COWAL DESIGN CONSULTANTS LTD

CONSULTING CIVIL & STRUCTURAL ENGINEERS

Taylor Lane Rathfarnham

Care Home Development

Drainage Impact Assessment Report

Drainage Impact Assessment Report

20-3406 Care Home Development

Taylor Lane Rathfarnham

Dublin

Revision	Date of issue	Comments	Prepared By	Checked By
-	06/05/2022	Initial Issue	G.R.Porch	S.M.

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1.0 Introduction

1.1

On behalf of our Client Morrison Community Care Group, we have been appointed to provide a Drainage Impact Assessment for Care Home Development at Taylors Lane Rathfarnham Dublin. The Development will consist of 3-4 storey nursing home building with 111 bedrooms (ensuites) and providing associated staff and resident welfare facilities, amenities and including extensive landscaped gardens. The protection and preservation of Newbrook House (a protected structure-Ref No 300) and incorporation with the construction of the new 3-4 storey nursing home. Formation of new vehicular access and pedestrian site access off Taylors Lane and associated landscaping works. Communal open space as well as other facilities open to the public such as hair salon, function suite and cinema. The development also includes 4 new 3 storey dwellings with associated parking landscaping and services. The development has provision of 24 parking spaces including 2 accessible spaces and 2 EV charging bays to service the nursing home and residential with 24 short and long stay cycle parking spaces (National Gride Reference 714006 727039).

1.2

This Drainage Impact appraisal will review and consider high level review the following information: -

- Existing Site & Ground Conditions
- Street-map Information
- Flood Risk Assessment
- Irish Water GIS Record Plans
- Surface Water SUD's management system in accordance with Irish Water disposal policies.
- Proposed Surface Water SUD's management system
- SUD's Maintenance Requirements & Ownership

2.0 Pre-Development Site Conditions

2.1

Site Description

The existing site is approximately 0.64Ha and slopes generally from southeast to northwest. The existing ground high level is 82.67m falling to 76.29m AOD on western site boundary. This development is bounded by residential properties to west and south with petrol station to the east. Taylor Lane road bounds the northern boundary.

2.2

Pre-Development Surface Water Runoff

The existing surface water drainage system serving this development pre-dates any SUD's regulations and therefore has a free surface water discharge prior to discharging into public surface water sewers with overland flows mostly contained within the demise of the site boundary.

The existing surface water discharge rate has been calculated based on a 50mm of rain intensity over hardstanding surfaces only. The pre-development total hardstanding surface area is 2953.3m2 (thereby) generating a surface water discharge runoff of 41.05 Litres per second (refer to drawing 20-3406-C-003 within Appendix B).

2.3

Site Investigation Summary

Potential sources of contamination are usually associated with current and former industrial activities, where the processing, storage, use, transportation and disposal of raw materials, products and wastes often leads to the contamination of underlying ground and groundwater. In addition, natural processes can also give rise to contamination such as hazardous gases.

3.0 Street-map Information

3.1

There appears to be an approximately a 6.38m level difference between the southwest and northwest site boundary adjacent to existing retaining wall. The Owenadoher River is located approximately 450.0m to the west with the Kilmashogue Stream approximately 330m to east, both watercourses flow from the south in northernly direction. There also an existing manmade former mill race drainage channel located with the demise of the site boundary.

Historically, this drainage channel abstracted water from Owenadoher River to serve the former Mill factory however, over time this drainage channel has been poorly maintain and has gradually backfill naturally over time.

Please refer to Appendix F, IE Consulting Water Environmental Civil Flood Risk Assessment Technical Note Rev 02 Dated May 2022 assessment of Mill Race Drainage Channel.

We arranged a meeting South Dublin Country Council and agreed the on-site scope of investigation works to determine the actual site condition and assess the existing connection between the Mill Race drainage channel from the west of Palmer Park Street flowing into our development. We also agreed the CCTV Survey investigation works will be overseen by Dublin Council Flood Officer on-site.

Due to the size of the CCTV Survey Report, we will issue a full copy upon requested.

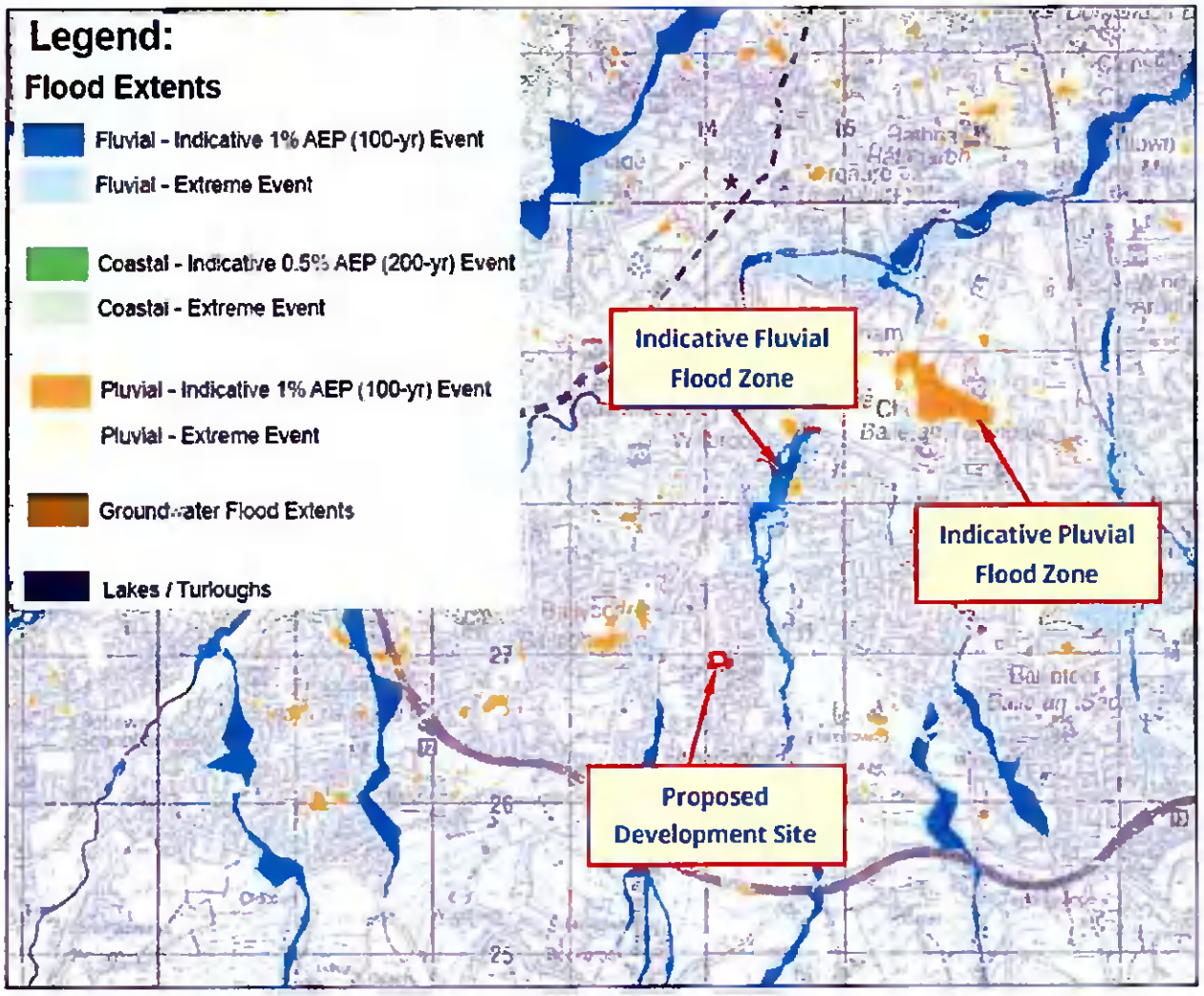
4.0 Flood Risk Assessment

4.1

EPA Surface Water Flooding Map

The proposed site location appears to be no risk of pluvial Flooding from Overland flows according to the attached EPA Flood Map.

Naturally pluvial surface water flows would be contained within the final SUD's drainage design for the development.



4.2

EPA River Water Flooding Map

The proposed site location doesn't appear to be any risk of Flooding from River Water Flooding according to the attached EPA Flood Map (refer to Appendix F for IE Consulting Flood Risk Assessment).

5.0 Irish Water GIS Record Plan Information

5.1

The proposed site appears to be well served by Irish Water adopted Foul and Surface Water network. Refer to Appendix E for Irish Water GIS Record Plans.

5.2

The generated Foul Water preferred discharge point for this development would be to the existing public foul water sewer located northeast of the development below Taylor Lane Road denoted as existing MH.1004 (refer to Appendix B).

5.3

The generated Surface Water preferred discharge point for this development would be to South Dublin Country Council Public Surface Water sewer, upstream from MH.S0002 located north of Taylor Lane Road.

5.4

Please note the above discharge locations will have been agreed with Irish Water and South Dublin Country Council through the Pre-Development Enquiry Application.

5.5

Due to the proposed location and size of the Care Home Building we intend to de-culvert the existing 900mm diameter surface water culvert sewer and diverted to open channel within demise of the site boundary subject to Local Authorities approval. We have lodge an application with Irish Water and await their response.

6.0 Surface Water Management Option Review

6.1 Option 01 - Rainwater Harvesting

For design purposes all private SUDS storage systems cannot be utilized for modelling purposes in accordance South Dublin Country Council Building Control due to systems being modified or removed by their owners or failing. Building standards also require such methods to be excluded from the design or considered at full capacity.

6.2 Option 2 - Soakaway

We would consider this development unsuitable for surface water soakaway design due to this development being a brown field site. The majority of the existing ground strata is made ground. As such, EPA would oppose such a method being adapted, as we are not permitted to utilize soakaways with made-ground strata as per EPA's Regulations. Below the made ground strata mostly comprises of stiff clay. Please refer to the Site Investigation Report.

6.3 Option 3 - Existing Watercourse

We recommend that the surface water generated form this development connects into the 900mm diameter culvert serving this development as per pre-development condition.

6.4 Option 4 - Existing Surface Water Sewer

Irish water confirmed there is no historical capacity issues with surface water sewer located below Taylor Lane Road on the northern boundary.

6.5 Option 5 - Existing Combined Sewer

There is no record of any public combined water sewers within vicinity of the development, Irish Water would prefer that the surface water is connected to the surface water sewer or nearby watercourse.

7.0 Post Development SUD's Surface Water Management

7.1

We have submitted a Technical Audit application to Irish Water to determine suitability of the proposed drainage infrastructure network and treatment proposals. We have lodge an application with Irish Water and await their response.

7.2

The foul water generated by this proposed development will be maintained in separate gravity system prior to connection to the existing Irish Water public foul water sewer network below Taylor Lane Road denoted as EX.MH.P1004 indicated on drawing 20-3406-C-032 Rev A – Proposed Underground Layout within Appendix B.

7.3

According to Irish Water records there are existing surface water sewer networks within the demise of the proposed development which we intend to discharge the development generated surface water as per the pre-development condition. The discharge will be restricted to the Greenfield Runoff totalling 5.0 Litres/Sec. Please refer to Appendix C for Micro Drainage Design Calculations for all storm events.

7.4

According to IE Consultants Flood Risk Assessment, the Mill Race drainage channel generates a hydraulic flow of 50.6 Litres/Sec. based on the surrounding contribution areas during 1 in 100-year storm event plus climate change.

We have therefore included this worst-case scenario as a base rate within the Micro Drainage Calculations. We have re-run this base rate during all storm events to ensure no overland flooding occurs within the open drainage channel / swale design and downstream network. Please refer to Appendix C for Micro Drainage Design Calculations for all storm events.

7.5

We have also surcharged our open drainage channel / swale system to determine the maximum surface water flow capacity provided within our division design. According to our Micro Drainage Calculations we believe the proposed design is capable of containing a Surface Water hydraulic base flow Rate of 162.1 Litres/Second under surcharged condition without on-site flooding issues occurring (based on manhole headloss of 500mm).

7.6

Proposed SUD's design will be in accordance with Sustainable Drainage Explanatory Design & Evaluation Guide Manual dated 2022, Greater Dublin Regional Code of Practice for Drainage Guidelines.

7.7

The proposed adopted foul and surface water network will be constructed in accordance with Irish Water Code of Practice for Wastewater Infrastructure Guidelines.

7.8

The proposed drainage network including storage and treatment facilities will be maintained privately.

7.9

The surface water generated from private roads and hardstanding areas collected through proposed road gully locations and will be treated via adjacent stormbloc filter trench sized to provide 1xVTR for Roof areas & 2xVTR for hardstanding areas based on 12.5mm of first flush surface water runoff.

7.10

The stormbloc storage filter trench systems serving the private roof and hardstanding area within the demise of private grounds will be maintained by Care Home owners.

7.11

The private roof stormbloc filter trench systems will be designed to cater for 1:100yr storm return period for all events with 20% climate change.

7.12

As highlighted on Pre- & Post-development overland flow drawings, we confirm that the overland flows and routes remain the same. Refer to drawing 20-3406-C-003 for Pre-development Overland Flow Layout & drawing 20-3406-C-004 for Post-development Overland Flow Layout contained within Appendix B.

8.0 Conclusion

We calculated the pre-development runoff discharging upstream from the existing Scottish Water surface water sewer as 41.05L/Sec. based on hardstanding areas only (pre-development area pre-dates SUD's regulations). This existing runoff will now treat and restricted to 5.0L/Sec. during all storm return period up to 100yr +20 Climate Change before discharging to the existing surface water culvert serving this development.

We therefore confirm the post development will offer a betterment to the existing Irish Water Network and unnamed drainage channel capacity and condition downstream of this development.

8.0 SUD's Maintenance Requirements & Ownership

8.1 – Stormbloc Filter Storage systems

The stormbloc storage filter trench systems to be maintained by Care Home Owners.

TABLE 21.1 Classification and recommended calculations for geocellular systems

Site classification	Criteria	Examples	Design information required	Calculations and analysis required	Qualifications of designer
0	Consequence of failure/excessive deformation, in context of safety are minor Size of installation is small (less than 3 m³), project below notification requirements for CDM 2015	Domestic applications such as a soakaway for a single house	Services search or cat scan for services	No formal design calculations required. Unit supplier to advise on application suitability of unit	Unit supplier installation advice usually sufficient
1	Consequence of failure/excessive deformation, in context of safety are minor; units will be installed in competent ground, eg firm to stiff clays or medium to dense sands (or stiffer/stronger ground), site is predominantly flat, and units are remote[1], from foundations slopes, retaining walls	Located in agricultural land or remote landscaping Located beneath private access roads, occasional use less than 15 mph. Located beneath or adjacent to car parks, with no HGV traffic (ie height/width barriers in place).	Desk study. Intrusive ground investigation to verify geology and site history Standardised manufacturer information and testing, based on design life and creep rupture testing for unit capacity likely to be sufficient	Undertake calculations for vertical distributed and concentrated loading Check adequacy of cover to units for attenuation of concentrated loading (simple load spread angle) and with respect to groundwater (flotation check) Assess 'active' pressures (K_a) for lateral load on installation	Incorporated or chartered engineer
2	Consequences of failure, in context of safety are minor. Large deformation may adversely affect functionality of facility, or units located shallower than 1 m, deeper than 3 m or located in soft clays or loose sands or located in vicinity[1] of foundations, slopes retaining walls	As for Class 1, but soil–structure interaction is potentially more complex Site functionality affected by deformation in excess of 50 mm[2] or differential movements in excess of 1 in 200 Located beneath public roads, subject to low to moderate speed (less than 30 mph) traffic Parking areas accessible to HGVs	As Class 1, plus site-specific quantitative data to verify ground strength and deformation characteristics As Class 1 plus creep test data for geocellular units to assess long-term deformation Greater understanding of the performance and manufacturer testing undertaken of the units required. The likely loading, fatigue, creep and temperature of operation may lead to specific testing or further investigation of unit performance	Sloping ground will require considered assessment of lateral loading. Recommended to include slope stability calculations, assessment of pre-existing shear zones in slopes. Note: lateral pressures can be significantly higher than K_o (for horizontal ground) Detailed assessment of the installation regarding construction activities, such as stockpiles, plant or crane operations Detailed assessment of adjacent structures, such as load paths of foundations	Chartered civil engineer, with more than five years' post chartered experience
3	Consequences of failure, in context of safety, are severe. Functionality of facility or adjacent pavements/structures sensitive to small deformations. Units located shallower than 0.5 m, or deeper than 4 m. Located in ground which is potentially unstable	Located beneath or adjacent to specialist loading facilities (cranes etc) Located beneath or adjacent to public roads subject to high speed (more than 30 mph) traffic. Subjected to significant cyclic loads. Site functionality affected by deformations less than 50 mm[2] or differential movements of less than 1 in 200 Regularly exposed to liquids at high temperatures	As Class 2, but may also need specialist sampling or tests to more reliably measure ground deformation characteristics As Class 2, plus possibly specialist test data for tank, or measurements of strength and stiffness at high (> 25°C) temperature	Bespoke analysis required, supervised by senior specialist geotechnical engineer of geotechnical advisor status.	Geotechnical advisor (see SISG, 2012)

Notes

1. A higher design classification may be used in order to justify a more economical design, for example, a more rigorous analysis of soil structure interaction may lead to increased confidence in the performance of a tank and allow lower quality backfill to be used around the tank or avoid the need for additional measures to reduce the earth pressure on the side of the tanks.
2. See O'Brien *et al* (in press) for definitions of 'remote from foundations, retaining walls, slopes etc.'
3. The design check requirements are intended as a minimum guide for consideration and are not an all-encompassing exhaustive list. Further requirements and checks may be required depending on the particular circumstance and as directed by a competent designer.

