	1.188	1.025	0.000	2.213
S1.001	S2	1.858	1.908	0.000	3.766
S1.002	S3	2.130	1.015	0.000	3.144
S1.003	S4	2.576	1.048	0.000	3.625
S2.000	S5	2.581	0.608	0.000	3.189
S1.004	S6	1.696	1.039	202.500	205.236
S1.005	S7	2.990	1.086	0.000	4.076
S1.006	S8	1.696	2.032	0.000	3.729
S1.007	S9	1.696	0.860	0.000	2.557
S1.008	S10	3.177	1.331	0.000	4.508
S1.009	S11	1.732	1.263	50.017	53.011
S1.010	S12	0.342	0.530	0.000	0.871
Total		23.662	13.746	252.517	289.925

Summary of Critical Results by Maximum Flood Volume (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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	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	0.257
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.200	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	10080 Winter	1	+10%				
S1.001	S2	10080 Winter	1	+10%				
S1.002	S3	10080 Winter	1	+10%	100/15 Summer			
S1.003	S4	10080 Winter	1	+10%	30/15 Summer			
S2.000	S5	10080 Winter	1	+10%	1/360 Winter			
S1.004	S6	10080 Winter	1	+10%	1/360 Winter			
S1.005	S7	10080 Winter	1	+10%				
S1.006	S8	10080 Winter	1	+10%				
S1.007	S9	10080 Winter	1	+10%				
S1.008	S10	10080 Winter	1	+10%	1/15 Winter			
S1.009	S11	10080 Winter	1	+10%	1/60 Winter			
S1.010	S12	10080 Winter	1	+10%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	73.000	-0.296	0.000	0.00		0.2	OK	
S1.001	S2	72.942	-0.290	0.000	0.01		0.4	OK	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	S3	72.833	-0.284	0.000	0.01		0.7	OK	
S1.003	S4	71.631	-0.252	0.000	0.01		0.8	OK	
S2.000	S5	71.628	-0.190	0.000	0.00		0.0	OK	
S1.004	S6	71.628	-0.190	0.000	0.01		0.8	OK	
S1.005	S7	69.535	-0.281	0.000	0.01		0.8	OK	
S1.006	S8	69.461	-0.288	0.000	0.01		1.2	OK	
S1.007	S9	68.853	-0.286	0.000	0.01		1.2	OK	
S1.008	S10	67.352	-0.228	0.000	0.07		1.4	OK	
S1.009	S11	67.334	-0.171	0.000	0.02		1.4	OK	
S1.010	S12	66.673	-0.202	0.000	0.02		1.4	FLOOD RISK	

Appendix C:

Attenuation Volume Calculations

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.394	0.394	6.0	59.9	O K
30 min Summer	1.539	0.539	6.0	82.0	O K
60 min Summer	1.680	0.680	6.0	103.4	O K
120 min Summer	1.792	0.792	6.0	120.4	Flood Risk
180 min Summer	1.829	0.829	6.0	126.0	Flood Risk
240 min Summer	1.844	0.844	6.0	128.3	Flood Risk
360 min Summer	1.851	0.851	6.0	129.4	Flood Risk
480 min Summer	1.844	0.844	6.0	128.2	Flood Risk
600 min Summer	1.829	0.829	6.0	126.0	Flood Risk
720 min Summer	1.811	0.811	6.0	123.2	Flood Risk
960 min Summer	1.768	0.768	6.0	116.7	Flood Risk
1440 min Summer	1.667	0.667	6.0	101.4	O K
2160 min Summer	1.488	0.488	6.0	74.1	O K
2880 min Summer	1.356	0.356	6.0	54.1	O K
4320 min Summer	1.202	0.202	5.8	30.7	O K
5760 min Summer	1.139	0.139	5.4	21.1	O K
7200 min Summer	1.118	0.118	4.8	17.9	O K
8640 min Summer	1.105	0.105	4.3	15.9	O K
10080 min Summer	1.096	0.096	3.8	14.6	O K
15 min Winter	1.444	0.444	6.0	67.5	O K
30 min Winter	1.610	0.610	6.0	92.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.917	0.0	63.6	18
30 min Summer	53.217	0.0	89.3	33
60 min Summer	35.054	0.0	118.1	62
120 min Summer	22.395	0.0	150.9	120
180 min Summer	17.078	0.0	172.7	174
240 min Summer	14.066	0.0	189.6	202
360 min Summer	10.667	0.0	215.7	268
480 min Summer	8.754	0.0	236.1	336
600 min Summer	7.505	0.0	253.0	406
720 min Summer	6.617	0.0	267.7	478
960 min Summer	5.422	0.0	292.4	616
1440 min Summer	4.094	0.0	331.2	894
2160 min Summer	3.088	0.0	375.0	1256
2880 min Summer	2.525	0.0	408.8	1588
4320 min Summer	1.899	0.0	461.0	2288
5760 min Summer	1.550	0.0	502.1	2944
7200 min Summer	1.324	0.0	536.0	3672
8640 min Summer	1.164	0.0	565.4	4400
10080 min Summer	1.044	0.0	591.4	5136
15 min Winter	75.917	0.0	71.3	18
30 min Winter	53.217	0.0	100.1	32

