Water, Wastewater Services & Surface water Management Design Report

Dunshaughlin East SHD

Doc No. WS-02-A

Prepared by:

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1.0 Contents

1.0 Introduction

1.1 Background

JOR Consultant Engineering were appointed by the applicant to provide engineering design services for a planning application to construct a new Strategic Housing Development at Dunshaughlin East.

This report aims to consider the main engineering elements involved with the proposed application for the development of the housing estate, including the following:

- Design of surface water network including provision of SUDS
- Design of Foul network
- Design of Water main supply

1.2 Existing Site

The site is located to the south west of the town of Dunshaughlin on the R147 approximately 750m from the village with the proposed site for the SHD application been a greenfield site. Construction work is ongoing for phases 1A &1B to the south of the SHD site with a planning permission permitted for phase 1C.

The site is bounded to the west by Dunshaughlin Business Park, North by Coldricks Pass housing estate, East by privately owned land/client owned land and South by the permitted next stage of the Willows development, Phase 1C.

The topography of the site slopes from the north to the south with a gentle slope from west to east. In the northern section of the site the land slopes in a northerly direction. There is approximately 5m fall between the highest and lowest parts of the site.

1.3 Proposals

The proposed development is an SHD housing & neighbourhood center development, to be located to the north of “The Willows” housing development phases 1A, 1B & 1C.

The proposed development consists of a residential development comprising of 913 no. residential units, a neighbourhood centre, including 2 no. retail units, a café / restaurant unit, a primary healthcare / gym, a community facility and a childcare facility, all associated open space, a section of the Dunshaughlin Outer Relief Road, internal roads, cycle and

pedestrian infrastructure, services and all other associated development on a site of c. 28.3 hectares.
The 913 no. residential units proposed consist of 505 no. houses (single, two, and three storey), 186 no. duplex units (three storey), and 222 no. apartments (four and five storey).

The 505 no. houses proposed consist of the following:

- 45 no. 2-bedroom houses
- 382 no. 3-bedroom houses (including 4 no. bungalows)
- 50 no. 4-bedroom houses (including 5 no. bungalows)
- 28 no. 4/5-bedroom houses (three storey)

The 186 no. duplex units consist of the following:

- 20 no. 1-bedroom duplex units
- 84 no. 2-bedroom duplex units
- 73 no. 3-bedroom duplex units
- 9 no. 4-bedroom duplex units

The 222 no. apartments consist of the following:

- 50 no. 1-bedroom apartments
- 151 no. 2-bedroom apartments
- 21 no. 3-bedroom apartments

The proposed neighbourhood centre facilities consist of a childcare facility with a GFA of 1,282 sq.m, a community facility with a GFA of 180 sq.m, 2 no. retail units with GFA of 1,000 sq.m and 190 sq.m, a café / restaurant unit with a GFA of 370 sq.m, and a primary healthcare / gym unit with a GFA of 1,040 sq.m.

2.0 Surface water Drainage

2.1 Existing Surface Water

The proposed site has an existing open drainage ditch which gravitates in a west to east direction across the lower half of the southern section of the site. This will be referred to as Outfall 2 for the purpose of this document. At the top of the northern section there is another existing drainage ditch which gravitates in a northerly direction away from the site and underneath the Lagore road. This will be referred to as Outfall 1 for the purpose of this document.