TABLE 16.1 Operation and maintenance requirements for filter drains

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

8.3 – Road Gully and Tails

Private gullies and tails to be inspected and maintain by Care Home Owners. We recommend road gullies should be inspected regularly, once every 6 to 12 months and cleaned as per required.

8.4 – Drainage Sewer Networks

Proposed adopted pipework and manholes to be inspected and maintain by Irish Water.

Proposed private pipework and manholes to be inspected and maintain by Care Home. We recommend drainage networks should be inspected regularly, once every 6 to 12 months and cleaned as per required.

All drainage systems and components should be maintained and inspected in accordance with Sustainable Drainage Explanatory Design & Evaluation Guide Manual dated 2022. Refer to drawing 20-3406-C-032 Rev A Proposed Underground Drainage Layout with Appendix D for locations.

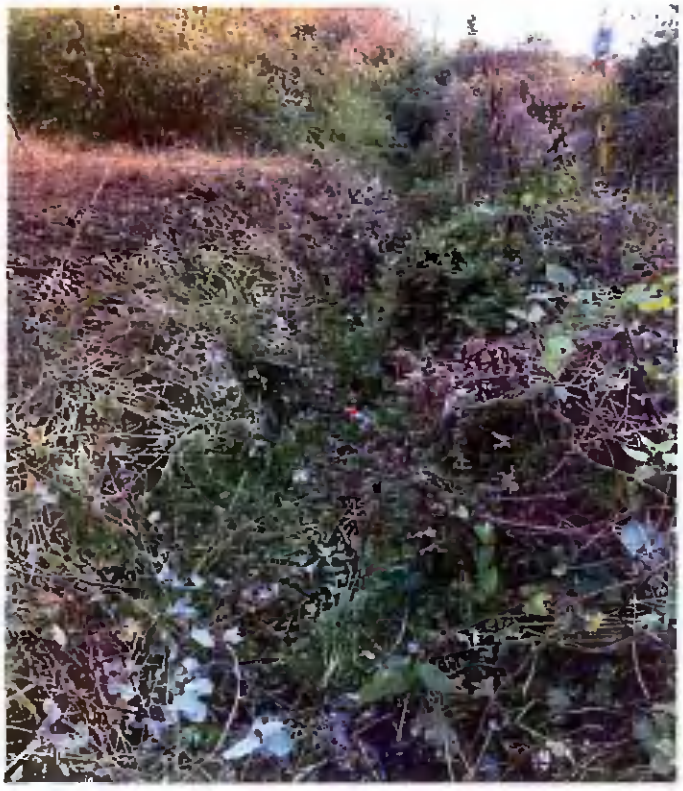
APPENDIX A
(Site Photographs)

Taylor Lane Site

Existing Taylor Lane Eastern Site Entrance

Existing Taylor Lane Western Site Entrance

Existing Palmer Park Culvert Diversion Manhole



Existing Old Mill Drainage Channel 01

Existing Old Mill Drainage Channel 02

Existing Mill Race Drainage Channel – Dye Test 01

Existing Mill Race Drainage Channel – Dye Test 02

APPENDIX B
(Proposed Development Drawings)

APPENDIX C
(Micro Drainage Calculations)

ICP SUDS Mean Annual Flood

Input

Return Period (years)	200	Soil	0.150
Area (ha)	0.384	Urban	0.000
SAAR (mm)	1030	Region Number	Ireland Greater Dublin

Results l/s

QBAR Rural	0.2
QBAR Urban	0.2
Q200 years	0.7
Q1 year	0.2
Q30 years	0.5
Q100 years	0.6

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 21-3406 - SURFACE NETWORK 01.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.000	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	1.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for 21-3406 - SURFACE NETWORK 01.SWS

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	77.182	0.385	200.5	0.068	5.00	50.6	0.600	o	300	Pipe/Conduit	
S1.001	6.358	0.105	60.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.002	10.999	0.195	56.4	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.000	22.374	0.225	99.4	0.046	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	6.283	0.525	12.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	11.365	0.115	98.8	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	5.440	0.395	13.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.002	11.011	0.275	40.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	18.854	0.315	59.9	0.000	0.00	0.0	0.600	o	375	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	49.18	6.16	79.485	0.068	50.6	0.0	0.0	1.11	78.2	59.7
S1.001	49.03	6.21	77.600	0.068	50.6	0.0	0.0	2.33	257.6	59.7
S1.002	48.78	6.28	77.495	0.068	50.6	0.0	0.0	2.42	266.9	59.7
S2.000	50.00	5.37	78.550	0.046	0.0	0.0	0.0	1.01	17.8	6.2
S2.001	50.00	5.41	78.325	0.046	0.0	0.0	0.0	2.93	51.8	6.2
S3.000	50.00	5.19	78.310	0.018	0.0	0.0	0.0	1.01	17.9	2.4
S3.001	50.00	5.22	78.195	0.018	0.0	0.0	0.0	2.73	48.2	2.4
S2.002	50.00	5.52	77.800	0.064	0.0	0.0	0.0	1.60	28.2	8.7
S1.003	48.35	6.42	77.300	0.132	50.6	0.0	0.0	2.35	259.1	67.9

Network Design Table for 21-3406 - SURFACE NETWORK 01.SWS

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
S4.000	18.000	0.090	200.0	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	6.629	0.045	147.3	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	14.000	0.070	200.0	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.003	13.522	0.110	122.9	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	21.493	0.175	122.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S5.000	15.000	0.120	125.0	0.040	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.001	5.995	0.370	16.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	16.668	0.160	104.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	15.965	1.140	14.0	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit	
S6.001	13.216	0.945	14.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.002	10.106	0.125	80.8	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	12.905	0.925	14.0	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.001	13.142	1.035	12.7	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.003	14.585	0.185	78.8	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.004	18.000	0.105	171.4	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.005	6.275	0.325	19.3	0.000	0.00	0.0	0.600	o	150	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)
S4.000	50.00	5.33	75.425	0.036	0.0	0.0	0.0	0.92	36.6	4.9
S4.001	50.00	5.43	75.335	0.072	0.0	0.0	0.0	1.08	42.7	9.7
S4.002	50.00	5.68	75.290	0.108	0.0	0.0	0.0	0.92	36.6	14.6
S4.003	50.00	5.87	75.220	0.144	0.0	0.0	0.0	1.18	46.8	19.5
S1.004	47.67	6.64	74.960	0.276	50.6	0.0	0.0	1.63	180.4	86.2
S5.000	50.00	5.28	75.500	0.040	0.0	0.0	0.0	0.90	15.9	5.4
S5.001	50.00	5.32	75.380	0.040	0.0	0.0	0.0	2.52	44.4	5.4
S1.005	47.19	6.79	74.785	0.316	50.6	0.0	0.0	1.77	196.0	91.0
S6.000	50.00	5.10	77.450	0.024	0.0	0.0	0.0	2.71	47.8	3.2
S6.001	50.00	5.18	76.310	0.033	0.0	0.0	0.0	2.71	47.9	4.5
S6.002	50.00	5.33	75.365	0.036	0.0	0.0	0.0	1.12	19.8	4.9
S7.000	50.00	5.08	77.200	0.019	0.0	0.0	0.0	2.71	47.9	2.6
S7.001	50.00	5.16	76.275	0.028	0.0	0.0	0.0	2.84	50.2	3.8
S6.003	50.00	5.54	75.240	0.078	0.0	0.0	0.0	1.13	20.0	10.6
S6.004	49.94	5.94	75.055	0.092	0.0	0.0	0.0	0.76	13.5	12.4
S6.005	49.79	5.98	74.950	0.092	0.0	0.0	0.0	2.30	40.7	12.4

Network Design Table for 21-3406 - SURFACE NETWORK 01.SWS

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
S1.006	17.431	0.085	205.1	0.000	0.00	0.0	0.600	o	900	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)
S1.006	46.80	6.93	74.175	0.408	50.6	0.0	0.0	2.18	1389.6	102.3

Manhole Schedules for 21-3406 - SURFACE NETWORK 01.SWS

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)
SHW.02	80.085	0.600	Open Manhole	1200	S1.000	79.485	300				
SHW.01	79.700	2.100	Open Manhole	1350	S1.001	77.600	375	S1.000	79.100	300	1425
SS05	79.380	1.885	Open Manhole	1350	S1.002	77.495	375	S1.001	77.495	375	
SS04.3	79.640	1.090	Open Manhole	1200	S2.000	78.550	150				
SS04.2	79.435	1.110	Open Manhole	1200	S2.001	78.325	150	S2.000	78.325	150	
SS04.1B	79.600	1.290	Open Manhole	1200	S3.000	78.310	150				
SS04.1A	79.300	1.105	Open Manhole	1200	S3.001	78.195	150	S3.000	78.195	150	
SS04.1	79.305	1.505	Open Manhole	1200	S2.002	77.800	150	S2.001	77.800	150	
								S3.001	77.800	150	
SS04	79.015	1.715	Open Manhole	1350	S1.003	77.300	375	S1.002	77.300	375	
								S2.002	77.525	150	
SS03.4	76.725	1.300	Open Manhole	1200	S4.000	75.425	225				
SS03.3	76.505	1.170	Open Manhole	1200	S4.001	75.335	225	S4.000	75.335	225	
SS03.2	76.510	1.220	Open Manhole	1200	S4.002	75.290	225	S4.001	75.290	225	
SS03.1	77.180	1.960	Open Manhole	1200	S4.003	75.220	225	S4.002	75.220	225	
SS03	78.075	3.115	Open Manhole	1350	S1.004	74.960	375	S1.003	76.985	375	2025
								S4.003	75.110	225	
SS02B	78.025	2.525	Open Manhole	1200	S5.000	75.500	150				
SS02A	77.190	1.810	Open Manhole	1200	S5.001	75.380	150	S5.000	75.380	150	
SS02	77.005	2.220	Open Manhole	1350	S1.005	74.785	375	S1.004	74.785	375	
								S5.001	75.010	150	
SS01.6	78.815	1.365	Open Manhole	1200	S6.000	77.450	150				
SS01.5	77.725	1.415	Open Manhole	1200	S6.001	76.310	150	S6.000	76.310	150	
SS01.4	76.620	1.255	Open Manhole	1200	S6.002	75.365	150	S6.001	75.365	150	
SS01.3B	78.535	1.335	Open Manhole	1200	S7.000	77.200	150				
SS01.3A	77.490	1.215	Open Manhole	1200	S7.001	76.275	150	S7.000	76.275	150	
SS01.3	76.455	1.215	Open Manhole	1200	S6.003	75.240	150	S6.002	75.240	150	
								S7.001	75.240	150	
SS01.2	76.480	1.425	Open Manhole	1200	S6.004	75.055	150	S6.003	75.055	150	
SS01.1	76.580	1.630	Open Manhole	1200	S6.005	74.950	150	S6.004	74.950	150	
SS01	76.620	2.445	Open Manhole	1800	S1.006	74.175	900	S1.005	74.625	375	
								S6.005	74.625	150	
SP0002	76.440	2.350	Open Manhole	1800		OUTFALL		S1.006	74.090	900	

Manhole Schedules for 21-3406 - SURFACE NETWORK 01.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SHW.02	713961.026	727001.690	713961.026	727001.690	Required	
SHW.01	714037.542	727011.809	714037.542	727011.809	Required	
SS05	714042.585	727015.681	714042.585	727015.681	Required	
SS04.3	714060.439	727007.065	714060.439	727007.065	Required	
SS04.2	714058.744	727029.375	714058.744	727029.375	Required	
SS04.1B	714051.666	727011.069	714051.666	727011.069	Required	
SS04.1A	714050.781	727022.401	714050.781	727022.401	Required	
SS04.1	714052.723	727027.482	714052.723	727027.482	Required	
SS04	714041.744	727026.648	714041.744	727026.648	Required	
SS03.4	714028.538	727036.406	714028.538	727036.406	Required	
SS03.3	714010.591	727035.031	714010.591	727035.031	Required	
SS03.2	714010.084	727041.641	714010.084	727041.641	Required	
SS03.1	714024.043	727042.710	714024.043	727042.710	Required	
SS03	714037.372	727044.989	714037.372	727044.989	Required	
SS02B	714041.497	727049.246	714041.497	727049.246	Required	
SS02A	714038.019	727063.837	714038.019	727063.837	Required	

Manhole Schedules for 21-3406 - SURFACE NETWORK 01.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SS02	714032.388	727065.896	714032.388	727065.896	Required	
SS01.6	713972.501	727032.645	713972.501	727032.645	Required	
SS01.5	713968.680	727048.146	713968.680	727048.146	Required	
SS01.4	713966.959	727061.250	713966.959	727061.250	Required	
SS01.3B	713981.731	727036.993	713981.731	727036.993	Required	
SS01.3A	713978.657	727049.526	713978.657	727049.526	Required	
SS01.3	713976.980	727062.561	713976.980	727062.561	Required	
SS01.2	713991.519	727063.723	713991.519	727063.723	Required	
SS01.1	714009.466	727065.098	714009.466	727065.098	Required	
SS01	714015.723	727065.577	714015.723	727065.577	Required	
SP0002	714013.814	727082.903			No Entry	

PIPELINE SCHEDULES for 21-3406 - SURFACE NETWORK 01.SWS

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	SHW.02	80.085	79.485	0.300	Open Manhole	1200
S1.001	o	375	SHW.01	79.700	77.600	1.725	Open Manhole	1350
S1.002	o	375	SS05	79.380	77.495	1.510	Open Manhole	1350
S2.000	o	150	SS04.3	79.640	78.550	0.940	Open Manhole	1200
S2.001	o	150	SS04.2	79.435	78.325	0.960	Open Manhole	1200
S3.000	o	150	SS04.1B	79.600	78.310	1.140	Open Manhole	1200
S3.001	o	150	SS04.1A	79.300	78.195	0.955	Open Manhole	1200
S2.002	o	150	SS04.1	79.305	77.800	1.355	Open Manhole	1200
S1.003	o	375	SS04	79.015	77.300	1.340	Open Manhole	1350
S4.000	o	225	SS03.4	76.725	75.425	1.075	Open Manhole	1200
S4.001	o	225	SS03.3	76.505	75.335	0.945	Open Manhole	1200
S4.002	o	225	SS03.2	76.510	75.290	0.995	Open Manhole	1200
S4.003	o	225	SS03.1	77.180	75.220	1.735	Open Manhole	1200
S1.004	o	375	SS03	78.075	74.960	2.740	Open Manhole	1350
S5.000	o	150	SS02B	78.025	75.500	2.375	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	77.182	200.5	SHW.01	79.700	79.100	0.300	Open Manhole	1350
S1.001	6.358	60.6	SS05	79.380	77.495	1.510	Open Manhole	1350
S1.002	10.999	56.4	SS04	79.015	77.300	1.340	Open Manhole	1350
S2.000	22.374	99.4	SS04.2	79.435	78.325	0.960	Open Manhole	1200
S2.001	6.283	12.0	SS04.1	79.305	77.800	1.355	Open Manhole	1200
S3.000	11.365	98.8	SS04.1A	79.300	78.195	0.955	Open Manhole	1200
S3.001	5.440	13.8	SS04.1	79.305	77.800	1.355	Open Manhole	1200
S2.002	11.011	40.0	SS04	79.015	77.525	1.340	Open Manhole	1350
S1.003	18.854	59.9	SS03	78.075	76.985	0.715	Open Manhole	1350
S4.000	18.000	200.0	SS03.3	76.505	75.335	0.945	Open Manhole	1200
S4.001	6.629	147.3	SS03.2	76.510	75.290	0.995	Open Manhole	1200
S4.002	14.000	200.0	SS03.1	77.180	75.220	1.735	Open Manhole	1200
S4.003	13.522	122.9	SS03	78.075	75.110	2.740	Open Manhole	1350
S1.004	21.493	122.8	SS02	77.005	74.785	1.845	Open Manhole	1350
S5.000	15.000	125.0	SS02A	77.190	75.380	1.660	Open Manhole	1200

PIPELINE SCHEDULES for 21-3406 - SURFACE NETWORK 01.SWS

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)
S5.001	o	150	SS02A	77.190	75.380	1.660	Open Manhole	1200
S1.005	o	375	SS02	77.005	74.785	1.845	Open Manhole	1350
S6.000	o	150	SS01.6	78.815	77.450	1.215	Open Manhole	1200
S6.001	o	150	SS01.5	77.725	76.310	1.265	Open Manhole	1200
S6.002	o	150	SS01.4	76.620	75.365	1.105	Open Manhole	1200
S7.000	o	150	SS01.3B	78.535	77.200	1.185	Open Manhole	1200
S7.001	o	150	SS01.3A	77.490	76.275	1.065	Open Manhole	1200
S6.003	o	150	SS01.3	76.455	75.240	1.065	Open Manhole	1200
S6.004	o	150	SS01.2	76.480	75.055	1.275	Open Manhole	1200
S6.005	o	150	SS01.1	76.580	74.950	1.480	Open Manhole	1200
S1.006	o	900	SS01	76.620	74.175	1.545	Open Manhole	1800