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

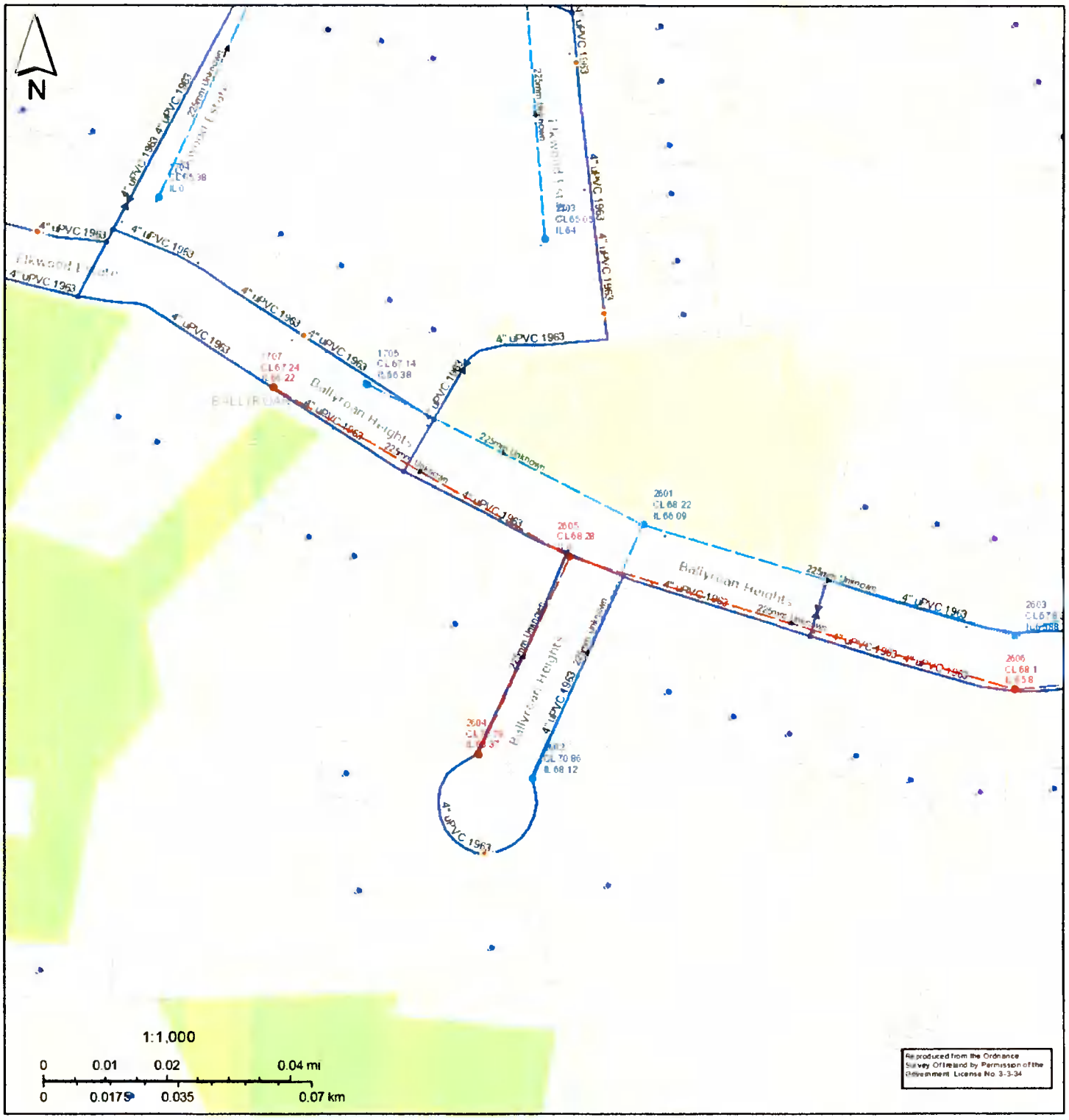
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	1.771	0.771	6.0	117.1	Flood Risk
120 min Winter	1.905	0.905	6.0	137.5	Flood Risk
180 min Winter	1.955	0.955	6.0	145.2	Flood Risk
240 min Winter	1.972	0.972	6.0	147.8	Flood Risk
360 min Winter	1.975	0.975	6.0	148.2	Flood Risk
480 min Winter	1.960	0.960	6.0	145.9	Flood Risk
600 min Winter	1.934	0.934	6.0	141.9	Flood Risk
720 min Winter	1.901	0.901	6.0	137.0	Flood Risk
960 min Winter	1.827	0.827	6.0	125.8	Flood Risk
1440 min Winter	1.655	0.655	6.0	99.5	O K
2160 min Winter	1.377	0.377	6.0	57.4	O K
2880 min Winter	1.221	0.221	5.9	33.6	O K
4320 min Winter	1.123	0.123	5.0	18.6	O K
5760 min Winter	1.102	0.102	4.1	15.4	O K
7200 min Winter	1.090	0.090	3.5	13.7	O K
8640 min Winter	1.082	0.082	3.1	12.5	O K
10080 min Winter	1.077	0.077	2.8	11.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	35.054	0.0	132.3	62
120 min Winter	22.395	0.0	169.1	118
180 min Winter	17.078	0.0	193.4	174
240 min Winter	14.066	0.0	212.4	226
360 min Winter	10.667	0.0	241.6	282
480 min Winter	8.754	0.0	264.4	360
600 min Winter	7.505	0.0	283.4	440
720 min Winter	6.617	0.0	299.8	516
960 min Winter	5.422	0.0	327.5	666
1440 min Winter	4.094	0.0	371.0	968
2160 min Winter	3.088	0.0	420.0	1300
2880 min Winter	2.525	0.0	457.9	1612
4320 min Winter	1.899	0.0	516.4	2208
5760 min Winter	1.550	0.0	562.4	2936
7200 min Winter	1.324	0.0	600.4	3672
8640 min Winter	1.164	0.0	633.3	4408
10080 min Winter	1.044	0.0	662.5	5024