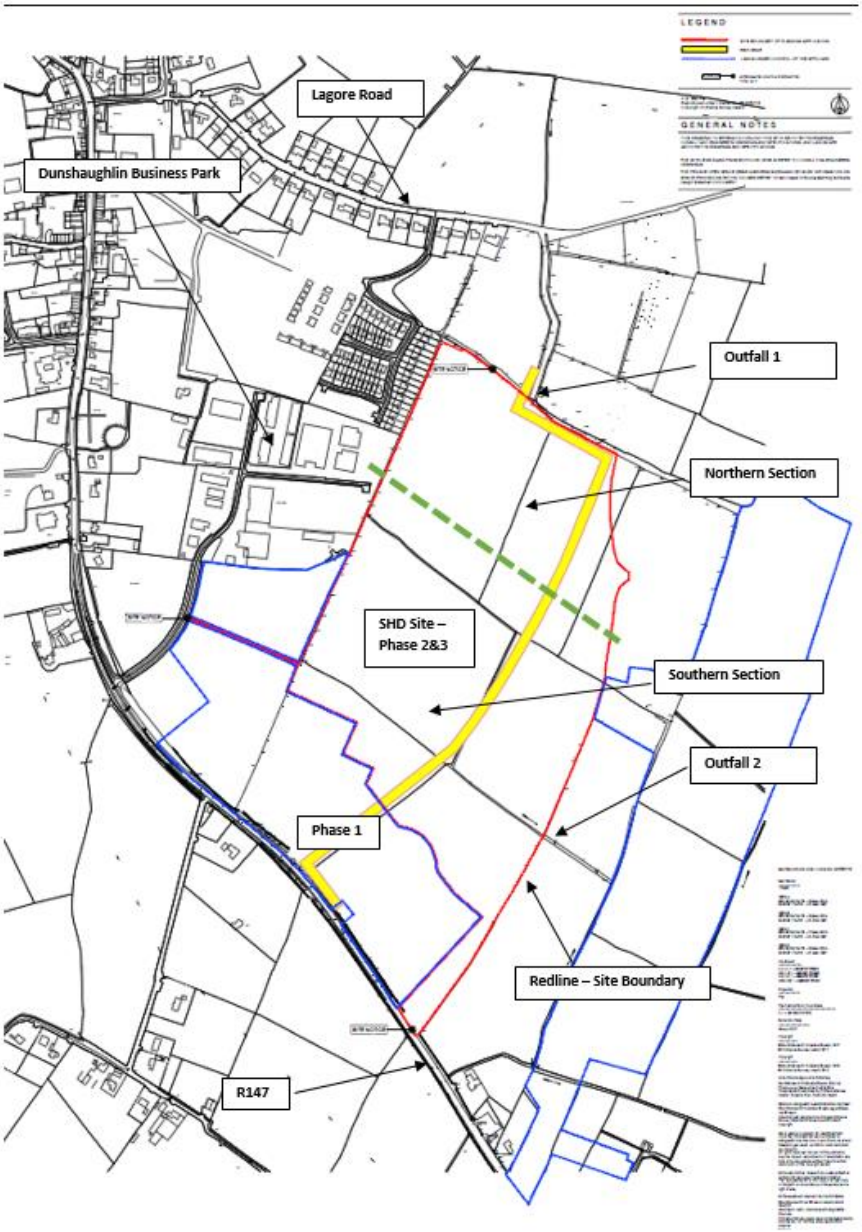


Figure 2.1

2.2 Surface Water Policy

The management of the surface water for the proposed development will be designed to comply with the policies and guidelines outlined in 'BS EN 752:2008 Drain and Sewer Systems outside buildings' and Building Regulations 2010, TGD Part H and the Greater Dublin Strategic Drainage Study (GDSDS). The guidelines in the above policies require the following main criteria to be provided by the design:

- River Water Quality Protection – satisfied by providing interception storage and treatment (Swales & driveway infiltration system)
- River Regime Protection – satisfied by attenuating to greenfield run-off rates
- Level of service (flooding) for the site – satisfied by surface water drainage design and run-off contained within site,
- Reducing run-off – satisfied by the installation of the infiltration swales & infiltration systems in the driveways

2.3 General Design

The proposed development will comprise of a new surface water drainage system to collect generated stormwater run-off and attenuate it before discharging to the existing drainage ditches (Outfall 1&2). The site has been divided up into two sections (Northern & Southern) and three catchment areas. Due to the existing site topography, the Northern Section will discharge into Outfall 1 and the Southern Section will discharge into Outfall 2 – See above Figure 2.1. The proposed catchment areas were based around existing site topography and available open/green space for attenuation storage. Attenuation storage will be provided within three on-line storage systems. Refer to Figure 2.2 & 2.3 below.

Catchment 1 caters for the northern section of the site and the proposed storm network 9 drains to attenuation system 1 which discharges through a hydrobrake manhole (Manhole no. 197) at a rate of 35.76 l/s into an existing drainage ditch (Outfall 1).
Catchment 2 caters for the western side of the southern section and the proposed storm networks 1, 2, 3, 4 & 8 drain to attenuation system 2 which discharges through a hydrobrake manhole (Manhole no. 190) at a rate of 59.8 l/s. Attenuation system 2 discharges into a new 375mm dia outfall pipe which gravitates to the headwall at Outfall no.2.