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)
S5.001	5.995	16.2	SS02	77.005	75.010	1.845	Open Manhole	1350
S1.005	16.668	104.2	SS01	76.620	74.625	1.620	Open Manhole	1800
S6.000	15.965	14.0	SS01.5	77.725	76.310	1.265	Open Manhole	1200
S6.001	13.216	14.0	SS01.4	76.620	75.365	1.105	Open Manhole	1200
S6.002	10.106	80.8	SS01.3	76.455	75.240	1.065	Open Manhole	1200
S7.000	12.905	14.0	SS01.3A	77.490	76.275	1.065	Open Manhole	1200
S7.001	13.142	12.7	SS01.3	76.455	75.240	1.065	Open Manhole	1200
S6.003	14.585	78.8	SS01.2	76.480	75.055	1.275	Open Manhole	1200
S6.004	18.000	171.4	SS01.1	76.580	74.950	1.480	Open Manhole	1200
S6.005	6.275	19.3	SS01	76.620	74.625	1.845	Open Manhole	1800
S1.006	17.431	205.1	SP0002	76.440	74.090	1.450	Open Manhole	1800

Setting Out Information - True Coordinates (21-3406 - SURFACE NETWORK 01.SWS)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S1.000	SHW.02	1200		713961.026	727001.690	713961.026	727001.690	
S1.001	SHW.01	1350		714037.542	727011.809	714037.542	727011.809	
S1.002	SS05	1350		714042.585	727015.681	714042.585	727015.681	
S2.000	SS04.3	1200		714060.439	727007.065	714060.439	727007.065	
S2.001	SS04.2	1200		714058.744	727029.375	714058.744	727029.375	
S3.000	SS04.1B	1200		714051.666	727011.069	714051.666	727011.069	
S3.001	SS04.1A	1200		714050.781	727022.401	714050.781	727022.401	
S2.002	SS04.1	1200		714052.723	727027.482	714052.723	727027.482	
S1.003	SS04	1350		714041.744	727026.648	714041.744	727026.648	
S4.000	SS03.4	1200		714028.538	727036.406	714028.538	727036.406	
S4.001	SS03.3	1200		714010.591	727035.031	714010.591	727035.031	
S4.002	SS03.2	1200		714010.084	727041.641	714010.084	727041.641	
S4.003	SS03.1	1200		714024.043	727042.710	714024.043	727042.710	
S1.004	SS03	1350		714037.372	727044.989	714037.372	727044.989	
S5.000	SS02B	1200		714041.497	727049.246	714041.497	727049.246	
S5.001	SS02A	1200		714038.019	727063.837	714038.019	727063.837	

Setting Out Information - True Coordinates (21-3406 - SURFACE NETWORK 01.SWS)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S1.005	SS02	1350		714032.388	727065.896	714032.388	727065.896	
S6.000	SS01.6	1200		713972.501	727032.645	713972.501	727032.645	
S6.001	SS01.5	1200		713968.680	727048.146	713968.680	727048.146	
S6.002	SS01.4	1200		713966.959	727061.250	713966.959	727061.250	
S7.000	SS01.3B	1200		713981.731	727036.993	713981.731	727036.993	
S7.001	SS01.3A	1200		713978.657	727049.526	713978.657	727049.526	
S6.003	SS01.3	1200		713976.980	727062.561	713976.980	727062.561	
S6.004	SS01.2	1200		713991.519	727063.723	713991.519	727063.723	
S6.005	SS01.1	1200		714009.466	727065.098	714009.466	727065.098	
S1.006	SS01	1800		714015.723	727065.577	714015.723	727065.577	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.006	SP0002	1800		714013.814	727082.903	

Free Flowing Outfall Details for 21-3406 - SURFACE NETWORK 01.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	SP0002	76.440	74.090	74.090	1800	0

Simulation Criteria for 21-3406 - SURFACE NETWORK 01.SWS

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for 21-3406 - SURFACE NETWORK 01.SWS

Orifice Manhole: SS04.2, DS/PN: S2.001, Volume (m³): 1.6

Diameter (m) 0.022 Discharge Coefficient 0.600 Invert Level (m) 78.325

Orifice Manhole: SS04.1A, DS/PN: S3.001, Volume (m³): 1.4

Diameter (m) 0.015 Discharge Coefficient 0.600 Invert Level (m) 78.195

Hydro-Brake® Optimum Manhole: SS03.1, DS/PN: S4.003, Volume (m³): 2.7

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	75.220
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5	Kick-Flo®	0.644	1.9
Flush-Flo™	0.318	2.3	Mean Flow over Head Range	-	2.1

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)	Depth (m)	Flow (l/s)
0.100	1.9	0.800	2.1	2.000	3.2	4.000	4.4	7.000	5.7
0.200	2.2	1.000	2.3	2.200	3.3	4.500	4.6	7.500	5.9
0.300	2.3	1.200	2.5	2.400	3.4	5.000	4.8	8.000	6.0
0.400	2.3	1.400	2.7	2.600	3.6	5.500	5.1	8.500	6.2
0.500	2.2	1.600	2.8	3.000	3.8	6.000	5.3	9.000	6.4
0.600	2.0	1.800	3.0	3.500	4.1	6.500	5.5	9.500	6.5

Orifice Manhole: SS02A, DS/PN: S5.001, Volume (m³): 2.3

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 75.380

Hydro-Brake® Optimum Manhole: SS01.1, DS/PN: S6.005, Volume (m³): 2.1

Unit Reference	MD-SHE-0062-2000-1400-2000
Design Head (m)	1.400
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage

Hydro-Brake® Optimum Manhole: SS01.1, DS/PN: S6.005, Volume (m³): 2.1

Application Surface	
Sump Available	Yes
Diameter (mm)	62
Invert Level (m)	74.950
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	2.0	Kick-Flo®	0.553	1.3
Flush-Flo™	0.272	1.6	Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.4	0.800	1.6	2.000	2.4	4.000	3.2	7.000	4.2
0.200	1.6	1.000	1.7	2.200	2.5	4.500	3.4	7.500	4.4
0.300	1.6	1.200	1.9	2.400	2.6	5.000	3.6	8.000	4.5
0.400	1.6	1.400	2.0	2.600	2.7	5.500	3.8	8.500	4.6
0.500	1.5	1.600	2.1	3.000	2.8	6.000	3.9	9.000	4.7
0.600	1.4	1.800	2.2	3.500	3.0	6.500	4.1	9.500	4.9

Storage Structures for 21-3406 - SURFACE NETWORK 01.SWS

Swale Manhole: SHW.02, DS/PN: S1.000

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	77.5
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	4.0
Safety Factor	2.0	Slope (1:X)	200.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	79.485	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5	Include Swale Volume	Yes

Porous Car Park Manhole: SS04.2, DS/PN: S2.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	12.5
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	17.4	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	78.805	Membrane Depth (mm)	0

Porous Car Park Manhole: SS04.1A, DS/PN: S3.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	13.9	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	78.670	Membrane Depth (mm)	0

Cellular Storage Manhole: SS03.3, DS/PN: S4.001

Invert Level (m)	75.335	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.63
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	26.9	26.9	0.900	26.9	45.6	1.800	26.9	64.2
0.100	26.9	29.0	1.000	26.9	47.6	1.900	26.9	66.3
0.200	26.9	31.0	1.100	26.9	49.7	2.000	26.9	68.4
0.300	26.9	33.1	1.200	26.9	51.8	2.100	26.9	70.5
0.400	26.9	35.2	1.300	26.9	53.9	2.200	26.9	72.5
0.500	26.9	37.3	1.400	26.9	55.9	2.300	26.9	74.6
0.600	26.9	39.3	1.500	26.9	58.0	2.400	26.9	76.7
0.700	26.9	41.4	1.600	26.9	60.1	2.500	26.9	78.8
0.800	26.9	43.5	1.700	26.9	62.2			

Cellular Storage Manhole: SS03.1, DS/PN: S4.003

Invert Level (m) 75.220 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.63
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.4	20.4	0.900	20.4	36.7	1.800	20.4	52.9
0.100	20.4	22.2	1.000	20.4	38.5	1.900	20.4	54.7
0.200	20.4	24.0	1.100	20.4	40.3	2.000	20.4	56.5
0.300	20.4	25.8	1.200	20.4	42.1	2.100	20.4	58.3
0.400	20.4	27.6	1.300	20.4	43.9	2.200	20.4	60.1
0.500	20.4	29.4	1.400	20.4	45.7	2.300	20.4	62.0
0.600	20.4	31.2	1.500	20.4	47.5	2.400	20.4	63.8
0.700	20.4	33.0	1.600	20.4	49.3	2.500	20.4	65.6
0.800	20.4	34.9	1.700	20.4	51.1			

Filter Drain Manhole: SS02A, DS/PN: S5.001

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.900
Safety Factor	2.0	Number of Pipes	2
Porosity	0.30	Slope (1:X)	100.0
Invert Level (m)	75.380	Cap Volume Depth (m)	0.000
Trench Width (m)	1.2	Cap Infiltration Depth (m)	0.000
Trench Length (m)	13.9		

Porous Car Park Manhole: SS01.5, DS/PN: S6.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	13.7
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	19.0	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	77.095	Membrane Depth (mm)	0

Porous Car Park Manhole: SS01.4, DS/PN: S6.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	13.9	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.990	Membrane Depth (mm)	0

Porous Car Park Manhole: SS01.3A, DS/PN: S7.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	12.5
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	17.4	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.860	Membrane Depth (mm)	0

Porous Car Park Manhole: SS01.3, DS/PN: S6.003

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	13.9	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.825	Membrane Depth (mm)	0

Cellular Storage Manhole: SS01.1, DS/PN: S6.005

Invert Level (m)	74.950	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.63
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	26.9	26.9	0.900	26.9	45.6	1.800	26.9	64.2
0.100	26.9	29.0	1.000	26.9	47.6	1.900	26.9	66.3
0.200	26.9	31.0	1.100	26.9	49.7	2.000	26.9	68.4
0.300	26.9	33.1	1.200	26.9	51.8	2.100	26.9	70.5
0.400	26.9	35.2	1.300	26.9	53.9	2.200	26.9	72.5
0.500	26.9	37.3	1.400	26.9	55.9	2.300	26.9	74.6
0.600	26.9	39.3	1.500	26.9	58.0	2.400	26.9	76.7
0.700	26.9	41.4	1.600	26.9	60.1	2.500	26.9	78.8
0.800	26.9	43.5	1.700	26.9	62.2			

Manhole Headloss for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	US/MH Headloss
S1.000	SHW.02	0.500
S1.001	SHW.01	0.500
S1.002	SS05	0.500
S2.000	SS04.3	0.500
S2.001	SS04.2	0.500
S3.000	SS04.1B	0.500
S3.001	SS04.1A	0.500
S2.002	SS04.1	0.500
S1.003	SS04	0.500
S4.000	SS03.4	0.500
S4.001	SS03.3	0.500
S4.002	SS03.2	0.500
S4.003	SS03.1	0.500
S1.004	SS03	0.500
S5.000	SS02B	0.500
S5.001	SS02A	0.500
S1.005	SS02	0.500
S6.000	SS01.6	0.500
S6.001	SS01.5	0.500
S6.002	SS01.4	0.500
S7.000	SS01.3B	0.500
S7.001	SS01.3A	0.500
S6.003	SS01.3	0.500
S6.004	SS01.2	0.500
S6.005	SS01.1	0.500
S1.006	SS01	0.500

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	SHW.02	0.679	5.366	70.783	76.827
S1.001	SHW.01	3.006	0.553	0.000	3.559
S1.002	SS05	2.698	1.066	0.000	3.764
S2.000	SS04.3	1.233	0.374	0.000	1.607
S2.001	SS04.2	1.255	0.090	11.578	12.923
S3.000	SS04.1B	1.459	0.180	0.000	1.639
S3.001	SS04.1A	1.250	0.075	9.262	10.587
S2.002	SS04.1	1.702	0.172	0.000	1.874
S1.003	SS04	2.455	1.933	0.000	4.388
S4.000	SS03.4	1.470	0.668	0.000	2.138
S4.001	SS03.3	1.323	0.216	19.828	21.367
S4.002	SS03.2	1.380	0.509	0.000	1.889
S4.003	SS03.1	2.217	0.487	25.190	27.894
S1.004	SS03	4.459	2.225	0.000	6.684
S5.000	SS02B	2.856	0.244	0.000	3.100
S5.001	SS02A	2.047	0.083	9.053	11.184
S1.005	SS02	3.178	1.667	0.000	4.845
S6.000	SS01.6	1.544	0.261	0.000	1.805
S6.001	SS01.5	1.600	0.212	12.690	14.502
S6.002	SS01.4	1.419	0.157	9.263	10.839
S7.000	SS01.3B	1.510	0.207	0.000	1.717
S7.001	SS01.3A	1.374	0.211	11.578	13.163
S6.003	SS01.3	1.374	0.237	9.262	10.873
S6.004	SS01.2	1.612	0.297	0.000	1.909
S6.005	SS01.1	1.843	0.084	27.624	29.551
S1.006	SS01	6.222	9.944	0.000	16.166
Total		53.164	27.517	216.112	296.793

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	SHW.02	15 Winter	30	+20%					79.709	-0.076
S1.001	SHW.01	15 Winter	30	+20%					77.796	-0.179
S1.002	SS05	15 Winter	30	+20%					77.658	-0.212
S2.000	SS04.3	120 Winter	30	+20%	30/15 Summer				79.204	0.504
S2.001	SS04.2	120 Winter	30	+20%	30/15 Summer				79.199	0.724
S3.000	SS04.1B	120 Winter	30	+20%	30/15 Summer				78.833	0.373
S3.001	SS04.1A	120 Winter	30	+20%	30/15 Summer				78.832	0.487
S2.002	SS04.1	120 Winter	30	+20%					77.822	-0.128
S1.003	SS04	15 Winter	30	+20%					77.446	-0.229
S4.000	SS03.4	120 Winter	30	+20%	30/15 Summer				76.162	0.512
S4.001	SS03.3	120 Winter	30	+20%	30/15 Summer				76.161	0.601
S4.002	SS03.2	120 Winter	30	+20%	30/15 Summer				76.160	0.645
S4.003	SS03.1	120 Winter	30	+20%	30/15 Summer				76.157	0.712
S1.004	SS03	15 Winter	30	+20%					75.141	-0.194
S5.000	SS02B	120 Winter	30	+20%	30/15 Summer				76.541	0.891
S5.001	SS02A	120 Winter	30	+20%	30/15 Summer				76.537	1.007
S1.005	SS02	15 Winter	30	+20%					74.964	-0.196
S6.000	SS01.6	15 Winter	30	+20%					77.492	-0.108
S6.001	SS01.5	15 Winter	30	+20%					76.360	-0.100
S6.002	SS01.4	120 Winter	30	+20%	30/15 Summer				75.864	0.349
S7.000	SS01.3B	15 Winter	30	+20%					77.237	-0.113
S7.001	SS01.3A	15 Winter	30	+20%					76.320	-0.105
S6.003	SS01.3	120 Winter	30	+20%	30/15 Summer				75.862	0.472

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SHW.02	0.000	0.91			68.4	OK	
S1.001	SHW.01	0.000	0.54			68.4	OK	
S1.002	SS05	0.000	0.40			68.3	OK	
S2.000	SS04.3	0.000	0.28			4.7	SURCHARGED	
S2.001	SS04.2	0.000	0.02		112	0.9	FLOOD RISK	
S3.000	SS04.1B	0.000	0.12			1.9	SURCHARGED	
S3.001	SS04.1A	0.000	0.01		104	0.4	SURCHARGED	
S2.002	SS04.1	0.000	0.05			1.3	OK	
S1.003	SS04	0.000	0.32			69.5	OK	
S4.000	SS03.4	0.000	0.10			3.3	SURCHARGED	
S4.001	SS03.3	0.000	0.05			1.6	SURCHARGED	
S4.002	SS03.2	0.000	0.11			3.5	SURCHARGED	
S4.003	SS03.1	0.000	0.06			2.3	SURCHARGED	
S1.004	SS03	0.000	0.47			71.7	OK	
S5.000	SS02B	0.000	0.25			3.7	SURCHARGED	
S5.001	SS02A	0.000	0.02		120	0.9	SURCHARGED	
S1.005	SS02	0.000	0.46			72.4	OK	
S6.000	SS01.6	0.000	0.17			7.6	OK	
S6.001	SS01.5	0.000	0.24		6	10.6	OK	
S6.002	SS01.4	0.000	0.20		72	3.5	SURCHARGED	
S7.000	SS01.3B	0.000	0.14			6.0	OK	
S7.001	SS01.3A	0.000	0.20		6	9.0	OK	
S6.003	SS01.3	0.000	0.40		68	7.5	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S6.004	SS01.2	120 Winter	30	+20%	30/15 Summer				75.856	0.651
S6.005	SS01.1	120 Winter	30	+20%	30/15 Summer				75.848	0.748
S1.006	SS01	15 Winter	30	+20%					74.348	-0.727