Appendix D:

Water Services Records

Irish Water Webmap



January 20, 2017

Legend

Surface	Soakaway	Lamphole		Gully		Closed	
Surface	Other; Unknown	Standard		Standard		Part Closed	
Cascade	Storm Culverts	Other; Unknown		Other; Unknown		Air Control Valves	
Catchpit	Storm Clean Outs	Outfall		Vent/Col		Water Stop Valves	
Hatchbox	Combined	Overflow		Other; Unknown		Meter	
Lamphole	Foul	Soakaway		Non-return		Group Scheme	
Standard	Overflow	Standard Outlet		Hydro		Source	
Other; Unknown	Unknown	Other; Unknown		Orifice Plate		District (Boundary Meter)	
Gully	Combined	Rodding Eye		PRV		Fire Hydrant	
Standard	Foul	Flushing Structure		PSV		Fire Hydrant/Washout	
Other; Unknown	Overflow	Other; Unknown		Other		Washout	
Vent/Col	Unknown	Sewer Flow Control Valves		Open		Treatment Plant	
Other; Unknown	Cascade	Treatment plant		Closed		Potable	
Outfall	Catchpit	Pump station		Part Closed		Raw Water	
Overflow	Hatchbox	Catchpit		Open		Pump Stations	

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated.

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Appendix E:

Foul Drainage Calculations

Structual Engineers
Unit 84 Omni Park SC
Santry Dublin 9

Date 16/02/2017 15:46 | Designed by USER
File 16-052_Drainage Design_20170216.1.MDX | Checked by
XP Solutions | Network 2016.1

Manhole Schedules for Foul - Unit

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	74.057	0.951	Open Manhole	1200	F1.000	73.106	225				
F2	74.642	1.726	Open Manhole	1200	F1.001	72.916	225	F1.000	72.916	225	
F3	74.675	2.024	Open Manhole	1200	F1.002	72.651	225	F1.001	72.651	225	
F4	73.912	3.029	Open Manhole	1200	F1.003	70.883	225	F1.002	72.487	225	1604
F5	72.227	2.468	Open Manhole	1200	F1.004	69.759	225	F1.003	70.653	225	894
F6	70.890	1.631	Open Manhole	1200	F1.005	69.259	225	F1.004	69.659	225	400
F7	70.317	1.201	Open Manhole	1200	F1.006	69.116	225	F1.005	69.116	225	
F8	69.980	2.071	Open Manhole	1200	F1.007	67.909	225	F1.006	68.973	225	1064
F9	68.743	0.929	Open Manhole	1200	F1.008	67.814	225	F1.007	67.814	225	
F10	66.824	0.605	Open Manhole	1200	F1.009	66.219	225	F1.008	66.219	225	
F	67.400	1.200	Open Manhole	1200		OUTFALL		F1.009	66.200	225	

