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PROJECT: Proposed Residential Development at Railway Street, Portlaoise, Co Laois

PROJECT NO: 17.168

DOCUMENT TITLE: Proposals for Foul and Surface Water Drainage, Water Supply and Roads

DOCUMENT NO: 17.168. RP01

Issue	Date	Description	Orig.	PE	PD	Issue Check
PL01	13.03.20	Issued for Planning	AW	AW	JR	BS

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1. INTRODUCTION

1.1. General

Ardain Developments in co-operation with Laois Co.Co. intends to lodge a planning permission application to Laois County Council for a residential development & carpark at Railway Street, Portlaoise, Co. Laois.

The Site Layout Plan involves the provision for 67 residential units. It also includes 93 spaces carpark are to cater nearby train station. The design of services, access etc has been based on the Site Layout Plan for the site which is the current vision for developing the site.

The purpose of this report is to address the civil engineering design items associated with the above, and to provide relevant back-up and design details to compliment the engineering drawings as submitted as part of this application.

2. SURFACE WATER DRAINAGE

2.1. General

The surface water drainage for this proposed development has been designed in accordance with the principles as set out in Section 3 of the publication "Recommendations for Site Development Works for Housing Areas" published by the Department of the Environment and Local Government, 1998, and also in accordance with BS8301: 1985 – British Code of Practice for Building Drainage and the Laois County Council Storm Water Management Policy. The design takes account of the principles as set out in the Greater Dublin Strategic Drainage Study (GDSDS)

The site is currently a greenfield site and drains naturally to the Triogue River that is located along Northern boundary of the site. It is proposed to collect the storm water run-off from the road network within the proposed development in an underground surface water pipe network, the water collected within this network will be attenuated in 2 separate underground Stormtech Attenuation chambers. This Stormtech chambers have been designed in accordance Greater Dublin Strategic Drainage Study (GDSDS) prior to final discharge via. a stone wall to the nearby Triogue River. It is proposed to locate the Stormtech Attenuation systems as follows:

- in the public open space to the north of the site.
- in carpark spaces

2.2. Surface Water Network Design

In order to provide for a measure of groundwater recharge, and to comply with the requirements of Sustainable Urban Drainage Systems (SuDS), it is proposed that the rainwater falling onto the roofs of the residential dwellings will be directed towards individual soakaways provided to the rear gardens of each residential dwelling to allow for the dispersal of rainwater falling onto the roofs into the groundwater table under the site. This approach will also reduce the stormwater loading to the existing Triogue River as a significant hardstanding area within the proposed development will not be directed towards the stream and will allow for a measure of recharge of the groundwater table.

In addition, it is also proposed to provide permeable paving to the private parking spaces to further enhance the SUDs approach.

It is proposed that storm water collected from the impermeable surfaces that include the proposed access roads throughout the development, all rooftops and private parking spaces will be directed towards the underground gravity pipe networks which will discharge via the Stormtech Attenuation chambers to the Triogue River along the Northern boundary of the site.

2.3. Attenuated Storm Drainage Network

As described above, the system will flow through underground attenuation tanks to reduce the outflow to Greenfield levels prior to discharge to the Triogue River along the Northern Boundary of the site. Details of the above can be seen on drawings 17.168-210.

From this underground chamber, the surface water will flow through a HydroBrake flow control devices to reduce the run-off to a rate below the allowable discharge allowed under the the Greater Dublin Strategic Drainage Study (GDSDS). A Class 1 bypass petrol interceptor will be placed upstream of the attenuation chamber to remove any petrol or hydrocarbons from the run-off prior to discharge to the attenuation chamber.

The surface water drainage network was designed using the Modified Rational Method, based on the following variables:

i.	Return Period	**=**	100 Years
ii.	M5-60(mm)	=	15.8mm
iii.	Max Rainfall	=	50mm / hr
iv.	Ratio R	=	0.278
v.	Volumetric Run-off Co-efficient	=	0.75

The contributing areas were calculated, and the Micro-Drainage software package was used to design the size of the attenuation chamber, and the results of this design can be seen in Appendix II. In addition, the climate change factor of 10% was adopted.

As above the underground storm network will drain proposed access roads throughout the development, all rooftops and private parking spaces.

The drainage network results for the underground storm water network are included in Appendix II.

2.4. Water Quantity - General Principles of the Attenuation System 1

As described above, the storm water system collects the storm water run-off generated by the proposed access roads throughout the development, all rooftops and private parking spaces. It will be constructed as 2 independent systems. Outflow from both will be collected and discharged to the nearby Triogue River, having firstly passed through a Class 1 by-pass separators.

2.4.1. Drainage Network 1- Attenuation Tank 1 (under carpark)

i. Site Area: 0.59 Ha
ii. SAAR: 1060mm
iii. Region No 13
iv. Soil Type 2
v. SPR 0.3

With reference to Appendix I, The UKSuds.com Greenfield Runoff Tool was used to calculate the allowable runoff rates. Using the IH124 Methodology the greenfield runoff rates are calculated as follows:

Q_{BAR}= 1.74 l/s for a 1:100-year event

Therefore, the allowable outflow has been calculated below.

Calculations describing the Greenfield runoff and the proposed outflow from the developed site are outlined below, for design return periods of 1 in 100 Years.

The overall site area for the proposed development is given as 0.59 hectares. Applying the permissible outflow equation of 2.0l/s/ha, in accordance with Greater Dublin Strategic Drainage Study, yields the following.