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.004	SS01.2	0.000	0.67			8.5	SURCHARGED	
S6.005	SS01.1	0.000	0.05		132	1.6	SURCHARGED	
S1.006	SS01	0.000	0.08			73.9	OK	

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	SHW.02	15 Winter	1	+20%					79.689	-0.096
S1.001	SHW.01	15 Winter	1	+20%					77.782	-0.193
S1.002	SS05	15 Winter	1	+20%					77.648	-0.222
S2.000	SS04.3	120 Winter	1	+20%	1/15 Summer				78.915	0.215
S2.001	SS04.2	120 Winter	1	+20%	1/15 Summer				78.911	0.436
S3.000	SS04.1B	120 Winter	1	+20%	1/15 Summer				78.693	0.233
S3.001	SS04.1A	120 Winter	1	+20%	1/15 Summer				78.691	0.346
S2.002	SS04.1	120 Winter	1	+20%					77.820	-0.130
S1.003	SS04	15 Winter	1	+20%					77.436	-0.239
S4.000	SS03.4	120 Winter	1	+20%					75.570	-0.080
S4.001	SS03.3	120 Winter	1	+20%	1/60 Winter				75.569	0.009
S4.002	SS03.2	120 Winter	1	+20%	1/30 Winter				75.568	0.053
S4.003	SS03.1	120 Winter	1	+20%	1/15 Summer				75.565	0.120
S1.004	SS03	15 Winter	1	+20%					75.128	-0.207
S5.000	SS02B	120 Winter	1	+20%	1/15 Summer				75.893	0.243
S5.001	SS02A	120 Winter	1	+20%	1/15 Summer				75.890	0.360
S1.005	SS02	15 Winter	1	+20%					74.951	-0.209
S6.000	SS01.6	15 Winter	1	+20%					77.478	-0.122
S6.001	SS01.5	30 Summer	1	+20%					76.341	-0.119
S6.002	SS01.4	30 Summer	1	+20%					75.414	-0.101
S7.000	SS01.3B	15 Winter	1	+20%					77.224	-0.126
S7.001	SS01.3A	15 Winter	1	+20%					76.304	-0.121
S6.003	SS01.3	15 Winter	1	+20%					75.312	-0.078
S6.004	SS01.2	120 Winter	1	+20%	1/30 Winter				75.282	0.077
S6.005	SS01.1	120 Winter	1	+20%	1/15 Summer				75.275	0.175

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SHW.02	0.000	0.80			60.3	OK	
S1.001	SHW.01	0.000	0.47			60.2	OK	
S1.002	SS05	0.000	0.35			60.3	OK	
S2.000	SS04.3	0.000	0.14			2.3	SURCHARGED	
S2.001	SS04.2	0.000	0.02		55	0.8	SURCHARGED	
S3.000	SS04.1B	0.000	0.04			0.6	SURCHARGED	
S3.001	SS04.1A	0.000	0.01		67	0.3	SURCHARGED	
S2.002	SS04.1	0.000	0.04			1.1	OK	
S1.003	SS04	0.000	0.28			61.3	OK	
S4.000	SS03.4	0.000	0.06			1.8	OK	
S4.001	SS03.3	0.000	0.06		54	1.9	SURCHARGED	
S4.002	SS03.2	0.000	0.09			2.9	SURCHARGED	
S4.003	SS03.1	0.000	0.06		73	2.3	SURCHARGED	
S1.004	SS03	0.000	0.42			63.5	OK	
S5.000	SS02B	0.000	0.12			1.8	SURCHARGED	
S5.001	SS02A	0.000	0.02		83	0.6	SURCHARGED	
S1.005	SS02	0.000	0.41			63.8	OK	
S6.000	SS01.6	0.000	0.08			3.4	OK	
S6.001	SS01.5	0.000	0.09		6	3.9	OK	
S6.002	SS01.4	0.000	0.23		7	4.0	OK	
S7.000	SS01.3B	0.000	0.06			2.7	OK	
S7.001	SS01.3A	0.000	0.07		5	3.4	OK	
S6.003	SS01.3	0.000	0.47		7	8.6	OK	
S6.004	SS01.2	0.000	0.35			4.5	SURCHARGED	
S6.005	SS01.1	0.000	0.04		60	1.5	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.006	SS01	15 Winter	1	+20%					74.335	-0.740	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.006	SS01	0.07			65.4	OK	

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	SHW.02	15 Winter	100	+20%	100/15 Winter				79.798	0.013
S1.001	SHW.01	15 Winter	100	+20%					77.813	-0.162
S1.002	SS05	15 Winter	100	+20%					77.671	-0.199
S2.000	SS04.3	120 Winter	100	+20%	100/15 Summer				79.376	0.676
S2.001	SS04.2	120 Winter	100	+20%	100/15 Summer				79.371	0.896
S3.000	SS04.1B	120 Winter	100	+20%	100/15 Summer				78.919	0.459
S3.001	SS04.1A	120 Winter	100	+20%	100/15 Summer				78.918	0.573
S2.002	SS04.1	120 Winter	100	+20%					77.823	-0.127
S1.003	SS04	15 Winter	100	+20%					77.457	-0.218
S4.000	SS03.4	120 Winter	100	+20%	100/15 Summer				76.491	0.841
S4.001	SS03.3	120 Winter	100	+20%	100/15 Summer				76.489	0.929
S4.002	SS03.2	120 Winter	100	+20%	100/15 Summer				76.488	0.973
S4.003	SS03.1	120 Winter	100	+20%	100/15 Summer				76.485	1.040
S1.004	SS03	15 Winter	100	+20%					75.154	-0.181
S5.000	SS02B	240 Winter	100	+20%	100/15 Summer				76.945	1.295
S5.001	SS02A	240 Winter	100	+20%	100/15 Summer				76.940	1.410
S1.005	SS02	15 Winter	100	+20%					74.977	-0.183
S6.000	SS01.6	15 Winter	100	+20%					77.498	-0.102
S6.001	SS01.5	15 Winter	100	+20%					76.368	-0.092
S6.002	SS01.4	240 Winter	100	+20%	100/15 Summer				76.052	0.537
S7.000	SS01.3B	15 Winter	100	+20%					77.243	-0.107
S7.001	SS01.3A	15 Winter	100	+20%					76.327	-0.098
S6.003	SS01.3	240 Winter	100	+20%	100/15 Summer				76.050	0.660
S6.004	SS01.2	240 Winter	100	+20%	100/15 Summer				76.044	0.839
S6.005	SS01.1	240 Winter	100	+20%	100/15 Summer				76.036	0.936

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SHW.02	0.000	1.03			77.7	FLOOD RISK	
S1.001	SHW.01	0.000	0.61			77.6	OK	
S1.002	SS05	0.000	0.45			77.2	OK	
S2.000	SS04.3	0.000	0.36			6.1	FLOOD RISK	
S2.001	SS04.2	0.000	0.02		123	1.0	FLOOD RISK	
S3.000	SS04.1B	0.000	0.15			2.4	SURCHARGED	
S3.001	SS04.1A	0.000	0.01		115	0.4	SURCHARGED	
S2.002	SS04.1	0.000	0.06			1.4	OK	
S1.003	SS04	0.000	0.36			78.6	OK	
S4.000	SS03.4	0.000	0.13			4.3	FLOOD RISK	
S4.001	SS03.3	0.000	0.06			1.8	FLOOD RISK	
S4.002	SS03.2	0.000	0.13			4.1	FLOOD RISK	
S4.003	SS03.1	0.000	0.06			2.6	SURCHARGED	
S1.004	SS03	0.000	0.53			80.8	OK	
S5.000	SS02B	0.000	0.22			3.2	SURCHARGED	
S5.001	SS02A	0.000	0.03		154	1.0	FLOOD RISK	
S1.005	SS02	0.000	0.52			81.5	OK	
S6.000	SS01.6	0.000	0.22			9.9	OK	
S6.001	SS01.5	0.000	0.32		6	13.8	OK	
S6.002	SS01.4	0.000	0.16		68	2.8	SURCHARGED	
S7.000	SS01.3B	0.000	0.18			7.8	OK	
S7.001	SS01.3A	0.000	0.26		6	11.7	OK	
S6.003	SS01.3	0.000	0.33		95	6.1	SURCHARGED	
S6.004	SS01.2	0.000	0.55			6.9	SURCHARGED	
S6.005	SS01.1	0.000	0.05		212	1.8	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.006	SS01	15 Winter	100	+20%					74.359	-0.716	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.006	SS01	0.09			82.8	OK	

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	SHW.02	15 Winter	100	+20%	100/15 Summer				80.001	0.141
S1.001	SHW.01	15 Winter	100	+20%	100/15 Summer				78.017	0.042
S1.002	SS05	15 Winter	100	+20%					77.777	-0.093
S2.000	SS04.3	120 Winter	100	+20%	100/15 Summer				79.376	0.676
S2.001	SS04.2	120 Winter	100	+20%	100/15 Summer				79.370	0.895
S3.000	SS04.1B	120 Winter	100	+20%	100/15 Summer				78.919	0.459
S3.001	SS04.1A	120 Winter	100	+20%	100/15 Summer				78.917	0.572
S2.002	SS04.1	120 Winter	100	+20%					77.823	-0.127
S1.003	SS04	15 Winter	100	+20%					77.542	-0.133
S4.000	SS03.4	240 Winter	100	+20%	100/15 Summer				76.499	0.849
S4.001	SS03.3	240 Winter	100	+20%	100/15 Summer				76.498	0.938
S4.002	SS03.2	240 Winter	100	+20%	100/15 Summer				76.498	0.983
S4.003	SS03.1	240 Winter	100	+20%	100/15 Summer				76.494	1.049
S1.004	SS03	15 Winter	100	+20%	100/15 Summer				75.352	0.017
S5.000	SS02B	240 Winter	100	+20%	100/15 Summer				76.944	1.294
S5.001	SS02A	240 Winter	100	+20%	100/15 Summer				76.939	1.409
S1.005	SS02	15 Winter	100	+20%					75.160	0.000
S6.000	SS01.6	15 Winter	100	+20%					77.498	-0.102
S6.001	SS01.5	15 Winter	100	+20%					76.368	-0.092
S6.002	SS01.4	240 Winter	100	+20%	100/15 Summer				76.052	0.537
S7.000	SS01.3B	15 Winter	100	+20%					77.243	-0.107
S7.001	SS01.3A	15 Winter	100	+20%					76.327	-0.098
S6.003	SS01.3	240 Winter	100	+20%	100/15 Summer				76.050	0.660
S6.004	SS01.2	240 Winter	100	+20%	100/15 Summer				76.044	0.839
S6.005	SS01.1	240 Winter	100	+20%	100/15 Summer				76.036	0.936
S1.006	SS01	15 Winter	100	+20%					74.434	-0.641

Summary of Critical Results by Maximum Level (Rank 1) for 21-3406 - SURFACE NETWORK 01.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SHW.02	0.000	1.18			158.4	FLOOD RISK	
S1.001	SHW.01	0.000	1.25			158.6	SURCHARGED	
S1.002	SS05	0.000	0.92			158.8	OK	
S2.000	SS04.3	0.000	0.36			6.0	FLOOD RISK	
S2.001	SS04.2	0.000	0.02		128	1.0	FLOOD RISK	
S3.000	SS04.1B	0.000	0.15			2.4	SURCHARGED	
S3.001	SS04.1A	0.000	0.01		120	0.4	SURCHARGED	
S2.002	SS04.1	0.000	0.06			1.4	OK	
S1.003	SS04	0.000	0.74			160.0	OK	
S4.000	SS03.4	0.000	0.08			2.7	FLOOD RISK	
S4.001	SS03.3	0.000	0.05		204	1.4	FLOOD RISK	
S4.002	SS03.2	0.000	0.10			3.1	FLOOD RISK	
S4.003	SS03.1	0.000	0.06		220	2.5	SURCHARGED	
S1.004	SS03	0.000	1.06			161.7	SURCHARGED	
S5.000	SS02B	0.000	0.21			3.1	SURCHARGED	
S5.001	SS02A	0.000	0.03		160	1.0	FLOOD RISK	
S1.005	SS02	0.000	1.02			159.9	OK	
S6.000	SS01.6	0.000	0.22			9.9	OK	
S6.001	SS01.5	0.000	0.32		6	13.8	OK	
S6.002	SS01.4	0.000	0.16		72	2.8	SURCHARGED	
S7.000	SS01.3B	0.000	0.18			7.8	OK	
S7.001	SS01.3A	0.000	0.26		6	11.7	OK	
S6.003	SS01.3	0.000	0.33		100	6.1	SURCHARGED	
S6.004	SS01.2	0.000	0.55			6.9	SURCHARGED	
S6.005	SS01.1	0.000	0.05		216	1.8	SURCHARGED	
S1.006	SS01	0.000	0.18			162.1	OK	

11

Non-Domestic Development - Rathfarnham CH

Proposed Calculation of Wastewater flow to BS EN 752-4

Designer Name:	**Graeme Porch**	Project Number:	**20-3406**
Date:	**01.03.22**	Page 1 of 1	**1**

Typical Frequency Factors (kDU) = 0.7 (Care Home)

Type of Appliance per House Type	Total	L0	L1	L2	L3							DU Value
Washbasin	77.4	14.4	25.2	25.2	12.6							0.3 to 0.6
Shower	75.0	12.0	25.2	25.2	12.6							0.3 to 0.6
Urinal	0.0	0.0	0.0	0.0	0.0							0.3 to 0.8
Bath	0.0	0.0	0.0	0.0	0.0							0.8 to 1.3
Kitchen Sink	16.9	2.6	10.4	2.6	1.3							0.8 to 1.3
Dishwasher	5.6	2.4	0.8	1.6	0.8							0.2 to 0.8
Household Washing Machine	0.0	0.0	0.0	0.0	0.0							0.5 to 0.8
Commercial Washing Machine	6.0	4.5	1.5	0.0	0.0							1.0 to 1.5
WC's (4.0 to 9.0 Cistern)	322.5	60.0	105.0	105.0	52.5							1.2 to 2.5
Floor Drains (DN 50 to 100)	16.0	4.0	4.0	4.0	4.0							0.6 to 2.0

519.4

Pipeline Design Flow (Peak) Q = kDU $\sqrt{\Sigma}$ DU = 0.7 x $\sqrt{}$ 519.4 = 15.95 Litres/Sec.

Calculation of Foul Water Mean Flowrate:-

From Table of Loadings for For Sewage Treatment Systems:-

Residential Old People/Nursing (Canteen) = 350 Litres per person / per day
Occupancy Rates = 94 Residents & 20 Staff per day
Equates to 39900/24/60/60 = **0.462 Litres/Sec**
Annual Water Consumption = **35910m3 = 0.416 Litres/Sec.**

Signed / Approved by: *Graeme Porch*

Network Design Table for 21-3406 - FOUL NETWORK 01.FWS

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F3.001	17.287	0.865	20.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.002	12.000	0.150	80.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F4.000	10.000	0.170	58.8	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F3.003	45.988	0.605	76.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.004	6.000	0.100	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	24.573	0.225	109.2	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F5.000	23.806	0.160	148.8	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F5.001	29.180	0.195	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F5.002	28.308	0.100	283.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F5.003	18.713	0.100	186.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	31.066	0.155	200.0	0.000	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 Hse Add Flow (l/s)		P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F3.001	75.910	0.000	0.0	17	0.1	17	0.81	1.97	34.7	0.9
F3.002	75.045	0.000	0.0	17	0.1	23	0.50	0.98	17.3	0.9
F4.000	75.065	0.000	0.0	10	0.0	17	0.47	1.14	20.2	0.5
F3.003	74.895	0.000	0.0	27	0.1	29	0.59	1.01	17.8	1.4
F1.004	74.290	0.000	0.0	111	0.5	55	0.98	1.13	20.0	5.7
F1.005	74.190	0.000	0.0	111	0.5	65	0.78	0.84	14.8	5.7
F5.000	74.445	0.000	0.0	0	0.0	0	0.00	0.94	37.4	0.0
F5.001	74.285	0.000	0.0	0	0.0	0	0.00	0.94	37.2	0.0
F5.002	74.090	0.000	0.0	0	0.0	0	0.00	0.68	27.0	0.0
F5.003	73.990	0.000	0.0	0	0.0	0	0.00	0.84	33.4	0.0
F1.006	73.890	0.000	0.0	111	0.5	64	0.61	0.81	32.2	5.7

Manhole Schedules for 21-3406 - FOUL NETWORK 01.FWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
FP1002	714099.821	727069.890	714099.821	727069.890	Required	
FP1003	714071.883	727074.447	714071.883	727074.447	Required	
FP1004	714053.857	727079.469	714053.857	727079.469	Required	
FP1006	714040.146	727107.346			No Entry	