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Calculation Method	EN 752	Maximum Backdrop Height (m)	0.000
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.70
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	17.431	0.190	91.7	0.000	48.8	0.0	1.500	o	225	Pipe/Conduit	
F1.001	30.904	0.265	116.6	0.000	48.8	0.0	1.500	o	225	Pipe/Conduit	
F1.002	16.126	0.164	98.3	0.000	48.8	0.0	1.500	o	225	Pipe/Conduit	
F1.003	33.351	0.230	145.0	0.000	24.4	0.0	1.500	o	225	Pipe/Conduit	
F1.004	19.933	0.100	199.3	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.005	30.618	0.143	214.1	0.000	59.7	0.0	1.500	o	225	Pipe/Conduit	
F1.006	13.800	0.143	96.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.007	18.874	0.095	198.7	0.000	17.5	0.0	1.500	o	225	Pipe/Conduit	
F1.008	35.040	1.595	22.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	3.418	0.019	179.9	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	73.106	0.000	0.0	48.8	0.0	41	0.70	1.20	47.7	3.5
F1.001	72.916	0.000	0.0	97.6	0.0	52	0.71	1.06	42.2	4.9
F1.002	72.651	0.000	0.0	146.4	0.0	55	0.80	1.16	46.0	6.0
F1.003	70.883	0.000	0.0	170.8	0.0	63	0.71	0.95	37.9	6.5
F1.004	69.759	0.000	0.0	170.8	0.0	69	0.64	0.81	32.3	6.5
F1.005	69.259	0.000	0.0	230.5	0.0	76	0.65	0.78	31.1	7.6
F1.006	69.116	0.000	0.0	230.5	0.0	62	0.86	1.17	46.5	7.6
F1.007	67.909	0.000	0.0	248.0	0.0	76	0.67	0.81	32.3	7.9
F1.008	67.814	0.000	0.0	248.0	0.0	43	1.47	2.46	97.6	7.9
F1.009	66.219	0.000	0.0	248.0	0.0	74	0.70	0.85	34.0	7.9

PIPELINE SCHEDULES for Foul - Unit

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	225	F1	74.057	73.106	0.726	Open Manhole	1200
F1.001	o	225	F2	74.642	72.916	1.501	Open Manhole	1200
F1.002	o	225	F3	74.675	72.651	1.799	Open Manhole	1200
F1.003	o	225	F4	73.912	70.883	2.804	Open Manhole	1200
F1.004	o	225	F5	72.227	69.759	2.243	Open Manhole	1200
F1.005	o	225	F6	70.890	69.259	1.406	Open Manhole	1200
F1.006	o	225	F7	70.317	69.116	0.976	Open Manhole	1200
F1.007	o	225	F8	69.980	67.909	1.846	Open Manhole	1200
F1.008	o	225	F9	68.743	67.814	0.704	Open Manhole	1200
F1.009	o	225	F10	66.824	66.219	0.380	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	17.431	91.7	F2	74.642	72.916	1.501	Open Manhole	1200
F1.001	30.904	116.6	F3	74.675	72.651	1.799	Open Manhole	1200
F1.002	16.126	98.3	F4	73.912	72.487	1.200	Open Manhole	1200
F1.003	33.351	145.0	F5	72.227	70.653	1.349	Open Manhole	1200
F1.004	19.933	199.3	F6	70.890	69.659	1.006	Open Manhole	1200
F1.005	30.618	214.1	F7	70.317	69.116	0.976	Open Manhole	1200
F1.006	13.800	96.5	F8	69.980	68.973	0.782	Open Manhole	1200
F1.007	18.874	198.7	F9	68.743	67.814	0.704	Open Manhole	1200
F1.008	35.040	22.0	F10	66.824	66.219	0.380	Open Manhole	1200
F1.009	3.418	179.9	F	67.400	66.200	0.975	Open Manhole	1200

Setting Out Information - True Coordinates (Foul - Unit)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
F1.000	F1	1200		713051.285	727668.612	
F1.001	F2	1200		713051.720	727651.187	
F1.002	F3	1200		713021.929	727642.970	
F1.003	F4	1200		713010.564	727654.410	
F1.004	F5	1200		713009.883	727687.754	
F1.005	F6	1200		713022.686	727703.031	
F1.006	F7	1200		713053.144	727706.160	
F1.007	F8	1200		713066.322	727710.257	
F1.008	F9	1200		713084.969	727707.338	
F1.009	F10	1200		713108.165	727733.601	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
F1.009	F	1200		713110.544	727736.055	