Allowable Outflow = 3.4 l/s

Q_{BAR} = 1.74l/s

From inspection of the Micro Drainage Storage results included in Appendix II, the Maximum Allowable Outflow versus the Maximum Design Outflow are summarised below:

Return Period	Allowable Outflow (l/s)	Design Outflow (l/s)
100	3.4	3.3

As can be seen above the design outflow is less than the maximum allowable outflow QBAR for the 1 in 100-year event. The maximum storage requirement occurs in the 360min Winter storm giving a maximum storage volume requirement of 109.6m3 in a 1:100-year event. With reference to the attached the storage volume provided is 110.4m3.

2.4.2. Drainage Network 2- Attenuation Tank 2 (housing estate)

i. Site Area: 1.42 Ha
ii. SAAR: 1060mm
iii. Region No 13
iv. Soil Type 2
v. SPR 0.3

With reference to Appendix I, The UKSuds.com Greenfield Runoff Tool was used to calculate the allowable runoff rates. Using the IH124 Methodology the greenfield runoff rates are calculated as follows:

Q_{BAR}= 4.21 l/s for a 1:100-year event

Therefore, the allowable outflow has been calculated below.

Calculations describing the Greenfield runoff and the proposed outflow from the developed site are outlined below, for design return periods of 1 in 100 Years.

The overall site area for the proposed development is given as 1.42 hectares. Applying the permissible outflow equation of 2.0l/s/ha, in accordance with Greater Dublin Strategic Drainage Study, yields the following.

Allowable Outflow = 8.21 l/s

Q_{BAR} = 4.21l/s

From inspection of the Micro Drainage Storage results included in Appendix II, the Maximum Allowable Outflow versus the Maximum Design Outflow are summarised below:

Return Period	Allowable Outflow (l/s)	Design Outflow (l/s)
100	8.21	8.0

As can be seen above the design outflow is less than the maximum allowable outflow Q_{BAR} for the 1 in 100-year event. The maximum storage requirement occurs in the 360min Winter storm giving a maximum storage volume requirement of 255.5m3 in a 1:100-year event. With reference to the attached the storage volume provided is 255.7m3.

2.5. Water Quality

In order to ensure that the quality of the Stormwater runoff to the public system is uncontaminated, a Class 1 bypass petrol interceptors, will be placed upstream of the proposed attenuation systems to ensure that all hydrocarbons collected from the road run-off do not end up in the public system, and ultimately the local river network.

It should be noted that the Stormtech system will essentially act as a soakaway. However, to be conservative zero infiltration has been assumed in the attenuation design.
A downstream defender is also proposed prior to discharge to Triogue River.

2.6. Flood Risk Consideration

Based on OPW Flood Maps max water level in 1 at 1000y flood event in the Triogue River adjacent to the site will be +89.43m. Having this considered lowest building floor level was set at +90.0m

3. FOUL DRAINAGE

3.1. General

The main foul drainage for the proposed residential scheme has been designed in accordance with Irish Water standards and Codes of Practice.

The site is currently greenfield, but there is exisitng public foul drainage located to the north next to river.

The site is in a process of pre-connection enquiry application with Irish Water.
It is proposed to collect the foul run-off from the proposed development in a new, separate underground foul network and direct towards the existing foul network in charge of Laois County Council.

3.2. Proposed Foul Drainage Network

It is proposed to lay a new foul gravity system to serve the entire development area. With reference to the attached Drainage plan each residential unit is served by a foul drain which then connects to a main foul drainage pipe work to be installed under the proposed access roadways. The main Foul Drainage pipe work varies in size throughout the development please refer to drawing 17.168-210.

The Foul Drainage within the scheme would remain in the control of the applicant until such time the development will be Taking in Charge.

4. WATER SUPPLY

4.1. General

The water supply for this proposed development has been designed in accordance with Irish Water requirements.

There is currently an existing watermain along the Church Street to the site east of the site. The proposed connection location is indicated on the attached Proposed Roads & Watermains layout 17.168-205.

It is proposed to form a connection to this watermain with a new MDPE watermain to serve the proposed development. It is proposed to lay the watermain within the footpaths where possible with and where it is not possible to construct the watermain in the footpath it will be laid under the access roads serving the proposed development. It is proposed to construct 100mm dia watermain throughout the development.

This connection will be fitted with an overall flow meter to monitor the water usage and losses for the entire development. A sluice valve combination will be fitted at the connection point and separately it is proposed to install a hydrant/scour valve combination at the lowest point on the line to allow for purging of the system.

Individual boundary boxes in accordance with Irish Water requirements will be provided on each private connection from the proposed watermain.

5. ROAD DESIGN

5.1. General

In terms of the internal road network, the design was prepared by the Architect and modified by JRA to comply with the Design Manual for Urban Roads and Streets (DMURS).

5.2. DMURS Compliance

With reference to the attached Roads and Public Lighting Layout drawings, 17.168-205, 206 & 600 you will note that the site is served by a main access road with 3 no. cul de sacs. The scheme design is such that the road will be overlooked by houses to the entire length of the access road. This will provide a sense of streetscape.

In terms of the horizontal alignment the access road has a number of turns and bends and meanders its way through the scheme. The footpaths are close to the carriage way in areas and move in and out parallel to the main road with areas of trees planted close to the carriageway to further enhance the sense of enclosure to encourage the reduction of vehicular speed organically.

The road width has been set at 5.5m in line with the DMURS document and internal radii of junctions at side roads is 3m, reducing the speed and reducing crossing distances for pedestrians.

3 No. raised speed ramp are proposed at the location indicated on the attached drawings to further reduce the speed when circulating throughout the proposed development. Tactile paving has been introduced at pedestrian crossing points and it is considered that there is a clear demarcation of pedestrian and vehicular priorities.