PIPELINE SCHEDULES for 21-3406 - FOUL NETWORK 01.FWS

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	150	FF06	79.520	77.700	1.670	Open Manhole	1200
F1.001	o	150	FF05	79.300	77.275	1.875	Open Manhole	1200
F1.002	o	150	FF04	79.085	76.950	1.985	Open Manhole	1200
F2.000	o	150	FF03.6	76.515	75.420	0.945	Open Manhole	1200
F2.001	o	150	FF03.5	76.510	75.145	1.215	Open Manhole	1200
F2.002	o	150	FF03.4	76.535	74.945	1.440	Open Manhole	1200
F2.003	o	150	FF03.3	76.530	74.795	1.585	Open Manhole	1200
F2.004	o	150	FF03.2	76.505	74.645	1.710	Open Manhole	1200
F2.005	o	150	FF03.1	77.320	74.495	2.675	Open Manhole	1200
F1.003	o	150	FF03	77.970	74.435	3.385	Open Manhole	1200
F3.000	o	150	FF02.4	78.760	76.410	2.200	Open Manhole	1200
F3.001	o	150	FF02.3	78.005	75.910	1.945	Open Manhole	1200
F3.002	o	150	FF02.2	76.585	75.045	1.390	Open Manhole	1200
F4.000	o	150	FF02.1A	76.840	75.065	1.625	Open Manhole	1200
F3.003	o	150	FF02.1	76.400	74.895	1.355	Open Manhole	1200
F1.004	o	150	FF02	77.045	74.290	2.605	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	16.984	40.0	FF05	79.300	77.275	1.875	Open Manhole	1200
F1.001	13.011	40.0	FF04	79.085	76.950	1.985	Open Manhole	1200
F1.002	22.684	40.1	FF03	77.970	76.385	1.435	Open Manhole	1200
F2.000	10.912	39.7	FF03.5	76.510	75.145	1.215	Open Manhole	1200
F2.001	12.088	60.4	FF03.4	76.535	74.945	1.440	Open Manhole	1200
F2.002	12.000	80.0	FF03.3	76.530	74.795	1.585	Open Manhole	1200
F2.003	12.088	80.6	FF03.2	76.505	74.645	1.710	Open Manhole	1200
F2.004	12.000	80.0	FF03.1	77.320	74.495	2.675	Open Manhole	1200
F2.005	4.807	80.1	FF03	77.970	74.435	3.385	Open Manhole	1200
F1.003	18.330	126.4	FF02	77.045	74.290	2.605	Open Manhole	1200
F3.000	10.000	20.0	FF02.3	78.005	75.910	1.945	Open Manhole	1200
F3.001	17.287	20.0	FF02.2	76.585	75.045	1.390	Open Manhole	1200
F3.002	12.000	80.0	FF02.1	76.400	74.895	1.355	Open Manhole	1200
F4.000	10.000	58.8	FF02.1	76.400	74.895	1.355	Open Manhole	1200
F3.003	45.988	76.0	FF02	77.045	74.290	2.605	Open Manhole	1200
F1.004	6.000	60.0	FF01	76.745	74.190	2.405	Open Manhole	1200

PIPELINE SCHEDULES for 21-3406 - FOUL NETWORK 01.FWS

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)
F1.005	o	150	FF01	76.745	74.190	2.405	Open Manhole	1200
F5.000	o	225	FP1000	77.040	74.445	2.370	Open Manhole	1200
F5.001	o	225	FP1001	76.990	74.285	2.480	Open Manhole	1200
F5.002	o	225	FP1002	76.500	74.090	2.185	Open Manhole	1200
F5.003	o	225	FP1003	76.660	73.990	2.445	Open Manhole	1200
F1.006	o	225	FP1004	76.730	73.890	2.615	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)
F1.005	24.573	109.2	FP1004	76.730	73.965	2.615	Open Manhole	1200
F5.000	23.806	148.8	FP1001	76.990	74.285	2.480	Open Manhole	1200
F5.001	29.180	150.0	FP1002	76.500	74.090	2.185	Open Manhole	1200
F5.002	28.308	283.1	FP1003	76.660	73.990	2.445	Open Manhole	1200
F5.003	18.713	186.3	FP1004	76.730	73.890	2.615	Open Manhole	1200
F1.006	31.066	200.0	FP1006	75.330	73.735	1.370	Open Manhole	1200

Setting Out Information - True Coordinates (21-3406 - FOUL NETWORK 01.FWS)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
F1.000	FF06	1200		714054.830	727009.265	714054.830	727009.265	
F1.001	FF05	1200		714053.544	727026.200	714053.544	727026.200	
F1.002	FF04	1200		714040.544	727025.213	714040.544	727025.213	
F2.000	FF03.6	1200		714030.482	727033.941	714030.482	727033.941	
F2.001	FF03.5	1200		714019.602	727033.108	714019.602	727033.108	
F2.002	FF03.4	1200		714007.549	727032.184	714007.549	727032.184	
F2.003	FF03.3	1200		714006.633	727044.149	714006.633	727044.149	
F2.004	FF03.2	1200		714018.685	727045.073	714018.685	727045.073	
F2.005	FF03.1	1200		714030.650	727045.989	714030.650	727045.989	
F1.003	FF03	1200		714035.326	727047.104	714035.326	727047.104	
F3.000	FF02.4	1200		713976.789	727033.516	713976.789	727033.516	
F3.001	FF02.3	1200		713974.578	727043.268	713974.578	727043.268	
F3.002	FF02.2	1200		713973.257	727060.505	713973.257	727060.505	
F4.000	FF02.1A	1200		713985.986	727051.450	713985.986	727051.450	
F3.003	FF02.1	1200		713985.222	727061.421	713985.222	727061.421	
F1.004	FF02	1200		714031.075	727064.934	714031.075	727064.934	

Setting Out Information - True Coordinates (21-3406 - FOUL NETWORK 01.FWS)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
F1.005	FF01	1200		714030.816	727070.928	714030.816	727070.928	
F5.000	FP1000	1200		714152.539	727064.572	714152.539	727064.572	
F5.001	FP1001	1200		714128.846	727066.894	714128.846	727066.894	
F5.002	FP1002	1200		714099.821	727069.890	714099.821	727069.890	
F5.003	FP1003	1200		714071.883	727074.447	714071.883	727074.447	
F1.006	FP1004	1200		714053.857	727079.469	714053.857	727079.469	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
F1.006	FP1006	1200		714040.146	727107.346	

Simulation Criteria for 21-3406 - FOUL NETWORK 01.FWS

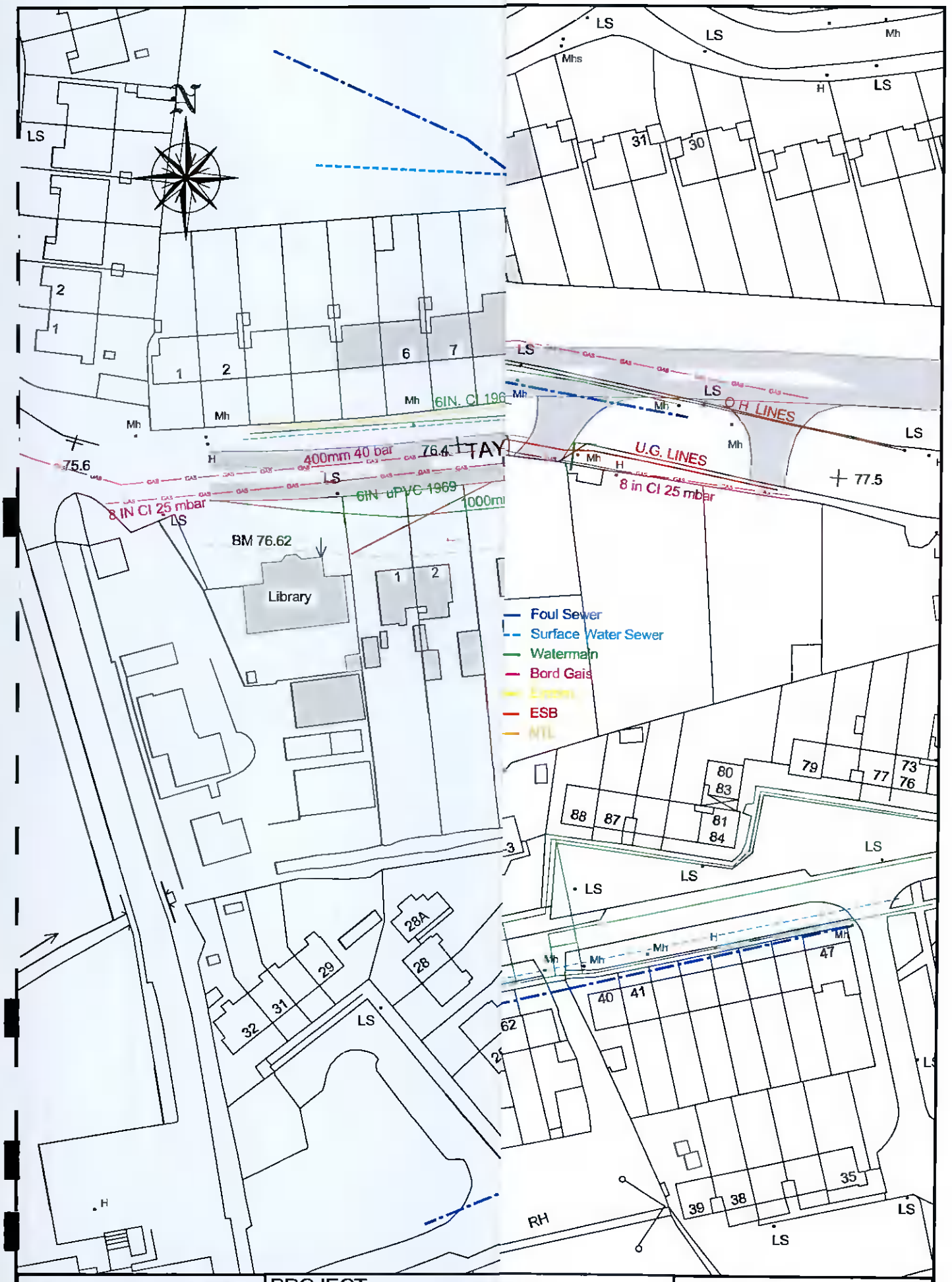
Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	0	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	0.000	Storm Duration (mins)	30
Ratio R	0.000		

APPENDIX D
(South Dublin Country Council Existing Drainage Plan)



SOUTH DUBLIN COUNTY COUNCIL

ARCHITECTS' DEPARTMENT
County Hall, TALLAGHT,
DUBLIN 24. TEL.01-4149000

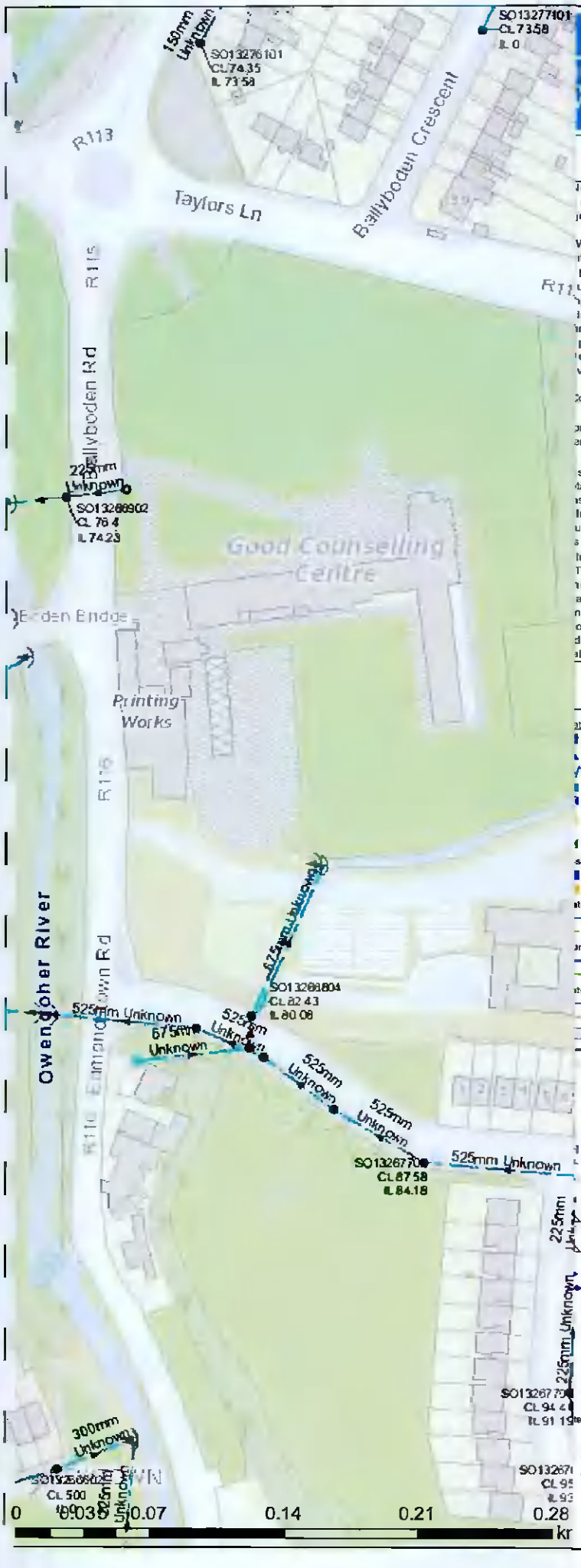
COUNTY ARCHITECT
B. BRENNAN. M Sc. Arch., F.R.I.A.I

PROJECT: Possible Infill H2007

TITLE: Site Constraints

DRG. NO. 2007-02

APPENDIX E
(Irish Water GIS Plans)



Print Date: 16/11/2021

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Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

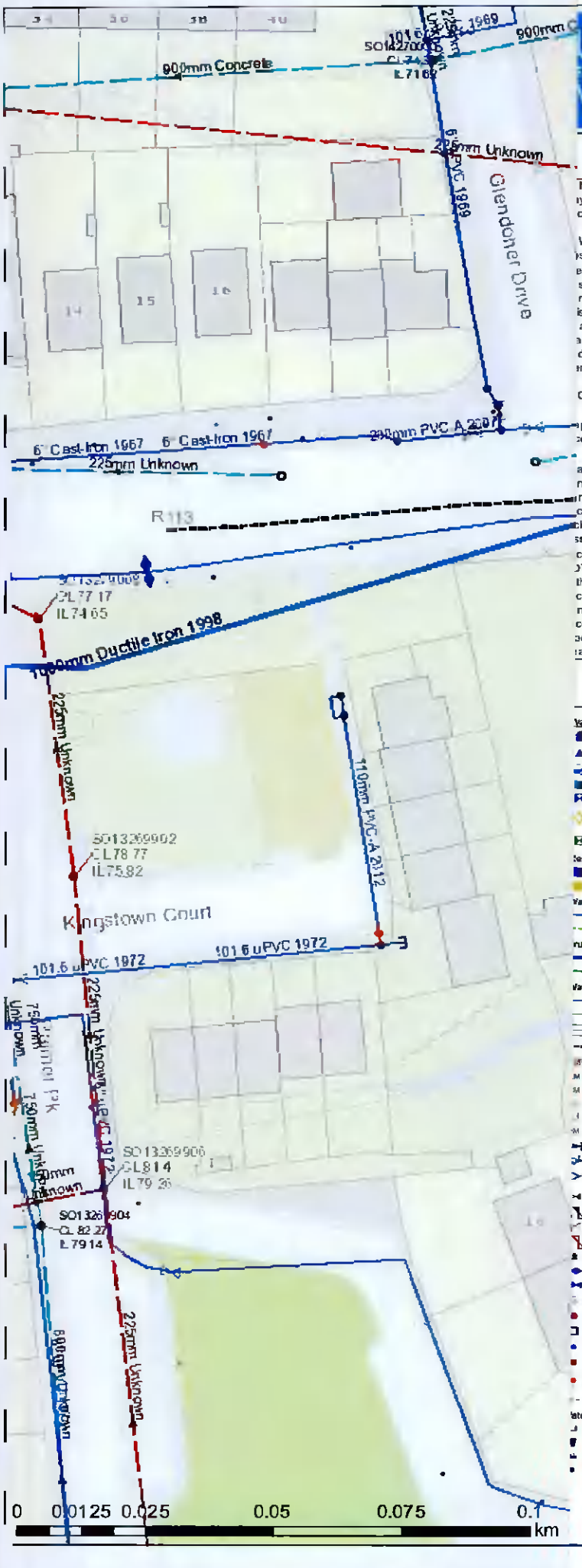
ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure



UISCE ÉIREANN : IRISH WATER

Print Date: 24/05/2021

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Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
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- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
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- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other, Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other, Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MV/LV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MV/LV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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.
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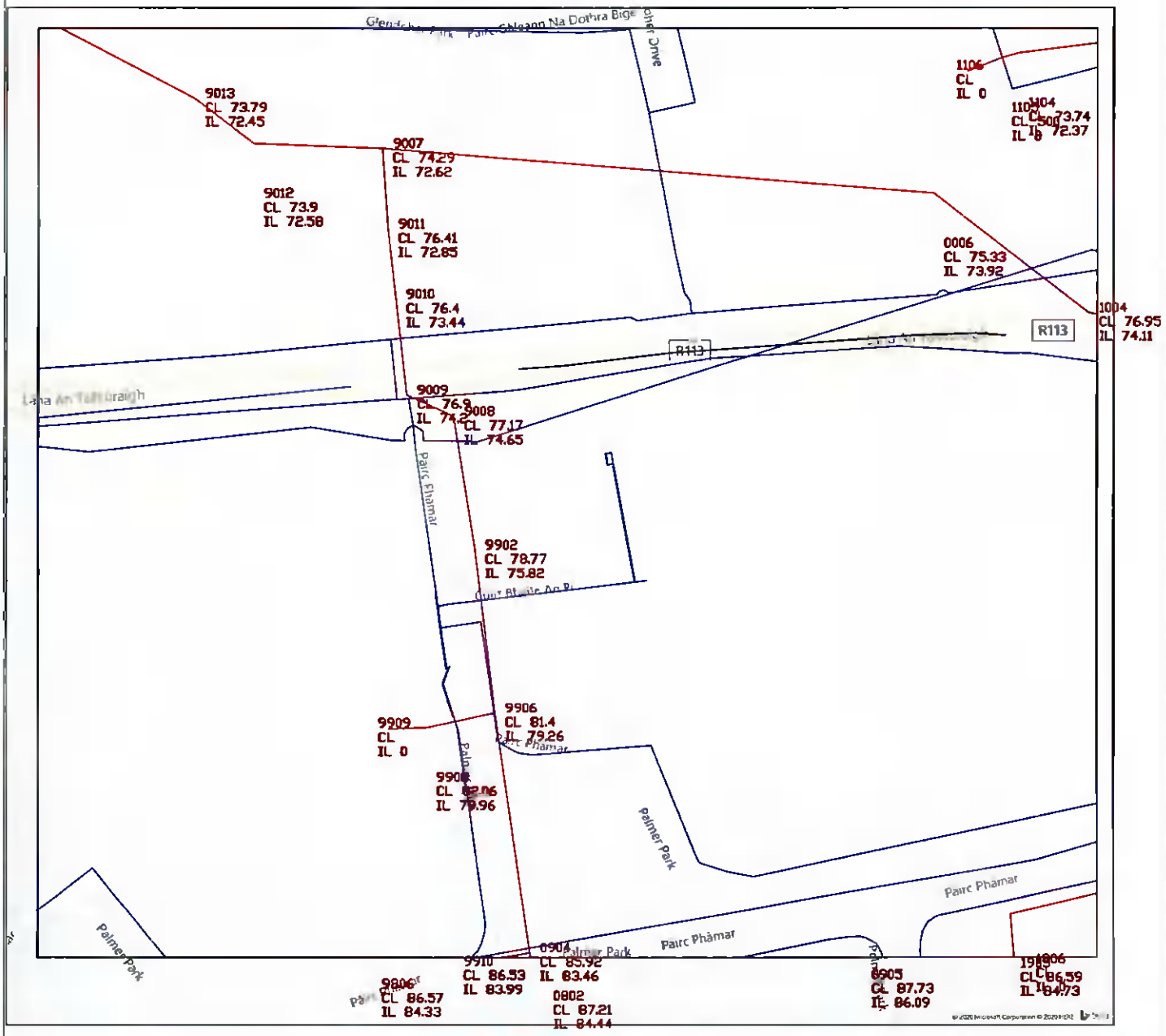

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works 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.
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APPENDIX F
(Flood Risk Assessment Technical Note)

Technical Note No. 2

Project No: IE2337 Prepared: LMc Checked: PMS Reviewed: JK

File Location: N:\IE_Projects\IE2337\5324

1. Hydrological Assessment of Former Mill Race Channel

The following sections present an assessment and analysis of the existing catchment area of the former Mill Race channel upstream of the proposed development site. This Technical Note No. 2 has been prepared in Response to Point 4 (a) and Point 4 (b) of a Clarification of Additional Information issued by South Dublin County Council in relation to Planning Application Reference SD21A/0232. This Technical Note No.2 should be read in conjunction with the previously submitted Technical Note submitted in response to the initial Request for Further Information. A copy of the previously submitted Technical Note is presented in *Appendix A*.

1.1. Clarification of Additional Information – Point 4(a) & Point 4(b)

Point 4(a) of the Clarification of Additional Information requests the following:

All catchment areas that flow into the former millrace have not been taken into consideration for attenuation calculations. For example where does the surface water generated from areas West and South West of the proposed development drain to. Examples include Palmer Park numbers 25 to 32 and the new primary health care development south west of proposed development Plan Reference SD13A/0222.

Point 4(b) of the Clarification of Additional Information requests the following:

It is still unclear what quantities of water flow through Mill Race passing through Site because all areas have not been considered. Submit a report to show surface water flows through former mill race channel for both dry and wet periods.

Response:

The previously prepared Technical Note (*Appendix A*) was prepared on the assumption that there was no direct connectivity between the former mill race channel at the location of Kingstown Drive (Palmer Park) roadway and the western boundary of the proposed development site.

A CCTV survey and drainage channel survey commissioned by Cowal Design on behalf of the applicant has subsequently been undertaken to confirm or otherwise the above assumption. The output of the CCTV and drainage channel survey did not identify a specific hydraulic structure, such as a drainage pipe or culvert, between the former mill race channel upstream of Palmer Park roadway and the western boundary of the proposed development site.

However the output of a dye testing exercise has identified some form connectivity between these two locations. As stated above, the specific type or form of connectivity structure, if any, could not be identified via the CCTV and drainage channel survey, however for the purposes of this Technical Note and in consideration of a 'worst case scenario' a direct and unimpeded connectively is assumed between the former mill race channel upstream of Palmer Park roadway and the western boundary of the proposed development site.

On the basis of the above identified connectivity, a detailed assessment and analysis of the former mill race channel catchment area upstream of the western boundary of the proposed development site has been undertaken. The catchment assessment and analysis has comprised the following elements:-

- Delineation of upstream sub-catchment areas
- Acquisition of Irish Water surface water drainage records for the area
- Assessment of upstream sub-catchment existing and proposed development
- Analysis of South Dublin County Council Planning Files in relation to existing and proposed development
- Detailed walkover survey to confirm sub-catchment and drainage outfall details
- Discussion with individual property owners
- Assessment of former mill race from location of former intake weir on the Owendoher River to upstream extent of former mill race channel adjacent to new HSE Primary Care Centre

Delineation & Assessment of Upstream Sub-Catchment Areas

Figure 1 below illustrates the output of the catchment assessment and analysis and delineation of sub-catchment areas upstream of the western boundary of the proposed development site.

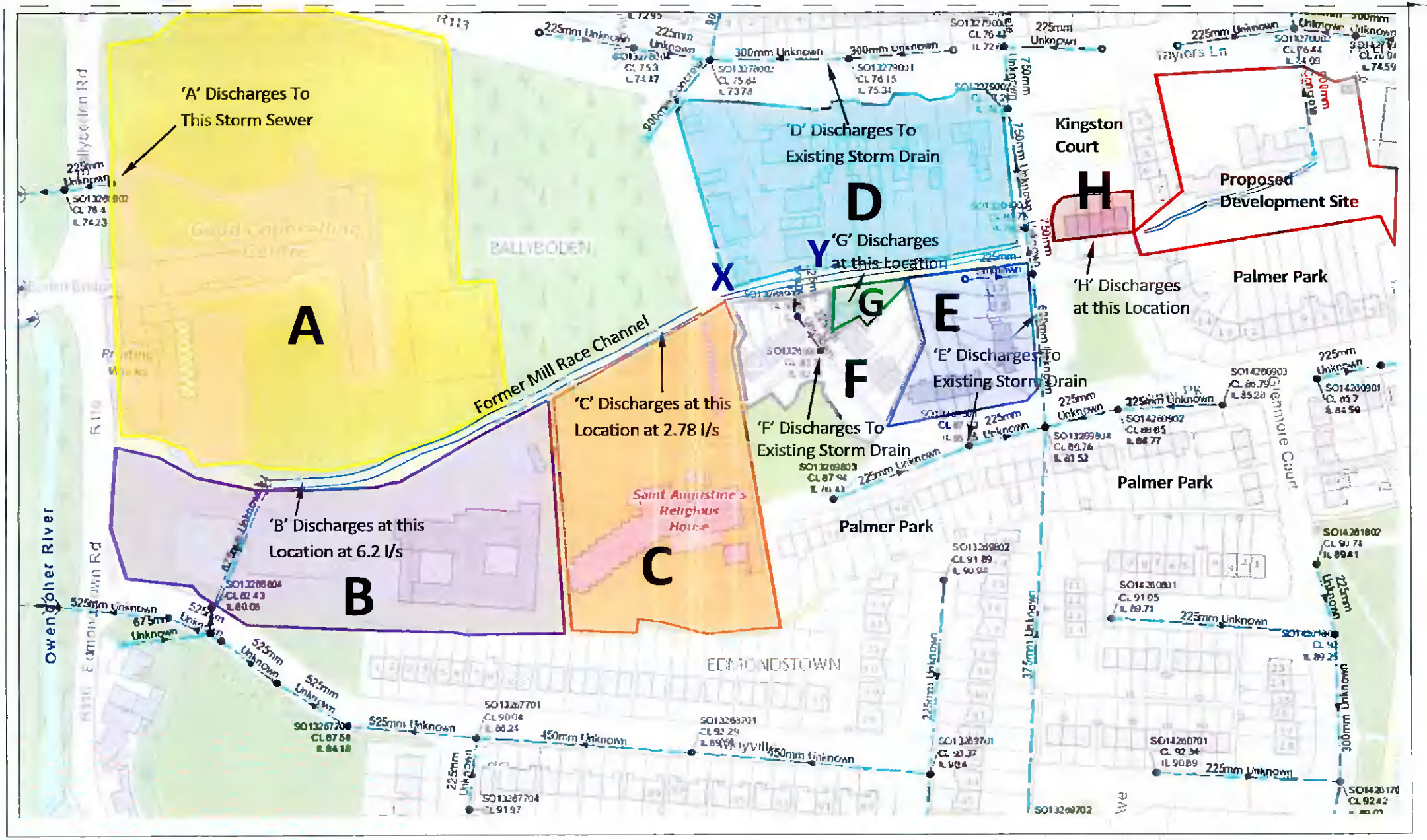

Figure 1 - Sub-Catchment Areas:

A – Good Counselling Centre	C – St Augustine's House	E – Existing Development (Palmers Park)
B – HSE Primary Care Centre	D – Existing Development (Taylors Lane)	F, G & H- Existing Development (Palmers Park)

For clarity the sub-catchment mapping illustrated on *Figure 1* below has been overlaid onto the acquired Irish Water surface water drainage network mapping for the area.

With reference to *Figure 1* above, the specific details of each sub-catchment areas 'A' to 'H' is summarised below:

Sub-Catchment Area 'A'

This sub-catchment area comprises the former St Augustine's Seminary / Good Counselling Centre and adjacent lands. An assessment of planning file references SD16A/0121 and SHD3ABP-307222-20 indicates that surface water generated from the existing development and proposed development within this sub-catchment area discharge to an existing 225mm diameter storm sewer at the location illustrated in *Figure 1* above. This storm sewer is conveyed across Ballyboden Road and discharges to the Owendoher River.

No surface water runoff from this sub-catchment area currently discharges to or is proposed to discharge to the former mill race channel.

Sub-Catchment Area 'B'

This sub-catchment area comprises the recently constructed HSE Primary Care Centre. An assessment of planning file reference SD13A/0222 indicates that surface waters associated with this development are attenuated and discharge to the former mill race channel at the location illustrated on *Figure 1* above and at a maximum discharge rate of **6.2 l/s**

Figure 2 below illustrates the attenuated surface water outfall from this sub-catchment area to the former mill race channel.

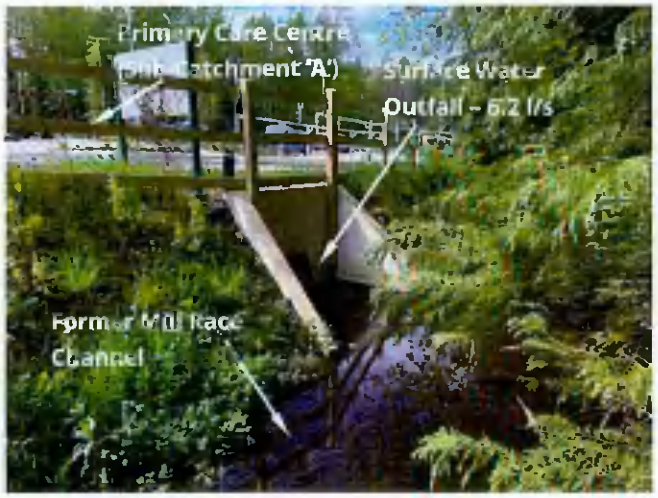

Figure 2

Sub-Catchment Area 'C'

This sub-catchment area comprises the former St Augustine's Religious House and proposed development which is currently on-going at this location. An assessment of planning file reference SD20A/0059 indicates that surface waters associated with the proposed development at this location shall be attenuated and will discharge to the former mill race channel at the location illustrated on *Figure 1* above and at a maximum discharge rate of **2.78 l/s**.

Figure 3 below illustrates the attenuated surface water outfall from this sub-catchment area to the former mill race channel.

Figure 3

Sub-Catchment Area 'D'

This sub-catchment area comprises existing development along Taylor's Lane.

As illustrated on *Figure 1* above all surface waters associated with this sub-catchment area discharge to the existing storm water sewer on Taylor's Lane.

No surface water runoff from this sub-catchment area discharges to the former mill race channel.

Sub-Catchment Area 'E'

This sub-catchment area comprises Palmer Park House Numbers 17-24a.

As illustrated on *Figure 1* above all surface waters associated with this sub-catchment area discharge to the existing 600mm diameter storm water sewer on Palmers Park access road.

No surface water runoff from this sub-catchment area discharges to the former mill race channel.

Sub-Catchment Area 'F' & Sub-Catchment Area 'G'

Sub-catchment area 'F' comprises Palmer Park House Numbers 25-32.

Sub-catchment area 'G' comprises Palmer Park House Number 28a.

Figure 1 above indicates that that Palmer Park house numbers 25-32 and the access roadway within this catchment area discharge to the former mill race channel via a 225mm diameter storm sewer at the location illustrated on *Figure 1* above. It is noted that an inspection and walkover survey of the former mill race channel between Point 'X' and Point 'Y' (as illustrated on *Figure 1*) did not indicate an any open channel watercourse at this location nor the outfall of the 225mm diameter storm sewer listed above.

An assessment of planning file reference SD01A/0451 indicates that surface waters associated Palmer Park house number 28a discharge directly to the former mill race channel at the location illustrated on *Figure 1* above.

Figure 4 below illustrates the hardstanding areas associated with Sub-Catchment Area 'F' and Sub-Catchment Area 'G' that are expected to discharge surface water runoff to the former mill race channel.

Figure 4

With reference to *Figure 4* above, the total hardstanding area (roof areas & access road areas) within Sub-Catchment area 'F' and Sub-Catchment area 'G' is approximately 1385m^2.

In consideration of a 1 in 100 year 6-hour duration rainfall event (see *Appendix B* - Met Eireann depth duration frequency table for this location) and considering a composite runoff co-efficient of 0.85, the surface water runoff rate from these sub-catchment areas to the former mill race channel is estimated as **27.5 l/s**.

The above surface water discharge rate assumes that all surface water runoff from these sub-catchment areas is un-attenuated and that no roof or other hardstanding areas discharge to soakaway systems.

Sub-Catchment Area 'H'

Sub-Catchment area 'H' comprises Kingston Court House Numbers 8-12.

As part of the CCTV survey works described in *Section 1.1* above, it could not be determined where surface water runoff generated from Kingstown Court House Number 8-12 discharges to. On this basis, and on a 'worst-case' scenario, for this purposes of this assessment it is assumed that surface waters generated from the roof areas of these houses discharge to the former mill race channel.

Figure 5 below illustrates the hardstanding roof areas associated with Sub-Catchment Area 'H' that are expected to discharge surface water runoff to the former mill race channel.

Figure 5

With reference to *Figure 5* above, the total hardstanding area (roof areas) within Sub-Catchment area 'H' is approximately 265m^2.

In consideration of a 1 in 100 year 6-hour duration rainfall event (see *Appendix B* - Met Eireann depth duration frequency table for this location) and considering a roof runoff co-efficient of 0.90, the surface water runoff rate from this sub-catchment area to the former mill race channel is estimated as **5.6 l/s**.

The above surface water discharge rate assumes that all surface water runoff from this sub-catchment areas is un-attenuated and that no roof areas discharge to soakaway systems.

1.2. Assessment of Former Mill Race Channel Intake

Figure 6 below illustrates the historic 25-inch mapping at the location of the intake of the former mill race channel. As illustrated an intake was provided on the Owendoher River via a weir structure in order to supply water to a former laundry facility and to a former paper mill located downstream and within the boundary of the proposed development site.