Setting Out Information - Site Coordinates (Foul - Unit)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
F1.000	F1	1200		713051.285	727668.612	
F1.001	F2	1200		713051.720	727651.187	
F1.002	F3	1200		713021.929	727642.970	
F1.003	F4	1200		713010.564	727654.410	
F1.004	F5	1200		713009.883	727687.754	
F1.005	F6	1200		713022.686	727703.031	
F1.006	F7	1200		713053.144	727706.160	
F1.007	F8	1200		713066.322	727710.257	
F1.008	F9	1200		713084.969	727707.338	
F1.009	F10	1200		713108.165	727733.601	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
F1.009	F	1200		713110.544	727736.055	

Area Summary for Foul - Unit

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
1.001	0.000	0.000
1.002	0.000	0.000
1.003	0.000	0.000
1.004	0.000	0.000
1.005	0.000	0.000
1.006	0.000	0.000
1.007	0.000	0.000
1.008	0.000	0.000
1.009	0.000	0.000
	Total	Total
	0.000	0.000

Free Flowing Outfall Details for Foul - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.009	F	67.400	66.200	66.200	1200	0

Simulation Criteria for Foul - Unit

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.200	Storm Duration (mins)	30
Ratio R	0.257		

Appendix F:

OPW Flood Mapping Summary Local Area Report

OPW National Flood Hazard Mapping

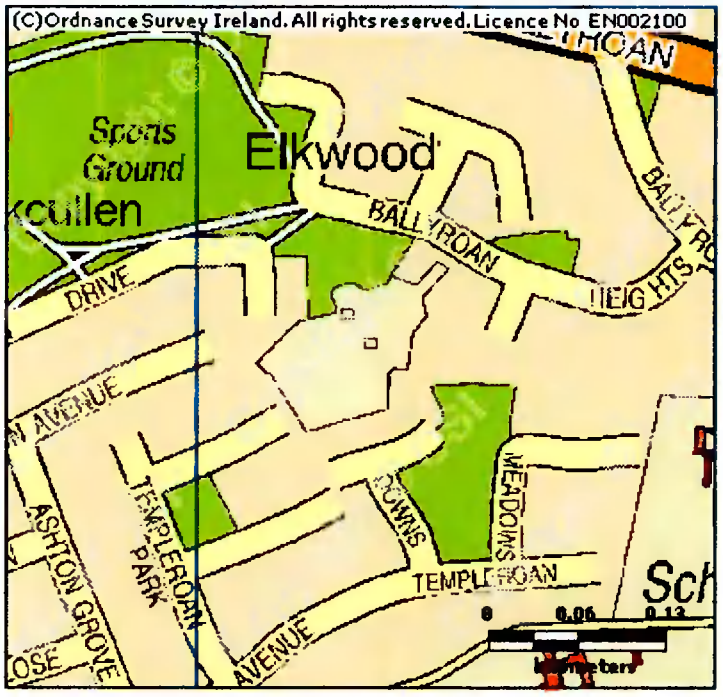
Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 131 276



Map Scale 1:5,215

Map Legend
Flood Points
Multiple / Recurring Flood Points
Areas Flooded
Hydrometric Stations
Rivers
Lakes
River Catchment Areas
Land Commission *
Drainage Districts *
Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

25 Results

1. Flooding at Limekiln Road, Ballyboden Rd, Co. Dublin on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

2. Owendoher River 24th Oct 2011 Willbrook Road
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

3. Flooding at Wellington Lane, Dublin 24 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

4. Flooding at Riverside Apartments, Milltown Road, Dublin 6 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

5. Dodder Woodview Cottages Rathfarnham Nov 2000
County: Dublin
Start Date: 05/Nov/2000
Flood Quality Code:3

Report Produced: 16-Feb-2017 12:42

Additional Information: Reports (1) Press Archive (3) More Mapped Information

---

6. Little Dargle Sept 1957
Start Date: 24/Sep/1957
County: Dublin
Flood Quality Code:3
Additional Information: Reports (3) More Mapped Information

---

7. Poddle Glendown Crescent Feb 1994
Start Date: 03/Feb/1994
County: Dublin
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

---

8. Poddle River Whitehall Road June 1993
Start Date: 11/Jun/1993
County: Dublin
Flood Quality Code:4
Additional Information: Reports (1) More Mapped Information

---

9. Dodder Mount Carmel Park recurring
Start Date:
County: Dublin
Flood Quality Code:4
Additional Information: Reports (1) Press Archive (1) More Mapped Information

---

10. Flooding at Homeville, Knocklyon, Dublin 16.on 24th Oct 2011
Start Date: 24/Oct/2011
County: Dublin
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

---

11. Flooding at Church Lane, Rathfarnham, Dublin 14.on 24th Oct 2011
Start Date: 24/Oct/2011
County: Dublin
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