In terms of parking it can be noted that the all the parking is in dedicated parking areas.

It is considered that that the scheme as proposed is a pedestrian friendly layout which adopts the principles of DMURS.

APPENDIX I

Allowable Surface Water Discharge Calculation

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Artur Winnicki
Site name:	17.178 Railway Street
Site location:	Carpark

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.03659° N
Longitude:	7.30023° W
Reference:	25318465
Date:	Mar 11 2020 11:43

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.5884

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	1060	1060
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.74	1.74
1 in 1 year (l/s):	1.48	1.48
1 in 30 years (l/s):	2.88	2.88
1 in 100 year (l/s):	3.4	3.4
1 in 200 years (l/s):	3.75	3.75

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Pipe Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.PIP
Manhole Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.MHS

Location - Scotland & Ireland

Return Period (years)	100
M5-60 (mm)	15.500
Ratio R	0.283
Maximum Rainfall (mm/hr)	50
Foul Sewage (l/s/ha)	0.00
O'flow Setting (*Foul only)	0
Volumetric Runoff Coeff.	0.75
Add Flow / Climate Change (%)	10
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Cover Depth for Optimisation (m)	1.200
Min Vel for Auto Design Only (m/s)	1.00
Min Slope for Optimisation (1:X)	500
Minimum Outfall Invert (m)	0.000
Ground Level at Outfall (m)	0.000
Outfall Manhole Name	
Outfall Manhole Dia/Length (mm)	0
Outfall Manhole Width (mm)	0

Designed with Level Inverts

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
5.000	69.87	1.542	45.3	0.102	2.00	0.0	0.600	o	150
5.001	15.86	0.106	149.6	0.033	0.00	0.0	0.600	o	225
6.000	38.75	0.258	150.2	0.027	2.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
5.000	50.0	2.8	92.800	0.102	0.0	0.0	1.4	1.50	26.5	15.2
5.001	50.0	3.0	91.258	0.135	0.0	0.0	1.8	1.07	42.4	20.1
6.000	50.0	2.8	91.942	0.027	0.0	0.0	0.4	0.82	14.4	4.0

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Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
5.002	22.03	0.147	149.9	0.034	0.00	0.0	0.600	o	225
7.000	25.39	0.169	150.2	0.017	2.00	0.0	0.600	o	150
8.000	25.08	0.167	150.2	0.021	2.00	0.0	0.600	o	150
9.000	12.14	0.081	149.9	0.032	2.00	0.0	0.600	o	150
8.001	16.43	0.110	149.4	0.000	0.00	0.0	0.600	o	150
7.001	21.10	0.141	149.6	0.000	0.00	0.0	0.600	o	150
5.003	12.00	0.080	150.0	0.000	0.00	0.0	0.600	o	225
5.004	3.00	0.020	150.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
5.002	50.0	3.4	90.504	0.196	0.0	0.0	2.7	1.07	42.4	29.2
7.000	50.0	2.5	90.979	0.017	0.0	0.0	0.2	0.82	14.4	2.5
8.000	50.0	2.5	90.850	0.021	0.0	0.0	0.3	0.82	14.4	3.1
9.000	50.0	2.2	90.200	0.032	0.0	0.0	0.4	0.82	14.5	4.8
8.001	50.0	2.8	90.119	0.053	0.0	0.0	0.7	0.82	14.5	7.9
7.001	50.0	3.3	90.009	0.070	0.0	0.0	0.9	0.82	14.5	10.4
5.003	50.0	3.6	89.868	0.266	0.0	0.0	3.6	1.07	42.4	39.6
5.004	50.0	3.6	89.788	0.266	0.0	0.0	3.6	1.07	42.4	39.6

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PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
5.000	o	150	1	93.830	92.800	0.880	1050
5.001	o	225	12	92.240	91.258	0.757	1050
6.000	o	150	12	92.630	91.942	0.538	1050
5.002	o	225	12	92.120	90.504	1.391	1050
7.000	o	150	12	92.240	90.979	1.111	1050
8.000	o	150	12	91.920	90.850	0.920	1050
9.000	o	150	12	91.260	90.200	0.910	1050
8.001	o	150	12	91.490	90.119	1.221	1050
7.001	o	150	12	92.240	90.009	2.081	1200
5.003	o	225	12	91.340	89.868	1.247	1050
5.004	o	225	12	91.140	89.788	1.127	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
5.000	69.87	45.3	12	92.240	91.258	0.832	1050
5.001	15.86	149.6	12	92.120	91.152	0.743	1050
6.000	38.75	150.2	12	92.120	91.684	0.286	1050
5.002	22.03	149.9	12	91.340	90.357	0.758	1050
7.000	25.39	150.2	12	92.240	90.810	1.280	1200
8.000	25.08	150.2	12	91.490	90.683	0.657	1050
9.000	12.14	149.9	12	91.490	90.119	1.221	1050
8.001	16.43	149.4	12	92.240	90.009	2.081	1200
7.001	21.10	149.6	12	91.340	89.868	1.322	1050
5.003	12.00	150.0	12	91.140	89.788	1.127	1050
5.004	3.00	150.0		0.000	89.768	-89.993	0

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PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)