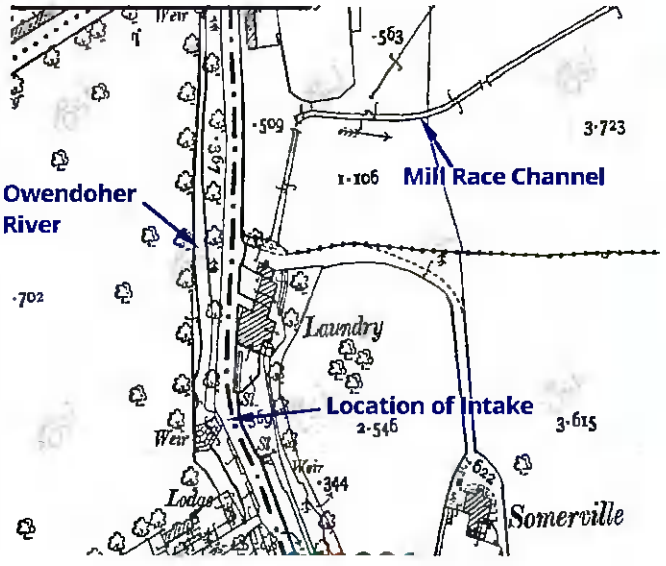

Figure 6

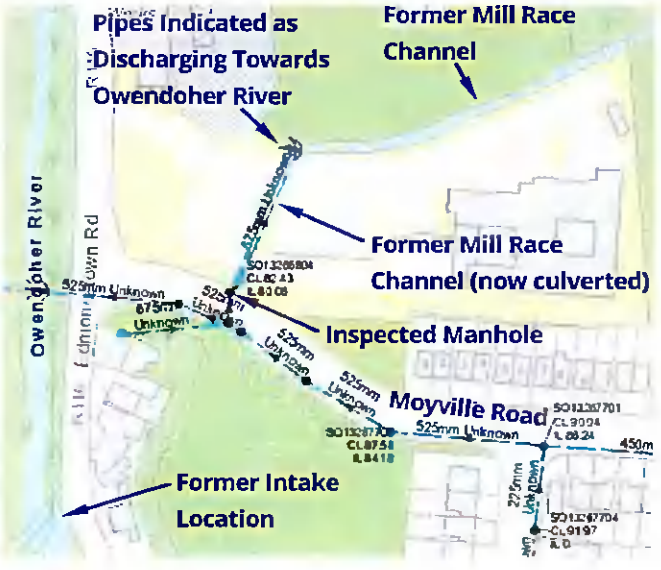

Figure 7

An inspection at the location of the existing weir structure and former intake indicates that this intake is no longer operational and that waters are currently not abstracted from the Owendoher River at this location and supplied to the former mill race channel.

With reference to *Figure 7* above, the Irish Water surface water drainage records for the area indicate that former mill race channel is now culverted via a single and twin 675mm diameter pipe from the location of the former laundry to the upstream extent of the former mill race channel. During site survey and inspection works the actual outfall location of the twin 675mm diameter pipes to the former mill race channel could not be physically identified or observed, however as illustrated in *Figure 7* above, the Irish Water surface water drainage records indicate that from this location this outfall is conveyed in an east to west direction towards the Owendoher River.

An inspection of the manhole on Moville Road at the upstream extent of the twin 675mm diameter culverts associated with the former mill race channel was also undertaken.

Figure 8 and *Figure 9* below indicates stagnant and standing waters within this manhole and indicates heavy siltation within the manhole chamber. There was no evident of any significant surface water conveyance through this manhole, which again indicates that the former mill race channel intake is no longer operational and that waters are currently not abstracted from the Owendoher River at this location and supplied to the former mill race channel.

Figure 8

Figure 9

1.3. Summary of Sub-Catchment Assessment & Analysis

In consideration of the above sub-catchment assessment and analysis, the potential maximum rate of surface waters, on a 'worst case scenario', that may discharge to the former mill race channel within the boundary of the proposed development site is summarised as follows:

Sub-Catchment 'B'	– 6.20 l/s
Sub-Catchment 'C'	– 2.78 l/s
Sub-Catchment 'F' & 'G'	- 27.5 l/s
Sub-Catchment 'H'	- 5.60 l/s
Technical Note 1 Assessment	- 8.50 l/s (see Technical Note 1, Appendix A)
Total	**50.6 l/s**

Appendix A

Technical Note No. 1

Technical Note:

Project No: IE2337 Prepared: LMc Checked: PMS Reviewed: JK

File Location: N:\IE_Projects\IE2337\5289

1. Hydrological Assessment - Background

The following sections present an assessment and analysis of the existing catchment area of the former Mill Race channel within the boundary of the proposed development site and the surface water runoff rates that may be expected to discharge to the former Mill Race channel in consideration of the mean annual (Qbar) and the 3.3% AEP (1 in 30 year) and 1% AEP (1 in 100 year) runoff events.

1.1. Assumptions

As illustrated in *Figure 1* below, this assessment and analysis assumes the following:-

1) There is no direct connectivity between the former mill race channel at the location of Kingstown Drive roadway and the western boundary of the proposed development site.
2) Hard-surfacing areas (roof areas, driveways, etc) associated with Kingstown Court house numbers 3-7 drain to the existing public storm sewer in Kingstown Drive, and only the rear garden areas of these properties have the potential to discharge surface water runoff to the area of the proposed development site and subsequently the former mill race channel.
3) Hard-surfacing areas (roof areas, driveways, etc) associated with Palmer Park house numbers 1-16 drain to the existing public storm sewer in Palmer Park road, and only the rear garden areas of these properties have the potential to discharge surface water runoff to the area of the proposed development site and subsequently the former mill race channel.
4) No surface water runoff from Taylors Lane roadway discharges in the direction of the proposed development site.

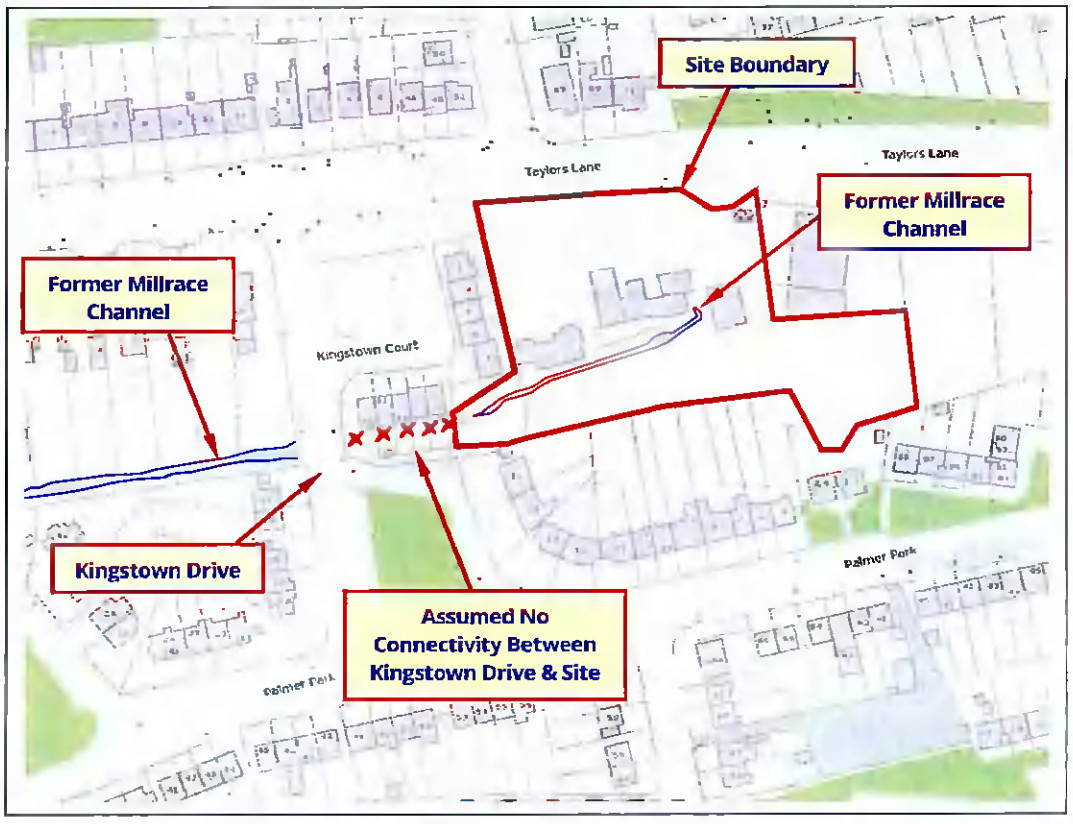

Figure 1

1.2. Topographical Survey and Contour Mapping

In order to assist in the assessment of the former Mill Race channel catchment area, a Digital Terrain Model (DTM) and contour mapping was developed to encompass the surrounding area of the proposed development site.

The DTM and contour mapping was developed utilising acquired LiDAR data for the area. The contour mapping and DTM developed for the area is illustrated in *Figure 2* and *Figure 3* below.

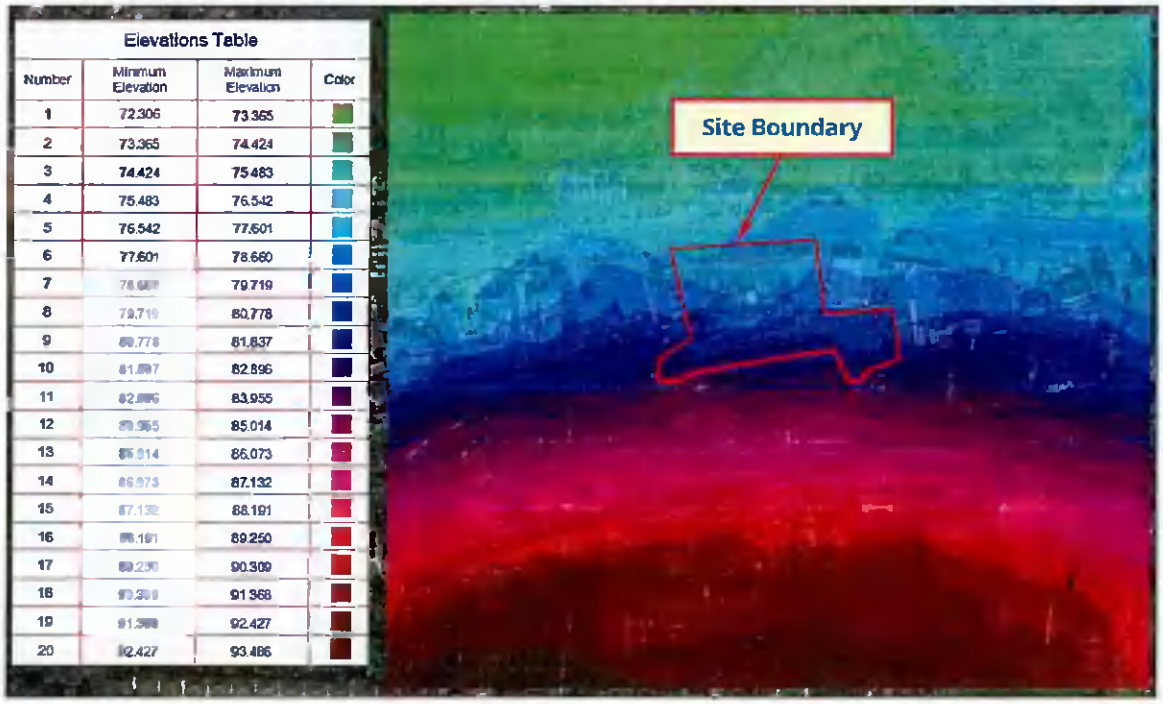

Figure 2 – DTM

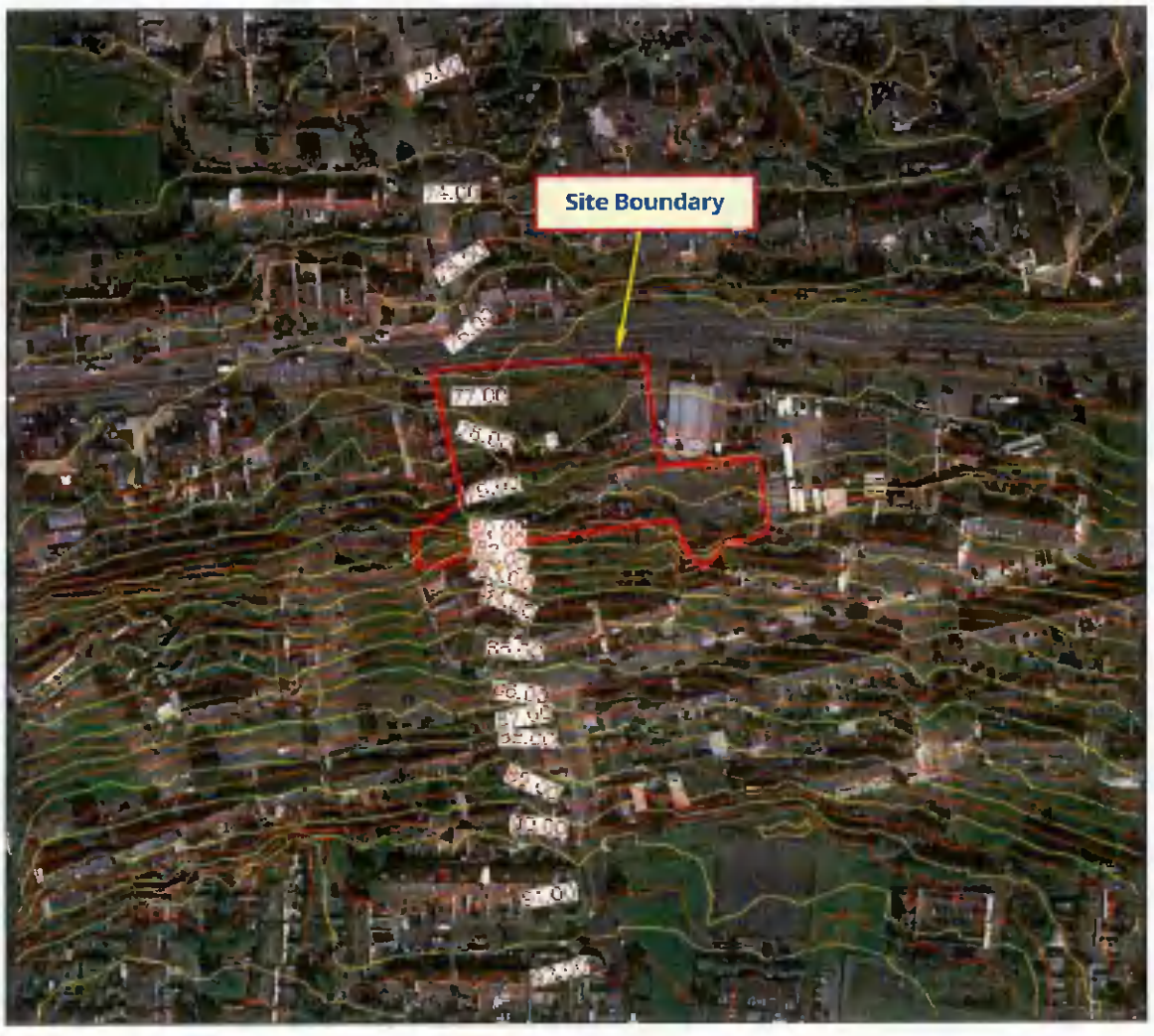

Figure 3 – Contour Mapping

1.3. Catchment Area Delineation

The catchment area of the former Mill Race channel has been delineated utilising the constructed DTM detailed in *Section 1.2* above and has been estimated to be 0.009069 km^2 to a point at the downstream extent of the channel as illustrated in *Figure 4* below.

Figure 4 – Mill Race Catchment

1.4. Mean Annual Flow Estimation

No suitable historical flow data, hydrometric gauging station data or anecdotal information is available from the OPW, EPA or local authority for the former Mill Race channel or catchment area from which an estimation of design flows can be extrapolated or correlated.

Given the small size of the catchment area of the former Mill Race channel, the FSU portal software is not considered appropriate to estimate the mean or median annual flow. The mean annual flow, Q_{BAR} (m^3/s), is therefore estimated by utilising the Institute of Hydrology Report (IH) No. 124 'Flow Estimation for Small Catchments' regression equation.

For catchment areas less than 50 hectares (0.5 km^2) in area it is recommended that the mean annual flow is calculated for a 50 hectare area and the flow for the actual catchment is then estimated through linear interpolation. The Hydrology Report (IH) No. 124 'Flow Estimation for Small Catchments' regression equation is listed below:-

$$Qbar\ Rural = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times SOIL^{2.17} \qquad EQN\ 7.1\ (IH124)$$

where:

AREA = the topographic catchment area

Area = 0.009069 Km^2

SAAR = Standard Annual Average Rainfall

***SAAR = 890.11 mm** (from Met Éireann data)*

SOIL = A number depending on the soil type and relating to the winter rain acceptance potential of the soils in the catchment. Values for SOIL are obtained from *Figure 5* and *Figure 6* below, which are replicated from map I. 4.18 (I) in the FSR.