---

12. Flooding at Castlefield, Glenvara and Glenlyon, Knocklyon, Dublin 16 on 24th Oct 2011
Start Date: 24/Oct/2011
County: Dublin
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

---

13. Flooding at Nutgrove Avenue, Rathfarnham, Dublin 14on 24th Oct 2011
Start Date: 24/Oct/2011
County: Dublin
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

---

14. Mount Carmel Park Firhouse Nov 2000
Start Date: 05/Nov/2000
County: Dublin
Flood Quality Code:3
Additional Information: Reports (1) Press Archive (1) More Mapped Information

---

15. Owenadoher Edmondstown Road. Nov 2000
Start Date: 05/Nov/2000
County: Dublin
Flood Quality Code:3
Additional Information: Reports (2) More Mapped Information

---

16. Knocklyon Ave Nov 2000
Start Date: 05/Nov/2000
County: Dublin
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

---

17. Old City water Course Spawell House Feb 1994
Start Date: 03/Feb/1994
County: Dublin
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

---

18. Boden Villas Feb 1994
Start Date: 03/Feb/1994
County: Dublin
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

---

19. Barton Drive Ballyboden Feb 1994 — Start Date: 03/Feb/1994

County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

20. Whitechurch Court Feb 1994 — Start Date: 03/Feb/1994

County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

21. Owendoher Willbrook Road August 1986 — Start Date: 25/Aug/1986

County: Dublin — Flood Quality Code:3

Additional Information: Reports (2) Press Archive (1) More Mapped Information

---

22. Osprey Estate Nov 1982 — Start Date: 05/Nov/1982

County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

23. Willbrook Rathfarnham Dec 1958 — Start Date: 16/Dec/1958

County: Dublin — Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

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24. Ballyboden Road Whitecliff Recurring — Start Date:

County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

25. Whitehall Road Kimmage Recurring — Start Date:

County: Dublin — Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

CHC

Civil and Structural Consulting Engineers

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Web: www.chcce.ie

Linda McEllin
Brock McClure Consultants
63 York Road,
Dun Laoghaire,
Co. Dublin.

18th July 2017

Our Ref. CHC-XX-XX-CO-C-0001

RE: BALLYROAN HOUSE, RATHFARNHAM, D.16

ADDITIONAL INFORMATION – SOUTH DUBLIN COUNTY COUNCIL PA REF.SD17A/0064

Dear Linda,

Further to site layout changes required as a result of the Additional Information request issued by South Dublin County Council, dated 21st April 2017, the engineering elements of the scheme have been updated to a more appropriate solution for the revised layout.

The removal of several units impacts on the relationship between the hard-standing and soft-standing areas within the sub-catchment, therefore it is necessary to recalculate the required storage for both attenuation tanks. The volume of Tank 2 within the green area to the south increased slightly, however the overall footprint of the 'Stormtech' attenuation tank remains unchanged.

The removal of unit E and its subsequent conversion into public open space further increased the area of permeable surface within the scheme. The increased proportion of soft-standing to hard-standing areas within the scheme has decreased the overall attenuation storage volumes required. Details of the attenuation volume calculations are appended to this letter.

All design revisions made to the 'Stormtech' attenuation tanks are in accordance with the Greater Dublin Strategic Drainage Study. See attached Micro drainage storage calculations for the revised sub catchments.

With the exception of the minor amendments detailed in the foregoing, the engineering elements of the scheme remain unchanged from that submitted as part of the original planning application submission.

If you have any queries or require any assistance regarding the changes to the drainage design please do not hesitate to contact the undersigned.

Yours Sincerely,

CONOR McLOUGHLIN BE (Hons) Civil Eng. MIEI
Senior Civil Engineer
For Corrigan Hodnett Consulting

cc Michael Hodnett, CHC, michael.hodnett@chcce.ie
Paul Corrigan, CHC, paul.corrigan@chcce.ie