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MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out PN	Pipes Out IL.(m)	Pipes Out D (mm)	Pipes In PN	Pipes In IL.(m)	Pipes In D (mm)
1	93.830	1.030	1050	5.000	92.800	150			
12	92.240	0.982	1050	5.001	91.258	225	5.000	91.258	150
12	92.630	0.688	1050	6.000	91.942	150			
12	92.120	1.616	1050	5.002	90.504	225	5.001	91.152	225
							6.000	91.684	150
12	92.240	1.261	1050	7.000	90.979	150			
12	91.920	1.070	1050	8.000	90.850	150			
12	91.260	1.060	1050	9.000	90.200	150			
12	91.490	1.371	1050	8.001	90.119	150	8.000	90.683	150
							9.000	90.119	150
12	92.240	2.231	1200	7.001	90.009	150	7.000	90.810	150
							8.001	90.009	150
12	91.340	1.472	1050	5.003	89.868	225	5.002	90.357	225
							7.001	89.868	150
12	91.140	1.352	1050	5.004	89.788	225	5.003	89.788	225
	0.000	-89.768	0		OUTFALL		5.004	89.768	225

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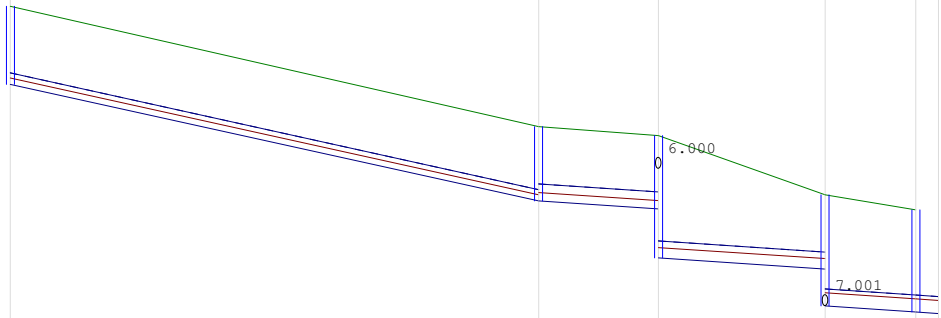
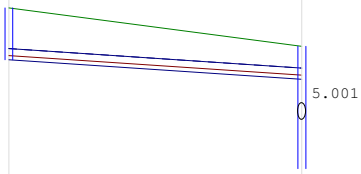
					
Hor Scale 1000 Ver Scale 100 Datum (m) 88.000					
PN	5.000	5.001	5.002	5.003	5.004
Dia (mm)	150	225	225	225	225
Slope (1:X)	45.3	149.6	149.9	150.0	150.0
Cover Level (m)	93.830	92.240	92.120	91.340	91.140 0.000
Invert Level (m)	92.800	91.258 91.258	91.152 90.504	90.357 89.868	89.788 89.738
Length (m)	69.87	15.86	22.03	12.00	3.00

MH Name	12	12
		
Hor Scale 1000 Ver Scale 100 Datum (m) 88.000		
PN	6.000	
Dia (mm)	150	
Slope (1:X)	150.2	
Cover Level (m)	92.630	92.120
Invert Level (m)	91.942	91.684
Length (m)	38.75	

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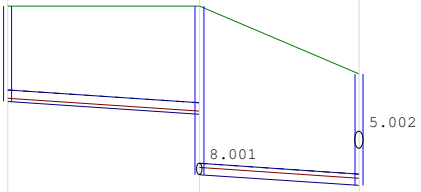
MH Name		12	12	12
				
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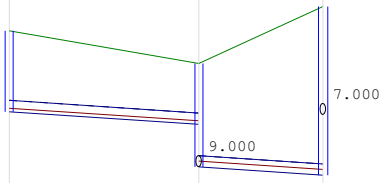
PN		7.000	7.001	
Dia (mm)		150	150	
Slope (1:X)		150.2	149.6	
Cover Level (m)		92.240	92.240	91.340
Invert Level (m)		90.979	90.810 90.009	89.868
Length (m)		25.39	21.10	

MH Name		12	12	12
				
Hor Scale 1000 Ver Scale 100 Datum (m) 87.000				
PN		8.000	8.001	
Dia (mm)		150	150	
Slope (1:X)		150.2	149.4	
Cover Level (m)		91.920	91.490	92.240
Invert Level (m)		90.850	90.683 90.119	90.009
Length (m)		25.08	16.43	

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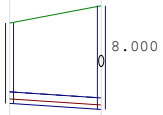
MH Name		12	12
Hor Scale 1000 Ver Scale 100 Datum (m) 87.000			
PN		9.000	
Dia (mm)		150	
Slope (1:X)		149.9	
Cover Level (m)		91.260	91.490
Invert Level (m)		90.200	90.119
Length (m)		12.14	

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Artur Winnicki
Site name:	17.178 Railway Street
Site location:	Estate

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.03720° N
Longitude:	7.29935° W
Reference:	3467657239
Date:	Mar 11 2020 11:56

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.4219

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	1060	1060
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	4.21	4.21
1 in 1 year (l/s):	3.58	3.58
1 in 30 years (l/s):	6.95	6.95
1 in 100 year (l/s):	8.21	8.21
1 in 200 years (l/s):	9.05	9.05

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Pipe Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.PIP
Manhole Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.MHS

Location - Scotland & Ireland

Return Period (years)	100
M5-60 (mm)	15.500
Ratio R	0.283
Maximum Rainfall (mm/hr)	50
Foul Sewage (l/s/ha)	0.00
O'flow Setting (*Foul only)	0
Volumetric Runoff Coeff.	0.75
Add Flow / Climate Change (%)	10
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Cover Depth for Optimisation (m)	1.200
Min Vel for Auto Design Only (m/s)	1.00
Min Slope for Optimisation (1:X)	500
Minimum Outfall Invert (m)	0.000
Ground Level at Outfall (m)	0.000
Outfall Manhole Name	
Outfall Manhole Dia/Length (mm)	0
Outfall Manhole Width (mm)	0