Catchment 3 caters for the eastern side of the southern section and the proposed storm networks 5, 6, 7 & 10 drain to attenuation system 3 which discharges via a hydrobrake manhole (Manhole no. 195) at a rate of 61.3 l/s into a 375mm dia outfall pipe that gravitates to the headwall at Outfall 2.

Refer to Figure 2.2 & 2.3 below to clarify layout of networks & attenuation systems.

Figure 2.2 - Plan showing Catchment Areas & Attenuation details

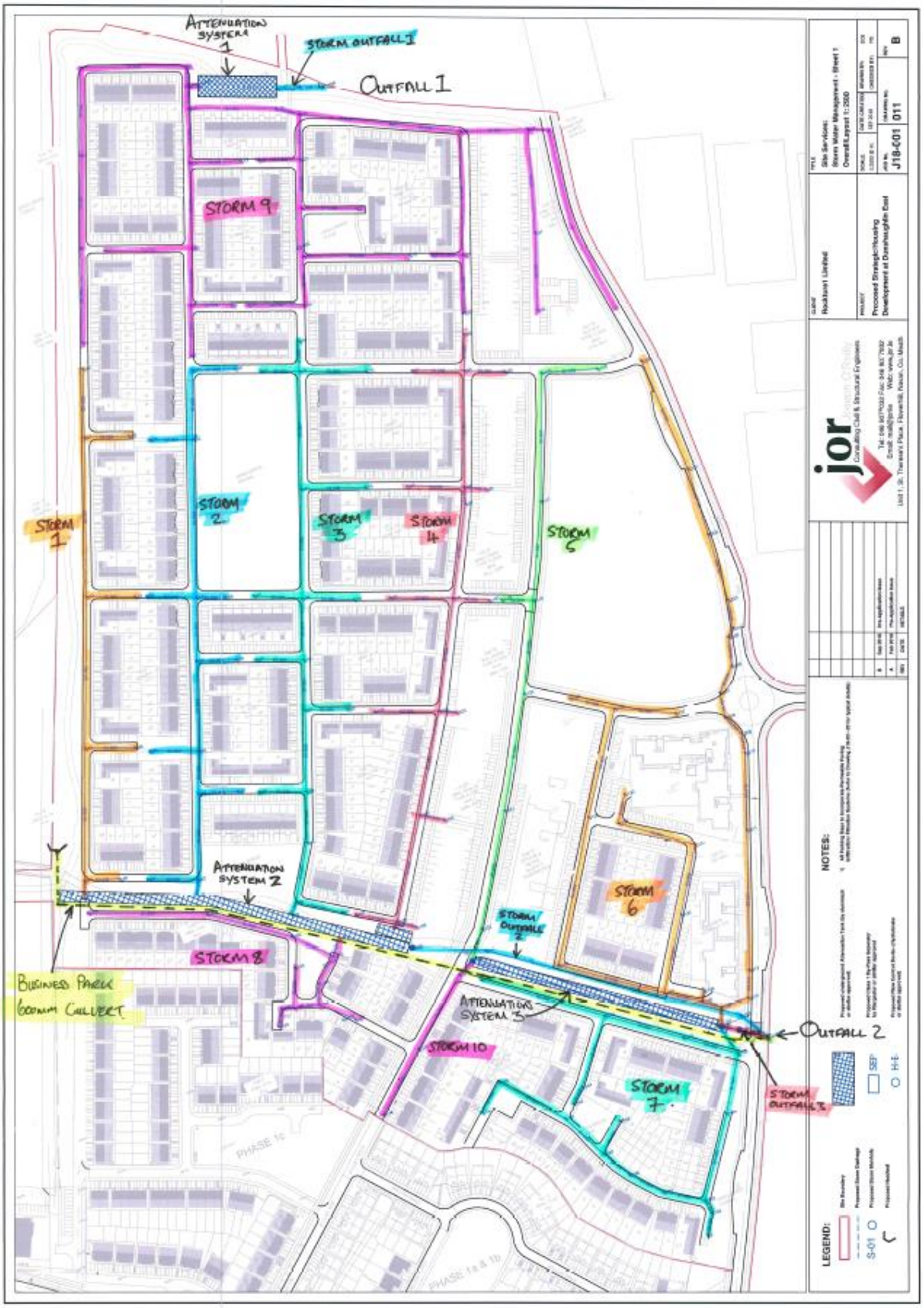


Figure 2.3 - Plan showing proposed storm networks

Flow/discharge from the site will be attenuated to greenfield run-off rates by Hydrobrake flow control devices installed on the last manholes prior to discharge to the existing drainage ditches. Refer to drawing J18-001-012 & J18-001-013 for surface water drainage layout.