Encl. 2017.07.14_Tank 1_Storage
2017.07.14_Tank 2_Storage

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.448	0.448	5.0	37.6	O K
30 min Summer	1.609	0.609	5.0	51.2	O K
60 min Summer	1.752	0.752	5.0	63.2	Flood Risk
120 min Summer	1.841	0.841	5.0	70.6	Flood Risk
180 min Summer	1.863	0.863	5.0	72.5	Flood Risk
240 min Summer	1.869	0.869	5.0	73.0	Flood Risk
360 min Summer	1.857	0.857	5.0	72.0	Flood Risk
480 min Summer	1.833	0.833	5.0	69.9	Flood Risk
600 min Summer	1.802	0.802	5.0	67.4	Flood Risk
720 min Summer	1.769	0.769	5.0	64.6	Flood Risk
960 min Summer	1.695	0.695	5.0	58.4	O K
1440 min Summer	1.514	0.514	5.0	43.2	O K
2160 min Summer	1.324	0.324	5.0	27.2	O K
2880 min Summer	1.213	0.213	4.9	17.9	O K
4320 min Summer	1.124	0.124	4.4	10.4	O K
5760 min Summer	1.102	0.102	3.6	8.5	O K
7200 min Summer	1.089	0.089	3.1	7.5	O K
8640 min Summer	1.081	0.081	2.7	6.8	O K
10080 min Summer	1.075	0.075	2.5	6.3	O K
15 min Winter	1.506	0.506	5.0	42.5	O K
30 min Winter	1.692	0.692	5.0	58.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.917	0.0	41.0	18
30 min Summer	53.217	0.0	57.5	32
60 min Summer	35.054	0.0	75.9	62
120 min Summer	22.395	0.0	97.0	116
180 min Summer	17.078	0.0	111.0	146
240 min Summer	14.066	0.0	121.9	180
360 min Summer	10.667	0.0	138.6	248
480 min Summer	8.754	0.0	151.7	320
600 min Summer	7.505	0.0	162.6	388
720 min Summer	6.617	0.0	172.0	458
960 min Summer	5.422	0.0	187.9	598
1440 min Summer	4.094	0.0	212.8	840
2160 min Summer	3.088	0.0	240.9	1188
2880 min Summer	2.525	0.0	262.6	1528
4320 min Summer	1.899	0.0	296.2	2204
5760 min Summer	1.550	0.0	322.5	2936
7200 min Summer	1.324	0.0	344.3	3664
8640 min Summer	1.164	0.0	363.2	4400
10080 min Summer	1.044	0.0	380.0	5056
15 min Winter	75.917	0.0	45.9	18
30 min Winter	53.217	0.0	64.4	32

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	1.855	0.855	5.0	71.8	Flood Risk
120 min Winter	1.969	0.969	5.0	81.4	Flood Risk
180 min Winter	1.992	0.992	5.0	83.4	Flood Risk
240 min Winter	1.997	0.997	5.0	83.7	Flood Risk
360 min Winter	1.973	0.973	5.0	81.7	Flood Risk
480 min Winter	1.928	0.928	5.0	78.0	Flood Risk
600 min Winter	1.875	0.875	5.0	73.5	Flood Risk
720 min Winter	1.818	0.818	5.0	68.7	Flood Risk
960 min Winter	1.693	0.693	5.0	58.3	O K
1440 min Winter	1.404	0.404	5.0	34.0	O K
2160 min Winter	1.187	0.187	4.8	15.7	O K
2880 min Winter	1.120	0.120	4.3	10.1	O K
4320 min Winter	1.092	0.092	3.2	7.7	O K
5760 min Winter	1.079	0.079	2.6	6.6	O K
7200 min Winter	1.071	0.071	2.3	6.0	O K
8640 min Winter	1.066	0.066	2.0	5.5	O K
10080 min Winter	1.061	0.061	1.8	5.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	35.054	0.0	85.0	60
120 min Winter	22.395	0.0	108.7	116
180 min Winter	17.078	0.0	124.3	166
240 min Winter	14.066	0.0	136.5	188
360 min Winter	10.667	0.0	155.3	268
480 min Winter	8.754	0.0	169.9	346
600 min Winter	7.505	0.0	182.1	422
720 min Winter	6.617	0.0	192.7	496
960 min Winter	5.422	0.0	210.5	646
1440 min Winter	4.094	0.0	238.4	878
2160 min Winter	3.088	0.0	269.8	1188
2880 min Winter	2.525	0.0	294.2	1472
4320 min Winter	1.899	0.0	331.7	2192
5760 min Winter	1.550	0.0	361.2	2936
7200 min Winter	1.324	0.0	385.6	3648
8640 min Winter	1.164	0.0	406.8	4336
10080 min Winter	1.044	0.0	425.6	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.200	Shortest Storm (mins)	15
Ratio R	0.257	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.289