Designed with Level Inverts

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	25.05	0.167	150.0	0.014	2.00	0.0	0.600	o	150
1.001	61.93	0.620	99.9	0.191	0.00	0.0	0.600	o	225
2.000	36.48	0.243	150.1	0.095	2.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	50.0	2.5	90.050	0.014	0.0	0.0	0.2	0.82	14.5	2.1
1.001	50.0	3.3	89.830	0.205	0.0	0.0	2.8	1.31	52.0	30.5
2.000	50.0	2.7	89.603	0.095	0.0	0.0	1.3	0.82	14.5	14.2

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Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
2.001	7.23	0.150	48.2	0.045	0.00	0.0	0.600	o	150
1.002	33.47	0.223	150.1	0.091	0.00	0.0	0.600	o	300
1.003	8.73	0.058	150.5	0.000	0.00	0.0	0.600	o	300
3.000	32.25	0.215	150.0	0.100	2.00	0.0	0.600	o	225
4.000	27.29	0.182	149.9	0.032	2.00	0.0	0.600	o	225
3.001	12.65	0.084	150.6	0.108	0.00	0.0	0.600	o	225
3.002	35.71	0.238	150.0	0.131	0.00	0.0	0.600	o	300
3.003	12.34	0.082	150.5	0.023	0.00	0.0	0.600	o	300
1.004	2.65	0.018	147.2	0.000	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
2.001	50.0	2.8	89.360	0.140	0.0	0.0	1.9	1.45	25.7	20.9
1.002	50.0	3.7	89.210	0.436	0.0	0.0	5.9	1.28	90.6	64.9
1.003	50.0	3.8	88.987	0.436	0.0	0.0	5.9	1.28	90.4	64.9
3.000	50.0	2.5	89.150	0.100	0.0	0.0	1.4	1.07	42.4	14.9
4.000	50.0	2.4	88.653	0.032	0.0	0.0	0.4	1.07	42.4	4.8
3.001	50.0	2.7	88.471	0.240	0.0	0.0	3.2	1.06	42.3	35.7
3.002	50.0	3.2	88.387	0.371	0.0	0.0	5.0	1.28	90.6	55.3
3.003	50.0	3.3	88.149	0.394	0.0	0.0	5.3	1.28	90.4	58.7
1.004	50.0	3.9	88.067	0.830	0.0	0.0	11.2	1.49	164.7	123.6

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PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	o	150	1	90.950	90.050	0.750	1050
1.001	o	225	2	90.830	89.830	0.775	1050
2.000	o	150	3	90.590	89.603	0.837	1050
2.001	o	150	4	90.520	89.360	1.010	1050
1.002	o	300	5	90.220	89.210	0.710	1050
1.003	o	300	6	89.930	88.987	0.643	1050
3.000	o	225	7	90.630	89.150	1.255	1050
4.000	o	225	8	89.630	88.653	0.752	1050
3.001	o	225	9	89.950	88.471	1.254	1050
3.002	o	300	10	89.770	88.387	1.083	1050
3.003	o	300	11	89.790	88.149	1.341	1050
1.004	o	375	12	90.480	88.067	2.038	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	25.05	150.0	2	90.830	89.883	0.797	1050
1.001	61.93	99.9	5	90.220	89.210	0.785	1050
2.000	36.48	150.1	4	90.520	89.360	1.010	1050
2.001	7.23	48.2	5	90.220	89.210	0.860	1050
1.002	33.47	150.1	6	89.930	88.987	0.643	1050
1.003	8.73	150.5	12	90.480	88.929	1.251	1350
3.000	32.25	150.0	9	89.950	88.935	0.790	1050
4.000	27.29	149.9	9	89.950	88.471	1.254	1050
3.001	12.65	150.6	10	89.770	88.387	1.158	1050
3.002	35.71	150.0	11	89.790	88.149	1.341	1050
3.003	12.34	150.5	12	90.480	88.067	2.113	1350
1.004	2.65	147.2		0.000	88.049	-88.424	0

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MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out PN	Pipes Out IL.(m)	Pipes Out D (mm)	Pipes In PN	Pipes In IL.(m)	Pipes In D (mm)
1	90.950	0.900	1050	1.000	90.050	150			
2	90.830	1.000	1050	1.001	89.830	225	1.000	89.883	150
3	90.590	0.987	1050	2.000	89.603	150			
4	90.520	1.160	1050	2.001	89.360	150	2.000	89.360	150
5	90.220	1.010	1050	1.002	89.210	300	1.001	89.210	225
							2.001	89.210	150
6	89.930	0.943	1050	1.003	88.987	300	1.002	88.987	300
7	90.630	1.480	1050	3.000	89.150	225			
8	89.630	0.977	1050	4.000	88.653	225			
9	89.950	1.479	1050	3.001	88.471	225	3.000	88.935	225
							4.000	88.471	225
10	89.770	1.383	1050	3.002	88.387	300	3.001	88.387	225
11	89.790	1.641	1050	3.003	88.149	300	3.002	88.149	300
12	90.480	2.413	1350	1.004	88.067	375	1.003	88.929	300
							3.003	88.067	300
	0.000	-88.049	0		OUTFALL		1.004	88.049	375