From our involvement in the design of the drainage systems for Phase 1 it was perceived that the existing ground for the proposed development had poor infiltration rates so it was arranged to carry out some additional infiltration testing. The infiltration testing report is located in Appendix B of this report. From the results it confirms the existing ground has very poor percolation/infiltration rates. With regards to this the attenuation systems were sized with no infiltration allowed for. To provide for some level of infiltration, to optimize the retention time and to provide quality improvement to the storm water runoff, in particular the first flush from the roads, it is proposed to use filtration swales & trenches as part of the SUDS for the proposed development. Also the rainwater from the roofs will be discharged into the driveway infiltration systems and then, through a perforated pipe connect into the surface water main network.

The site is designed with impermeable surfaces running to permeable paving, swales and gullies. No surface water/ rainwater will discharge into the foul sewer system. There are no proposed combined sewers on the site. The Storm network will include connections to:

- Driveway infiltration systems
- Infiltration swales & trenches
- Surface water gullies
- Bypass Separators
- Attenuation Systems

2.4 Design Review – JBA Consulting

JBA Consulting were appointed by JOR Consulting Engineers to undertake a review of the stormwater design for the proposed project. JBA built models of the proposed storm networks and attenuation systems and simulated them in MicroDrainage for the 1% AEP rainfall event. A flood model was created separately and the findings of the flood model incorporated into the outfall conditions – Refer to document 2018s900 for JBA's report and findings – (issued as a separate document). The proposed storm network and attenuation systems have been revised to include JBA Consulting recommendations stated in section 3 & 4 of their report.

2.5 Contributing Areas

The overall site are (inside redline boundary) is 28.3ha. The net site area for the purpose of drainage design is 27.94ha approximately. To calculate the greenfield run-off for the whole site and for each catchment the different impermeable areas which contribute are summarised below in table 2.1.

	Total Area	Impermeable Area (m^2)			Total Imp. Area	Storage required	Max Allowable Discharge	Attenuation System
		Roofs & Driveways	Roads & footpaths	Carpark bays				
Catchment 1	63725	14007	10251	1888	26146	965.49	35.76	1
Catchment 2	106479	33634.5	16750.5	2050	52435	2098.37	59.76	2
Catchment 3	109208	23796.5	16856	3462.5	44115	1618.71	61.30	3
Whole Site	279412	71438	43857.5	7400.5	122696	4682.57	156.82	

Table 2.1 – Catchment Areas

2.6 Soil Values

The soil type has a major influence on the greenfield run-off rate / allowable discharge quantity. From the below tables and maps a soil value of 4 is calculated for the area of the proposed development. The characteristics of a soil value 4 are a low Winter Rain Acceptance Parameter (WRAP) and high run-off which equate to a clayey, poorly drained ground type. Refer to the below figures indicating the soil type:

- Figure 2.4 from the irishsuds.ie greenfield runoff estimation tool indicates a soil type 4. This can be backed up with the soils map shown in figure 2.5.
- Table 2.2 is from Appendix D in the regional policies Volume 2 of the Greater Dublin Strategic Drainage Study.
- Figure 2.6 - If the soil permeability and topographic slope are factored in, a soil value 4 is also indicated. This table is from a report compiled by the Institute of Hydrology, Report 126 – Hydrology of soil types – A hydrologically based classification of the soils of the United Kingdom'.
- Referencing the Flood Risk Assessment Section 3.2.1 & 3.2.2 – the soil characteristics of a soil type 4 were observed during a site inspection
- Referencing Appendix E of the Flood Risk Assessment – The trial pit logs confirm a brown/grey clay present which indicate a soil type 4.