Time (mins) From:	To:	Area (ha)
0	4	0.289

Model Details

Storage is Online Cover Level (m) 2.000

Tank or Pond Structure

Invert Level (m) 1.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	84.0	1.000	84.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	1.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.247	0.247	0.8	34.6	O K
30 min Summer	1.344	0.344	0.8	48.1	O K
60 min Summer	1.448	0.448	0.8	62.8	O K
120 min Summer	1.560	0.560	0.8	78.4	O K
180 min Summer	1.628	0.628	0.8	87.9	O K
240 min Summer	1.676	0.676	0.8	94.6	O K
360 min Summer	1.740	0.740	0.9	103.6	Flood Risk
480 min Summer	1.781	0.781	0.9	109.4	Flood Risk
600 min Summer	1.808	0.808	0.9	113.2	Flood Risk
720 min Summer	1.827	0.827	0.9	115.7	Flood Risk
960 min Summer	1.846	0.846	0.9	118.4	Flood Risk
1440 min Summer	1.861	0.861	0.9	120.5	Flood Risk
2160 min Summer	1.862	0.862	0.9	120.6	Flood Risk
2880 min Summer	1.851	0.851	0.9	119.1	Flood Risk
4320 min Summer	1.817	0.817	0.9	114.4	Flood Risk
5760 min Summer	1.776	0.776	0.9	108.7	Flood Risk
7200 min Summer	1.734	0.734	0.9	102.7	Flood Risk
8640 min Summer	1.691	0.691	0.8	96.7	O K
10080 min Summer	1.649	0.649	0.8	90.8	O K
15 min Winter	1.277	0.277	0.8	38.8	O K
30 min Winter	1.386	0.386	0.8	54.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.917	0.0	34.2	19
30 min Summer	53.217	0.0	47.8	34
60 min Summer	35.054	0.0	64.4	64
120 min Summer	22.395	0.0	82.3	124
180 min Summer	17.078	0.0	94.0	182
240 min Summer	14.066	0.0	103.1	242
360 min Summer	10.667	0.0	116.8	362
480 min Summer	8.754	0.0	126.6	482
600 min Summer	7.505	0.0	132.5	602
720 min Summer	6.617	0.0	134.1	720
960 min Summer	5.422	0.0	133.9	934
1440 min Summer	4.094	0.0	132.3	1170
2160 min Summer	3.088	0.0	205.3	1560
2880 min Summer	2.525	0.0	223.5	1988
4320 min Summer	1.899	0.0	240.1	2812
5760 min Summer	1.550	0.0	275.5	3640
7200 min Summer	1.324	0.0	294.1	4472
8640 min Summer	1.164	0.0	310.2	5280
10080 min Summer	1.044	0.0	324.3	6056
15 min Winter	75.917	0.0	38.3	19
30 min Winter	53.217	0.0	53.3	33

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	1.503	0.503	0.8	70.5	O K
120 min Winter	1.630	0.630	0.8	88.3	O K
180 min Winter	1.708	0.708	0.9	99.1	Flood Risk
240 min Winter	1.763	0.763	0.9	106.9	Flood Risk
360 min Winter	1.839	0.839	0.9	117.5	Flood Risk
480 min Winter	1.890	0.890	0.9	124.5	Flood Risk
600 min Winter	1.924	0.924	1.0	129.4	Flood Risk
720 min Winter	1.949	0.949	1.0	132.9	Flood Risk
960 min Winter	1.980	0.980	1.0	137.1	Flood Risk
1440 min Winter	1.997	0.997	1.0	139.6	Flood Risk
2160 min Winter	1.996	0.996	1.0	139.4	Flood Risk
2880 min Winter	1.977	0.977	1.0	136.8	Flood Risk
4320 min Winter	1.916	0.916	1.0	128.3	Flood Risk
5760 min Winter	1.847	0.847	0.9	118.6	Flood Risk
7200 min Winter	1.778	0.778	0.9	108.9	Flood Risk
8640 min Winter	1.709	0.709	0.9	99.3	Flood Risk
10080 min Winter	1.643	0.643	0.8	90.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	35.054	0.0	72.1	62
120 min Winter	22.395	0.0	92.1	122
180 min Winter	17.078	0.0	105.1	180
240 min Winter	14.066	0.0	115.1	238
360 min Winter	10.667	0.0	129.4	356
480 min Winter	8.754	0.0	136.0	472
600 min Winter	7.505	0.0	137.4	586
720 min Winter	6.617	0.0	137.8	700
960 min Winter	5.422	0.0	138.2	922
1440 min Winter	4.094	0.0	140.0	1326
2160 min Winter	3.088	0.0	229.8	1664
2880 min Winter	2.525	0.0	249.8	2132
4320 min Winter	1.899	0.0	253.3	3064
5760 min Winter	1.550	0.0	308.5	3928
7200 min Winter	1.324	0.0	329.4	4824
8640 min Winter	1.164	0.0	347.4	5704
10080 min Winter	1.044	0.0	363.3	6552

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.200	Shortest Storm (mins)	15
Ratio R	0.257	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.247

Time (mins) From:	To:	Area (ha)
0	4	0.247

Model Details

Storage is Online Cover Level (m) 2.000

Tank or Pond Structure

Invert Level (m) 1.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	140.0	1.000	140.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	1.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0
Flush-Flo™	0.205	0.8
Kick-Flo®	0.415	0.7
Mean Flow over Head Range	-	0.8

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 (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		