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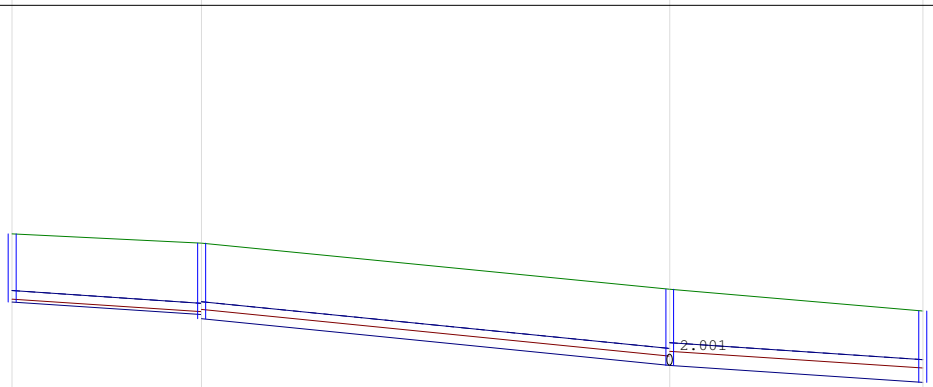
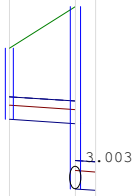
MH Name	1	2	5	6
				
PN	1.000	1.001	1.002	
Dia (mm)	150	225	300	
Slope (1:X)	150.0	99.9	150.1	
Cover Level (m)	90.950	90.830	90.220	89.930
Invert Level (m)	90.050	89.883 89.830	89.210 89.210	88.987
Length (m)	25.05	61.93	33.47	

Hor Scale 1000

Ver Scale 100

Datum (m) 86.000

MH Name	6	12
		
PN	1.003	1.004
Dia (mm)	300	375
Slope (1:X)	150.5	147.2
Cover Level (m)	89.930	90.480 0.000
Invert Level (m)	88.987	88.929 88.049
Length (m)	8.73	2.65

Hor Scale 1000

Ver Scale 100

Datum (m) 85.000

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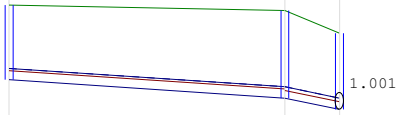
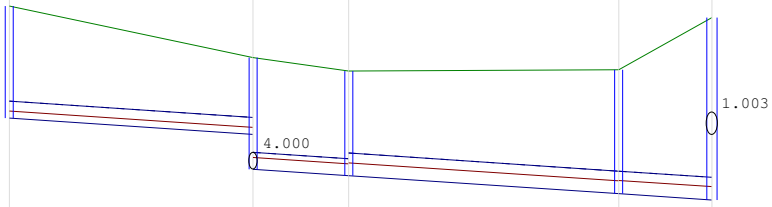
MH Name	3	4	5
			
Hor Scale 1000 Ver Scale 100 Datum (m) 86.000			
PN	2.000	2.001	
Dia (mm)	150	150	
Slope (1:X)	150.1	48.2	
Cover Level (m)	90.590	90.520	90.220
Invert Level (m)	89.603	89.360 89.360	89.210
Length (m)	36.48	7.23	

MH Name	7	9	10	11	12
					
Hor Scale 1000 Ver Scale 100 Datum (m) 85.000					
PN	3.000	3.001	3.002	3.003	
Dia (mm)	225	225	300	300	
Slope (1:X)	150.0	150.6	150.0	150.5	
Cover Level (m)	90.630	89.950	89.770	89.790	90.480
Invert Level (m)	89.150	88.935 88.471	88.387 88.387	88.149 88.149	88.067
Length (m)	32.25	12.65	35.71	12.34	

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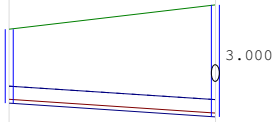
MH Name	8	9
Hor Scale 1000 Ver Scale 100 Datum (m) 85.000		
PN	4.000	
Dia (mm)	225	
Slope (1:X)	149.9	
Cover Level (m)	89.630	89.950
Invert Level (m)	88.653	88.471
Length (m)	27.29	

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APPENDIX II

Attenuation Tank Calculations for 100 Year Return Period

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

Half Drain Time : 324 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	0.489	0.489	0.0	2.3	2.3	50.5	O K
30 min Winter	0.660	0.660	0.0	2.6	2.6	68.1	O K
60 min Winter	0.819	0.819	0.0	2.9	2.9	84.5	O K
120 min Winter	0.962	0.962	0.0	3.1	3.1	99.2	O K
180 min Winter	1.024	1.024	0.0	3.2	3.2	105.6	O K
240 min Winter	1.052	1.052	0.0	3.3	3.3	108.6	O K
360 min Winter	1.062	1.062	0.0	3.3	3.3	109.6	O K
480 min Winter	1.060	1.060	0.0	3.3	3.3	109.4	O K
600 min Winter	1.047	1.047	0.0	3.3	3.3	108.1	O K
720 min Winter	1.028	1.028	0.0	3.3	3.3	106.1	O K
960 min Winter	0.980	0.980	0.0	3.2	3.2	101.1	O K
1440 min Winter	0.876	0.876	0.0	3.0	3.0	90.4	O K
2160 min Winter	0.730	0.730	0.0	2.7	2.7	75.4	O K
2880 min Winter	0.601	0.601	0.0	2.5	2.5	62.0	O K
4320 min Winter	0.358	0.358	0.0	2.3	2.3	36.9	O K
5760 min Winter	0.150	0.150	0.0	2.3	2.3	15.4	O K
7200 min Winter	0.107	0.107	0.0	2.1	2.1	11.0	O K
8640 min Winter	0.091	0.091	0.0	1.8	1.8	9.4	O K
10080 min Winter	0.082	0.082	0.0	1.6	1.6	8.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	81.664	0.0	52.8	25
30 min Winter	55.684	0.0	72.0	39
60 min Winter	35.659	0.0	92.5	68
120 min Winter	22.224	0.0	115.3	122
180 min Winter	16.713	0.0	130.0	178
240 min Winter	13.628	0.0	141.4	234
360 min Winter	10.193	0.0	158.6	306
480 min Winter	8.284	0.0	171.9	376
600 min Winter	7.049	0.0	182.8	454
720 min Winter	6.176	0.0	192.2	530
960 min Winter	5.011	0.0	208.0	684
1440 min Winter	3.730	0.0	232.2	976
2160 min Winter	2.777	0.0	259.4	1404
2880 min Winter	2.250	0.0	280.3	1820
4320 min Winter	1.671	0.0	312.2	2632
5760 min Winter	1.352	0.0	336.9	3112
7200 min Winter	1.147	0.0	357.2	3680
8640 min Winter	1.002	0.0	374.6	4408
10080 min Winter	0.894	0.0	389.9	5136