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Damien O'Brien
Site name:	Phase 2 & 3 The Willows
Site location:	Dunshaughlin East

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.50373° N
Longitude:	6.53444° W
Reference:	6503787
Date:	2018-12-06T12:26:31

Methodology	IH124

Site characteristics

Total site area (ha)	27.940

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	4	4
HOST class	---	---
SPR/SPRHOST	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm)	863	863
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	172.33	172.33
1 in 1 year (l/s)	146.48	146.48
1 in 30 years (l/s)	367.05	367.05
1 in 100 years (l/s)	449.77	449.77

Figure 2.4 – Irishsuds.ie Greenfield runoff rate estimation

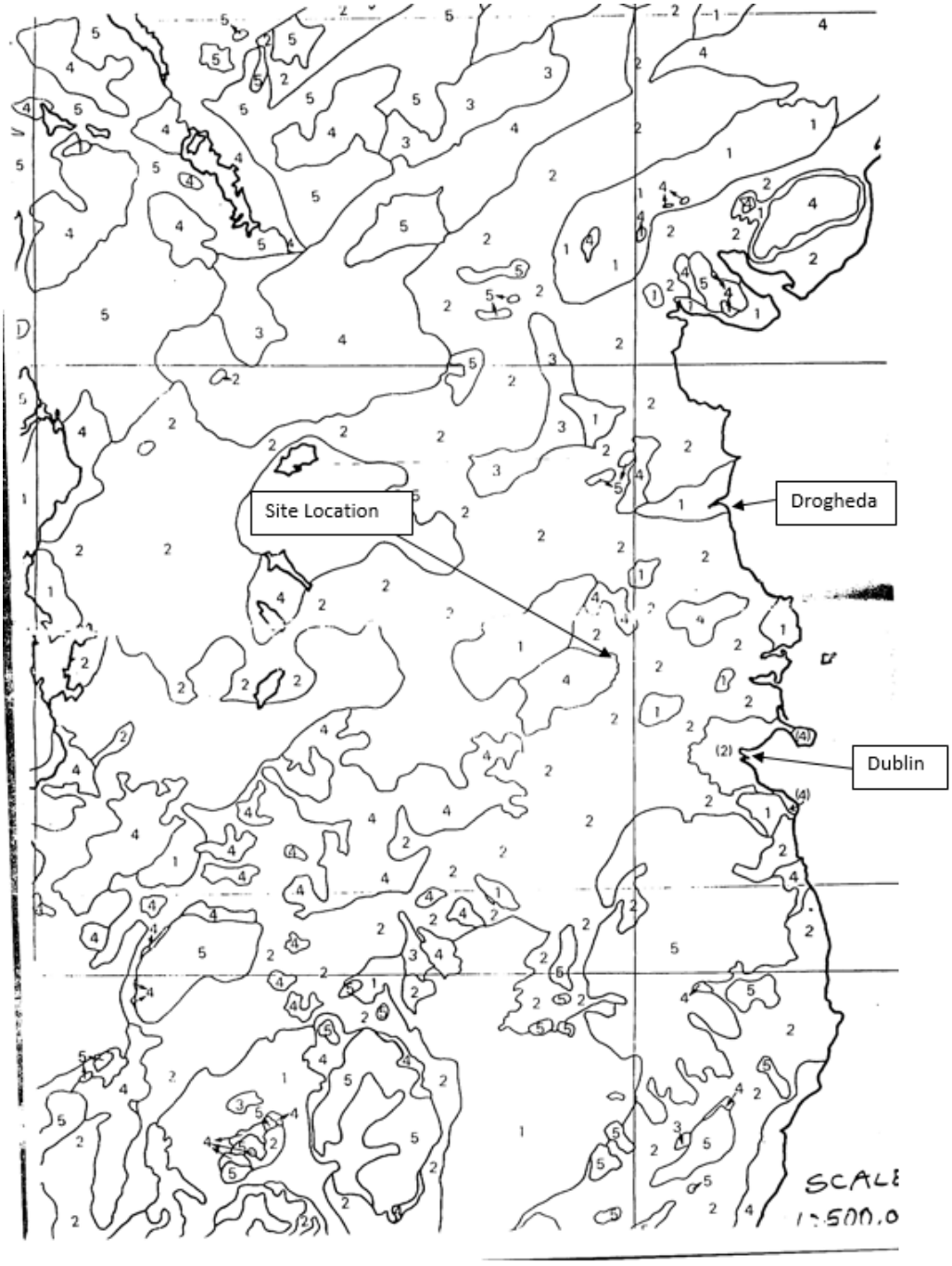


Figure 2.5 – Soils Map

SOIL	WRAP	Runoff	SOIL Value	Soil Characteristics
1	Very high	Very low	0.15	Sandy, well drained
2	High	Low	0.30	Intermediate soils (sandy)
3	Moderate	Moderate	0.40	Intermediate soils (silty)
4	Low	High	0.45	Clayey, poorly drained
5	Very low	Very high	0.50	Steep, rocky areas

Table D1 Different Classes of Soil

Table 2.2 - Table D1 is from the GDSDS Appendix D – Regional Policies

2 From WRAP to HOST

The Winter Rainfall Acceptance Potential (WRAP) classification makes a logical starting point in describing the development of a new classification. The deficiencies of the WRAP system were a major reason for the development of HOST and experiences in using WRAP helped define desirable properties of the replacement classification.