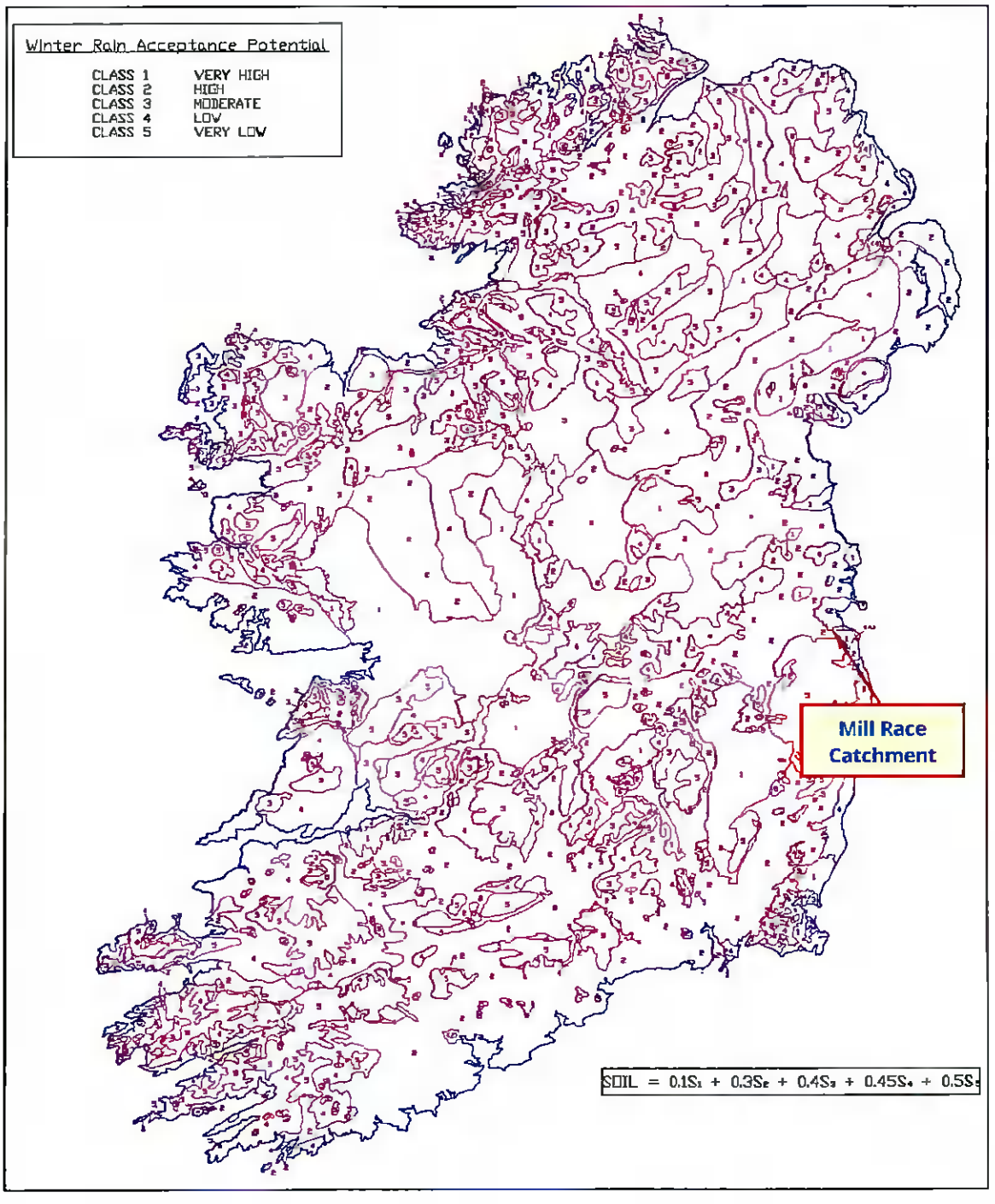

Figure 5 – Winter Rainfall Acceptance Potential

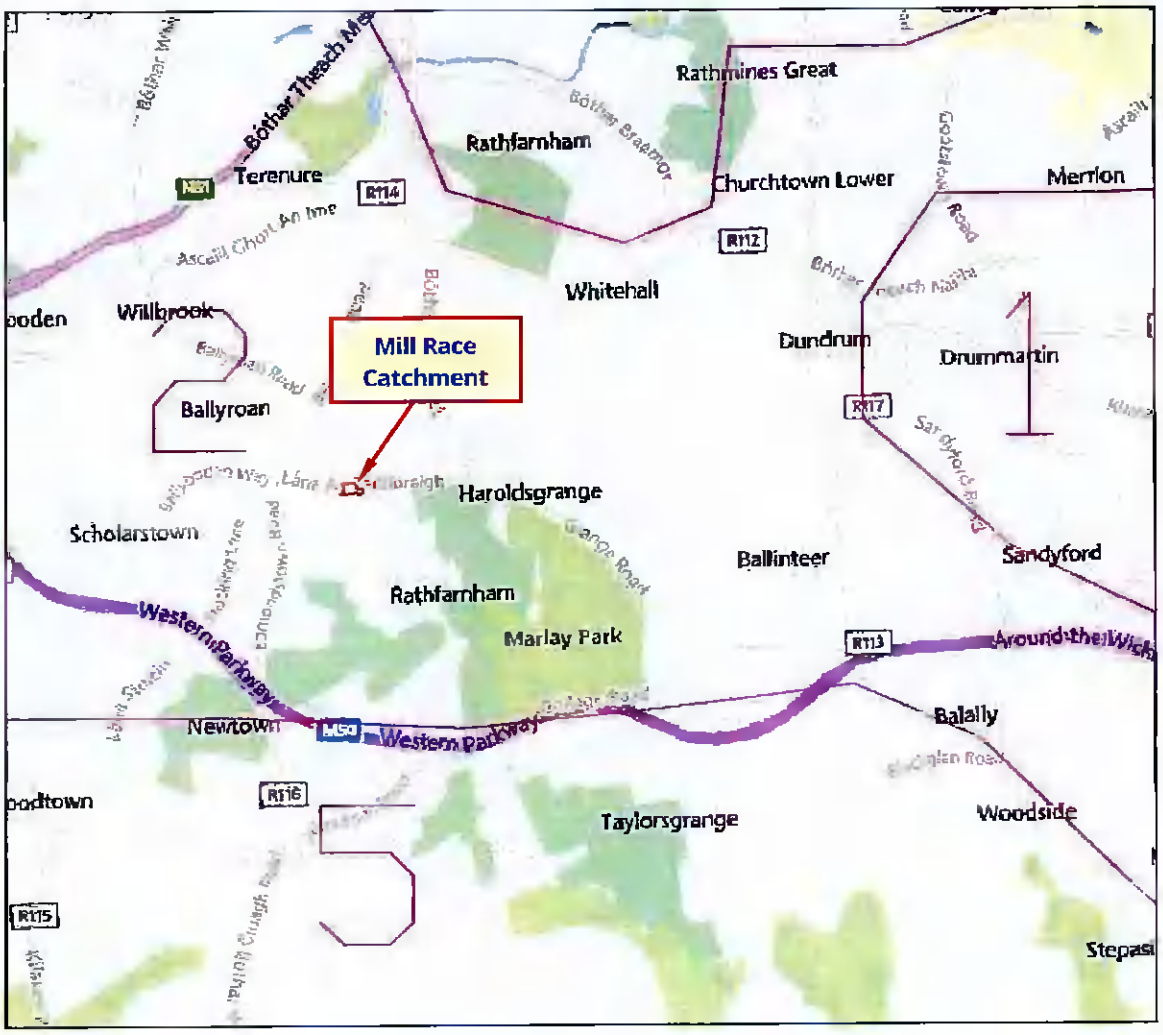

Figure 6 – Winter Rainfall Acceptance Potential

From *Figure 5* and *Figure 6* above (not to scale) the Mill Race catchment area comprises 100% SOIL Type 2.

Therefore:

SOIL = 0.15(S1) + 0.3(S2) + 0.40(S3) + 0.45(S4) + 0.5(S5)

SOIL = 0.15(0) + 0.3(1.0) + 0.40(0) + 0.45(0) + 0.5(0)

SOIL = 0.3

Therefore:

$Qbar = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$ *EQN 7.1 (IH124)*

$Qbar = 0.00108 \times 0.5^{0.89} \times 890.11^{1.17} \times 0.3^{2.17}$ = ***121 l/s (0.121 m^3/s)*** *(for 50 hectare catchment area)*

The IH Report 124 Flood estimation for small catchments equation has a standard factorial error of 1.65, therefore the design Q_{BAR} is:-

121 l/s x 1.65 = ***199.65 l/s***

The Qbar flow for the actual former Mill Race channel is estimated using linear interpolation as shown below:-

$$Qbar\ Rural = \frac{Qbar\ Design}{0.5} \times Site\ Area$$

Therefore:-

$$Qbar\ Rural = \frac{199.65}{0.5} \times 0.009069$$

$\Rightarrow$ Q_{BAR} = **3.62 *l/s***

1.5. Estimated Flows for Different Return Periods

The return period flows 'Q_T' are estimated using the index method and multiplying the annual maximum flow by the appropriate growth factor 'X_T' using the FSR (1975) national growth curve for Ireland, as shown in *Figure 7* below: -

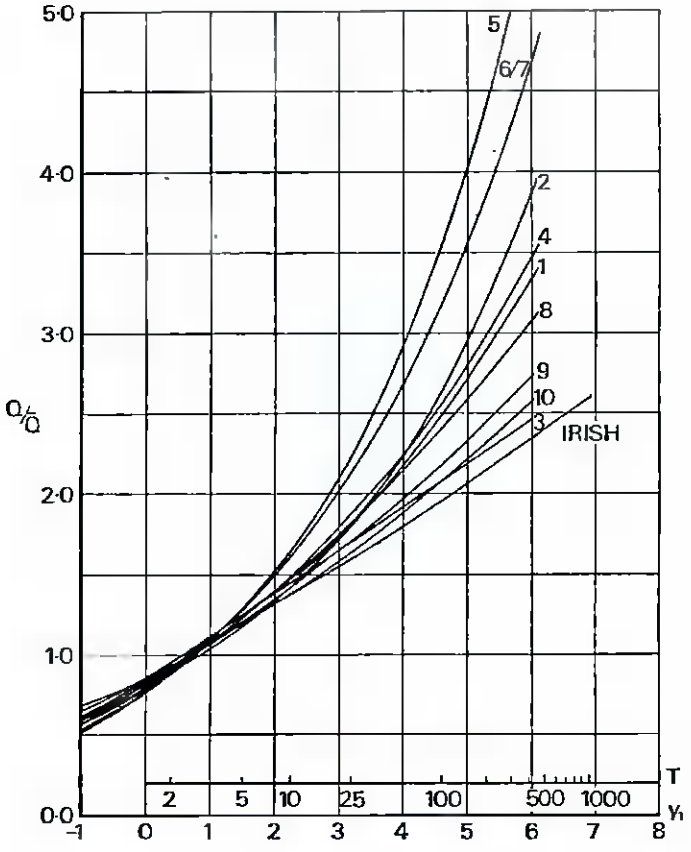

Figure 7 – Regional Growth Factors

For return periods 2, 5, 10, 20, 30, 50 and 100years the growth factors determined from *Figure 6* are listed in *Table 1* below: -

Flood Return Period (Yrs)	2	5	10	20	30	50	100
Growth Curve Factor (Q_T/Q_{BAR})	0.95	1.2	1.37	1.54	1.63	1.77	1.96

Table 1: Growth Factors Applied to Irish Catchments for Q_{BAR} Discharge Prediction

Table 2 below lists the estimated peak flow in the former Mill Race channel at the point of interest for different return periods: -

Flood Return Period (Yrs)	2	5	10	20	30	50	100
Mill Race Estimated Peak Flow (l/s)	3.43	4.34	4.95	5.57	5.90	6.40	7.09

Table 2: Estimated Peak Flows in the Mill Race Channel for Different Return Periods

The estimated 3.3% AEP (1 in 30 year) and 1% AEP (1 in 100 year) flows for the former Mill Race channel along the reach under consideration are therefore:-

Q_{30} = ***5.90 l/s***

Q_{100} = ***7.09 l/s***

1.6. Climate Change

It is generally acknowledged that future climate change will cumulate in decreases in summer rainfall amounts and increases in winter rainfall amounts. The levels or percentages of increase or decrease are still subjective and dependant on future studies and analysis.

The recently published Greater Dublin Strategic Drainage Study (GDSDS) suggests that by the year 2100 summer rainfall depths will have decreased by 35-45%, with a corresponding increase in winter rainfall depths by 20%. The suggested increase in winter rainfall depth will inevitability result in higher catchment run-off and therefore greater flood peaks.

It is therefore prudent to include a climate change factor in any estimation of flood peak volumes. In this instance a 20% increase in estimated flood peaks is provided for in this assessment. Therefore, the predicted 1% AEP (1 in 100-year) flood flows are increased to reflect the climate change factor.

The estimated 3.3% AEP + climate change (1 in 30 year + CC) and 1% AEP plus climate change (1 in 100 year + CC) flow in the former Mill Race watercourse along the reach under consideration is therefore:-

$\Rightarrow Q_{30+CC} = 5.90 \times 1.20 =$ ***7.08 l/s***

$\Rightarrow Q_{100+CC} = 7.09 \times 1.20 =$ ***8.50 l/s***

Appendix B

Met Eireann – DDF Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 314073, Northing: 226995,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.7,	4.0,	4.7,	5.8,	6.5,	7.1,	9.1,	11.4,	12.9,	15.1,	17.1,	18.7,	21.2,	23.1,	24.7,	N/A ,
10 mins	3.7,	5.5,	6.5,	8.0,	9.1,	9.9,	12.6,	15.8,	18.0,	21.1,	23.9,	26.1,	29.5,	32.2,	34.4,	N/A ,
15 mins	4.4,	6.5,	7.6,	9.4,	10.7,	11.6,	14.9,	18.6,	21.2,	24.8,	28.1,	30.7,	34.7,	37.9,	40.5,	N/A ,
30 mins	5.8,	8.5,	9.9,	12.2,	13.7,	14.9,	18.9,	23.5,	26.7,	31.1,	35.1,	38.2,	43.1,	46.9,	50.1,	N/A ,
1 hours	7.6,	11.0,	12.9,	15.7,	17.6,	19.1,	24.1,	29.8,	33.6,	39.0,	43.8,	47.6,	53.5,	58.1,	61.9,	N/A ,
2 hours	10.1,	14.3,	16.7,	20.2,	22.6,	24.5,	30.6,	37.6,	42.3,	48.9,	54.8,	59.4,	66.5,	72.0,	76.6,	N/A ,
3 hours	11.8,	16.8,	19.4,	23.4,	26.2,	28.3,	35.2,	43.2,	48.4,	55.8,	62.4,	67.5,	75.4,	81.6,	86.7,	N/A ,
4 hours	13.2,	18.7,	21.6,	26.0,	29.0,	31.3,	38.9,	47.6,	53.3,	61.3,	68.4,	74.0,	82.5,	89.2,	94.7,	N/A ,
6 hours	15.6,	21.8,	25.2,	30.2,	33.6,	36.2,	44.8,	54.6,	61.0,	70.0,	78.0,	84.2,	93.7,	101.1,	107.2,	N/A ,
9 hours	18.3,	25.5,	29.3,	35.0,	38.9,	41.9,	51.6,	62.6,	69.8,	79.9,	88.8,	95.7,	106.3,	114.6,	121.4,	N/A ,
12 hours	20.5,	28.4,	32.7,	38.9,	43.2,	46.4,	57.1,	69.0,	76.8,	87.7,	97.4,	104.9,	116.4,	125.2,	132.6,	N/A ,
18 hours	24.1,	33.2,	38.0,	45.2,	50.0,	53.7,	65.7,	79.1,	87.9,	100.1,	111.0,	119.3,	132.1,	141.9,	150.1,	N/A ,
24 hours	27.0,	37.1,	42.4,	50.2,	55.5,	59.5,	72.6,	87.2,	96.7,	110.0,	121.7,	130.7,	144.5,	155.1,	163.9,	194.4,
2 days	33.8,	45.3,	51.3,	60.0,	65.8,	70.3,	84.5,	100.1,	110.2,	124.2,	136.4,	145.7,	159.9,	170.8,	179.7,	210.4,
3 days	39.3,	52.0,	58.5,	68.0,	74.2,	79.0,	94.2,	110.8,	121.4,	136.0,	148.7,	158.4,	173.0,	184.2,	193.4,	224.8,
4 days	44.2,	57.8,	64.8,	74.9,	81.6,	86.6,	102.6,	120.0,	131.1,	146.3,	159.5,	169.5,	184.6,	196.1,	205.6,	237.7,
6 days	52.7,	68.0,	75.8,	87.0,	94.3,	99.8,	117.3,	136.0,	148.0,	164.2,	178.2,	188.8,	204.8,	216.9,	226.8,	260.4,
8 days	60.2,	77.0,	85.5,	97.6,	105.4,	111.4,	130.1,	150.0,	162.6,	179.8,	194.5,	205.7,	222.4,	235.0,	245.3,	280.2,
10 days	67.1,	85.2,	94.2,	107.2,	115.5,	121.9,	141.6,	162.7,	175.9,	193.9,	209.3,	220.9,	238.3,	251.4,	262.0,	298.1,
12 days	73.6,	92.8,	102.4,	116.1,	124.9,	131.6,	152.3,	174.3,	188.2,	206.9,	222.9,	234.9,	252.9,	266.4,	277.5,	314.6,
16 days	85.6,	107.0,	117.5,	132.5,	142.1,	149.4,	171.9,	195.7,	210.5,	230.5,	247.6,	260.4,	279.5,	293.8,	305.4,	344.5,
20 days	96.7,	120.0,	131.4,	147.6,	157.9,	165.7,	189.8,	215.1,	230.8,	252.0,	270.0,	283.5,	303.5,	318.6,	330.8,	371.5,
25 days	109.8,	135.1,	147.6,	165.0,	176.2,	184.6,	210.4,	237.4,	254.2,	276.7,	295.7,	309.9,	331.1,	346.9,	359.7,	402.5,

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