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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)	16.500	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	No	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.309

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.103	4	8	0.103	8	12	0.103

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Model Details

Storage is Online Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	172.0	172.0	1.200	0.0	231.8
1.100	172.0	231.8			

Hydro-Brake® Outflow Control

Design Head (m) 1.100 Hydro-Brake® Type Md6 SW Only Invert Level (m) 0.000
Design Flow (l/s) 3.4 Diameter (mm) 75

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.5	3.000	5.6	7.000	8.5
0.200	2.3	1.400	3.8	3.500	6.0	7.500	8.8
0.300	2.1	1.600	4.1	4.000	6.4	8.000	9.1
0.400	2.2	1.800	4.3	4.500	6.8	8.500	9.4
0.500	2.3	2.000	4.5	5.000	7.2	9.000	9.6
0.600	2.5	2.200	4.8	5.500	7.5	9.500	9.9
0.800	2.9	2.400	5.0	6.000	7.9		
1.000	3.2	2.600	5.2	6.500	8.2		

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

Half Drain Time : 301 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	0.496	0.496	0.0	6.9	6.9	118.8	O K
30 min Winter	0.670	0.670	0.0	6.9	6.9	160.4	O K
60 min Winter	0.832	0.832	0.0	7.1	7.1	199.2	O K
120 min Winter	0.975	0.975	0.0	7.6	7.6	233.4	O K
180 min Winter	1.035	1.035	0.0	7.8	7.8	247.8	O K
240 min Winter	1.061	1.061	0.0	7.9	7.9	254.1	O K
360 min Winter	1.067	1.067	0.0	8.0	8.0	255.5	O K
480 min Winter	1.061	1.061	0.0	7.9	7.9	254.0	O K
600 min Winter	1.043	1.043	0.0	7.9	7.9	249.8	O K
720 min Winter	1.019	1.019	0.0	7.8	7.8	243.9	O K
960 min Winter	0.960	0.960	0.0	7.6	7.6	229.9	O K
1440 min Winter	0.834	0.834	0.0	7.1	7.1	199.6	O K
2160 min Winter	0.645	0.645	0.0	6.9	6.9	154.4	O K
2880 min Winter	0.451	0.451	0.0	6.9	6.9	107.9	O K
4320 min Winter	0.204	0.204	0.0	6.8	6.8	48.8	O K
5760 min Winter	0.151	0.151	0.0	5.7	5.7	36.1	O K
7200 min Winter	0.128	0.128	0.0	4.9	4.9	30.6	O K
8640 min Winter	0.114	0.114	0.0	4.3	4.3	27.2	O K
10080 min Winter	0.104	0.104	0.0	3.9	3.9	24.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	81.664	0.0	124.7	25
30 min Winter	55.684	0.0	170.2	39
60 min Winter	35.659	0.0	218.9	66
120 min Winter	22.224	0.0	272.9	122
180 min Winter	16.713	0.0	307.9	178
240 min Winter	13.628	0.0	334.8	234
360 min Winter	10.193	0.0	375.6	302
480 min Winter	8.284	0.0	407.0	374
600 min Winter	7.049	0.0	432.9	452
720 min Winter	6.176	0.0	455.2	530
960 min Winter	5.011	0.0	492.4	682
1440 min Winter	3.730	0.0	549.7	978
2160 min Winter	2.777	0.0	614.4	1404
2880 min Winter	2.250	0.0	664.0	1788
4320 min Winter	1.671	0.0	739.4	2336
5760 min Winter	1.352	0.0	798.2	2992
7200 min Winter	1.147	0.0	846.2	3680
8640 min Winter	1.002	0.0	887.4	4408
10080 min Winter	0.894	0.0	923.5	5144

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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)	16.500	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	No	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.732

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.244	4	8	0.244	8	12	0.244

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Model Details

Storage is Online Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	399.0	399.0	1.200	0.0	490.5
1.100	399.0	490.5			

Hydro-Brake® Outflow Control

Design Head (m) 1.100 Hydro-Brake® Type Md6 SW Only Invert Level (m) 0.000
Design Flow (l/s) 8.2 Diameter (mm) 116