2.1 The Winter Rainfall Acceptance Potential classification

The Winter Rainfall Acceptance Potential classification was based on a theoretical consideration of soil hydrological processes and made use of four main soil and site properties i.e. soil water regime, depth to an impermeable layer, the permeability of the soil horizons above this layer, and the slope of the land. The classification scheme is shown in Table 2.1. The soil water regime classification was based on a system given in the Soil Survey Field Handbook (Hodgson, 1974). The three classes identified are:

1) soils rarely waterlogged within 40 cm depth, and for less than 90 days within 70 cm in most years,

2) soils commonly waterlogged within 40 cm, but for less than 335 days within 70 cm in most years, and

3) soils waterlogged within 40 cm for more than 180 days, and for more than 335 days within 70 cm in most years.

An impermeable layer is defined as a layer with a hydraulic conductivity of less than 0.1 m day^{-1} and should therefore be considered slowly permeable rather than impermeable. Depth to such a layer is often closely related to the water regime class but because of exceptions to this general rule both properties were included.

Table 2.1 *The WRAP classification scheme*

Water regime class	Depth to impermeable horizon(cm)	Slope Classes								
		<2°			2-8°			>8°		
		Permeability class (above impermeable horizon)								
		Rapid	Medium	Slow	Rapid	Medium	Slow	Rapid	Medium	Slow
1	>80	1			1		2	1	2	3
	80-40			2			3			4
	<40	-			-			-		
2	>80	2		3			-			
	80-40				4					
	<40	3								
3	>80	5					-			
	80-40									
	<40									

Winter Rain Acceptance Class		Winter Run-off Potential	
1	Very high	1	Very Low
2	High	2	Low
3	Moderate	3	Moderate
4	Low	4	High
5	Very low	5	Very high

2

Figure 2.6 – WRAP classification scheme

2.7 Greenfield Run-off Discharge Rates

Run-off from the development will be attenuated to greenfield run-off rates in accordance with the requirements of the GDSDS using a Hydrobrake flow control devices. The discharge limit will be 156.81/s in accordance with the GDSDS. Refer to the below tables which indicate the areas and values used to calculate the maximum allowable discharge for the whole site and the individual catchment areas.

Greenfield Run-off Discharge Rate

Whole Site

Maximum Allowable Greenfield Discharge Rate - Based on GDSDS Vol Two					
Joseph O'Reilly Consulting Engineers Unit 1, St. Therese's place, Flower Hill Navan, Co.Meath		Project Site Date	Dunshaughlin East SHD Application Dunshaughlin Co.Meath 04/12/2018		
1	Area (for calcualtions) Site Area		AREA=	0.50000 0.27941	km^2 km^2
2	Standard Average Annual Rainfall		SAAR=	863	mm
3	Percentage of each Soil Type (G1, G2, G3, G4 & G5)		G1= G2= G3= G4= G5=	0 0 0 100 0	% % % % %
4	Soil Index of Site $SOIL = \frac{0.15G1 + 0.30G2 + 0.4G3 + 0.45G4 + 0.5G5}{G1+G2+G3+G4+G5}$		SOIL=	0.45	
5	Mean Annual Flow (l/s) QBAR rural = 0.00108 (AREA)^0.89 x (SAAR)^1.17 x (SOIL)^2.17		QBARrural = QBARrural = 5.612299523 l/sec/ha	0.280614976 m^3/sec 280.6149762 l/sec	
6	Maximum Allowable Discharge Max Allowable Discharge (l/sec/ha) Max Allowable Discharge (l/sec)			5.61230 156.81438	

Ref:
Greater Dublin Strategic Drainage Study - Volume 2
Flood Studies Report, NERC (1975), Vol 1
Insitute of Hyrology No.124: Flood Estimation for Small Catchments, 1994

Surface Water Attenuation
Extreme Rainfall data from Met Eireann

RETURN PERIOD 100year

Impermeable Area 122696 sq.m
Max Allowable Discharge 156.81 l/sec

Storm Duration	(mins)	Rainfall Depth (mm)	Rainfall Intensity (mm/hr)	Rainfall Intensity (+10%) (mm/hr)	Discharge to Hydrobrake (L/s)	Net flow (L/s)	Flow to Storage (L/s)	Storage Vol Required (m^3)	
5 mins	5	13.4	160.80	176.88	156.81	6028.46	5871.65	1761.49	
10 mins	10	18.7	112.20	123.42	156.81	4206.43	4049.61	2429.77	
15 mins	15	22	88.00	96.80	156.81	3299.16	3142.34	2828.11	
30 mins	30	27.2	54.40	59.84	156.81	2039.48	1882.67	3388.80	
1 hour	60	33.6	33.60	36.96	156.81	1259.68	1102.86	3970.31	
2 hour	120	41.5	20.75	22.83	156.81	777.93	621.11	4472.01	
3 hour	180	47	15.67	17.23	156.81	587.35	430.54	4649.79	
4 hour	240	51.3	12.83	14.11	156.81	480.81	324.00	4665.61	max
6 hour	360	58.1	9.68	10.65	156.81	363.03	206.22	4454.31	
9 hour	540	65.8	7.31	8.04	156.81	274.10	117.28	3799.95	
12 hour	720	71.9	5.99	6.59	156.81	224.63	67.82	2929.65	
18 hour	1080	81.4	4.52	4.97	156.81	169.54	12.73	824.63	
24 hour	1440	88.8	3.70	4.07	156.81	138.71	-18.10	-1563.82	
2 days	2880	100.1	2.09	2.29	156.81	78.18	-78.63	-13587.47	

Catchment 1

Maximum Allowable Greenfield Discharge Rate - Based on GDSDS Vol Two					
Joseph O'Reilly Consulting Engineers Unit 1, St. Therese's place, Flower Hill Navan, Co.Meath		Project Site Date	Dunshaughlin East SHD Application Dunshaughlin Co.Meath 04/12/2018		
1	Area (for calcualtions) Site Area		AREA=	0.50000 0.06373	km^2 km^2
2	Standard Average Annual Rainfall		SAAR=	863	mm
3	Percentage of each Soil Type (G1, G2, G3, G4 & G5)		G1= G2= G3= G4= G5=	0 0 0 100 0	% % % % %
4	Soil Index of Site $SOIL = \frac{0.15G1 + 0.30G2 + 0.4G3 + 0.45G4 + 0.5G5}{G1+G2+G3+G4+G5}$		SOIL=	0.45	
5	Mean Annual Flow (l/s) QBAR rural = 0.00108 (AREA)^0.89 x (SAAR)^1.17 x (SOIL)^2.17		QBARrural = QBARrural = 5.612299523	0.280614976 280.6149762	m^3/sec l/sec l/sec/ha
6	Maximum Allowable Discharge Max Allowable Discharge (l/sec/ha) Max Allowable Discharge (l/sec)			5.61230 35.76438	

Ref:
Greater Dublin Strategic Drainage Study - Volume 2
Flood Studies Report, NERC (1975), Vol 1
Insitute of Hyrology No.124: Flood Estimation for Small Catchments, 1994

RETURN PERIOD 100year

Impermeable Area 26146 sq.m
Max Allowable Discharge 35.8 l/sec

Storm Duration	(mins)	Rainfall Depth (mm)	Rainfall Intensity (mm/hr)	Rainfall Intensity (+10%) (mm/hr)	Discharge to Hydrobrake (L/s)	Net flow (L/s)	Flow to Storage (L/s)	Storage Vol Required (m^3)	
5 mins	5	13.4	160.80	176.88	35.76	1284.64	1248.88	374.66	
10 mins	10	18.7	112.20	123.42	35.76	896.37	860.61	516.36	
15 mins	15	22	88.00	96.80	35.76	703.04	667.27	600.55	
30 mins	30	27.2	54.40	59.84	35.76	434.60	398.84	717.91	
1 hour	60	33.6	33.60	36.96	35.76	268.43	232.67	837.60	
2 hour	120	41.5	20.75	22.83	35.76	165.77	130.01	936.06	
3 hour	180	47	15.67	17.23	35.76	125.16	89.40	965.49	max
4 hour	240	51.3	12.83	14.11	35.76	102.46	66.70	960.41	
6 hour	360	58.1	9.68	10.65	35.76	77.36	41.60	898.48	
9 hour	540	65.8	7.31	8.04	35.76	58.41	22.64	733.68	
12 hour	720	71.9	5.99	6.59	35.76	47.87	12.10	522.87	
18 hour	1080	81.4	4.52	4.97	35.76	36.13	0.36	23.58	
24 hour	1440	88.8	3.70	4.07	35.76	29.56	-6.20	-536.10	
2 days	2880	100.1	2.09	2.29	35.76	16.66	-19.10	-3301.15	