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	8.4	3.000	13.3	7.000	20.3
0.200	6.7	1.400	9.1	3.500	14.4	7.500	21.0
0.300	6.9	1.600	9.7	4.000	15.4	8.000	21.7
0.400	6.5	1.800	10.3	4.500	16.3	8.500	22.4
0.500	6.3	2.000	10.9	5.000	17.2	9.000	23.0
0.600	6.4	2.200	11.4	5.500	18.0	9.500	23.7
0.800	7.0	2.400	11.9	6.000	18.8		
1.000	7.7	2.600	12.4	6.500	19.6		

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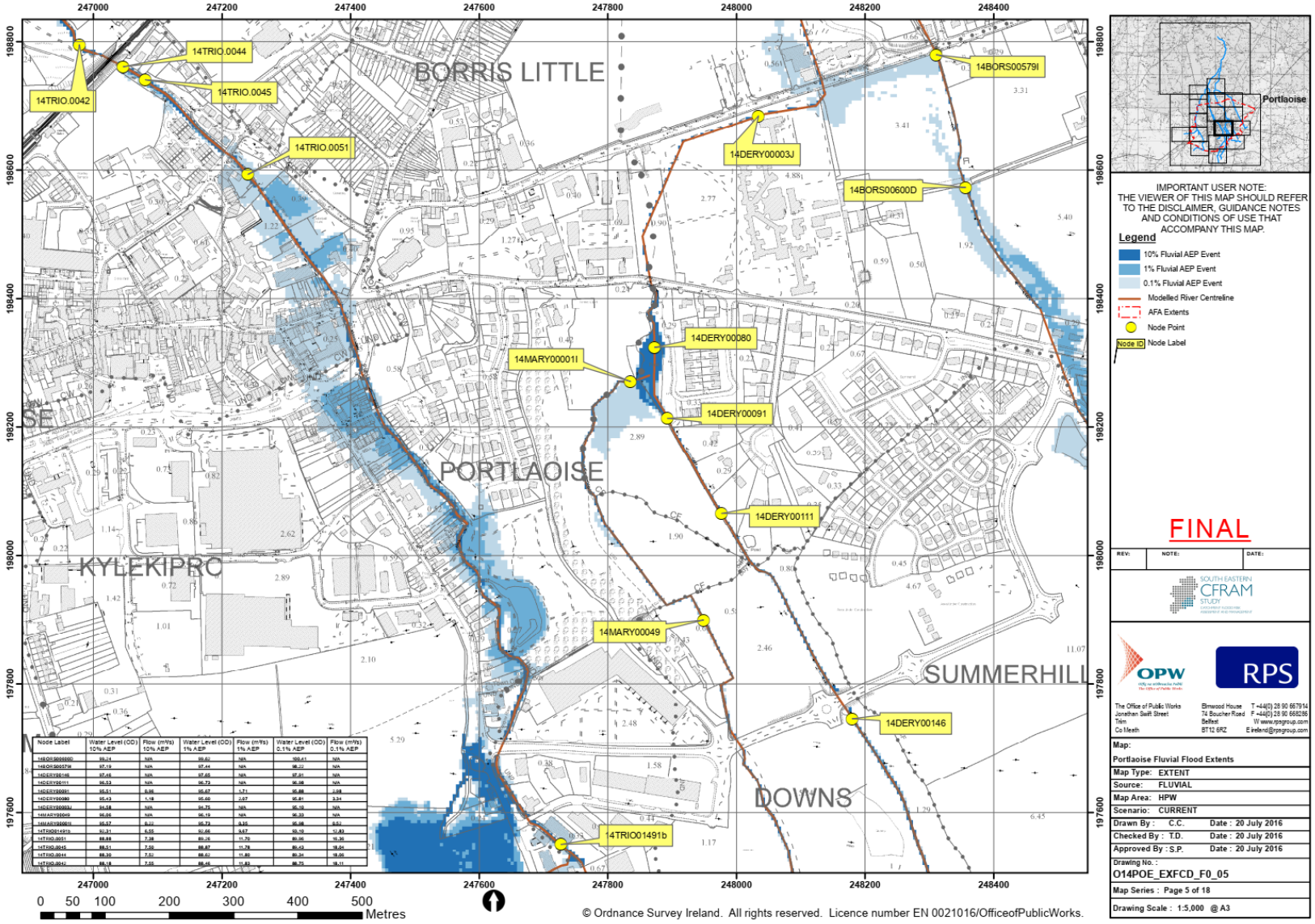
APPENDIX III

‘Portlaoise Fluvial Flood Extent Map’ by OPW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198800
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198400
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197600
14TRIO.0044
14TRIO.0045
14TRIO.0042
14TRIO.0051
14BORS00579I
14DERY00003J
14BORS00600D
14DERY00080
14MARY00001I
14DERY00091
14DERY00111
14MARY00049
14DERY00146
14TRIO01491b
BORRIS LITTLE
PORTLAOISE
KYLEKIPRO
SUMMERHILL
DOWNS
SE
0 50 100 200 300 400 500
Metres
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Portlaoise
IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.
Legend
10% Fluvial AEP Event
1% Fluvial AEP Event
0.1% Fluvial AEP Event
Modelled River Centreline
AFA Extents
Node Point
Node ID Node Label
FINAL
REV:
NOTE:
DATE:
SOUTH EASTERN CFRAM STUDY
OPW
RPS
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E belfast@rpsgroup.com
Map:
Portlaoise Fluvial Flood Extents
Map Type: EXTENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 20 July 2016
Checked By : T.D. Date : 20 July 2016
Approved By : S.P. Date : 20 July 2016
Drawing No. :
O14POE_EXFCD_F0_05
Map Series : Page 5 of 18
Drawing Scale : 1:5,000 @ A3