Catchment 2

Maximum Allowable Greenfield Discharge Rate - Based on GDSDS Vol Two					
Joseph O'Reilly Consulting Engineers Unit 1, St. Therese's place, Flower Hill Navan, Co.Meath		Project Site Date	Dunshaughlin East SHD Application Dunshaughlin Co.Meath 04/12/2018		
1	Area (for calcualtions) Site Area		AREA=	0.50000 0.10648	km^2 km^2
2	Standard Average Annual Rainfall		SAAR=	863	mm
3	Percentage of each Soil Type (G1, G2, G3, G4 & G5)		G1= G2= G3= G4= G5=	0 0 0 100 0	% % % % %
4	Soil Index of Site SOIL = $\frac{0.15G1 + 0.30G2 + 0.4G3 + 0.45G4 + 0.5G5}{G1+G2+G3+G4+G5}$		SOIL=	0.45	
5	Mean Annual Flow (l/s) QBAR rural = 0.00108 (AREA)^0.89 x (SAAR)^1.17 x (SOIL)^2.17		QBARrural = QBARrural = 5.612299523 l/sec/ha	0.280614976 m^3/sec 280.6149762 l/sec	
6	Maximum Allowable Discharge Max Allowable Discharge (l/sec/ha) Max Allowable Discharge (l/sec)			5.61230 59.75920	

Ref:
Greater Dublin Strategic Drainage Study - Volume 2
Flood Studies Report, NERC (1975), Vol 1
Insitute of Hyrology No.124: Flood Estimation for Small Catchments, 1994

Surface Water Attenuation
Extreme Rainfall data from Met Eireann

RETURN PERIOD 100year

Impermeable Area 52435 sq.m
Max Allowable Discharge 59.76 l/sec

Storm Duration	(mins)	Rainfall Depth (mm)	Rainfall Intensity (mm/hr)	Rainfall Intensity (+10%) (mm/hr)	Discharge to Hydrobrake (L/s)	Net flow (L/s)	Flow to Storage (L/s)	Storage Vol Required (m^3)	
5 mins	5	13.4	160.80	176.88	59.76	2576.31	2516.55	754.96	
10 mins	10	18.7	112.20	123.42	59.76	1797.65	1737.89	1042.73	
15 mins	15	22	88.00	96.80	59.76	1409.92	1350.16	1215.14	
30 mins	30	27.2	54.40	59.84	59.76	871.59	811.83	1461.29	
1 hour	60	33.6	33.60	36.96	59.76	538.33	478.57	1722.86	
2 hour	120	41.5	20.75	22.83	59.76	332.45	272.69	1963.39	
3 hour	180	47	15.67	17.23	59.76	251.01	191.25	2065.49	
4 hour	240	51.3	12.83	14.11	59.76	205.48	145.72	2098.37	max
6 hour	360	58.1	9.68	10.65	59.76	155.14	95.39	2060.32	
9 hour	540	65.8	7.31	8.04	59.76	117.14	57.38	1859.05	
12 hour	720	71.9	5.99	6.59	59.76	96.00	36.24	1565.49	
18 hour	1080	81.4	4.52	4.97	59.76	72.45	12.69	822.63	
24 hour	1440	88.8	3.70	4.07	59.76	59.28	-0.48	-41.34	
2 days	2880	100.1	2.09	2.29	59.76	33.41	-26.35	-4552.77	

Catchment 3

Maximum Allowable Greenfield Discharge Rate - Based on GDSDS Vol Two					
Joseph O'Reilly Consulting Engineers Unit 1, St. Therese's place, Flower Hill Navan, Co.Meath		Project Site Date	Dunshaughlin East SHD Application Dunshaughlin Co.Meath 04/12/2018		
1	Area (for calcualtions) Site Area		AREA=	0.50000 0.10921	km^2 km^2
2	Standard Average Annual Rainfall		SAAR=	863	mm
3	Percentage of each Soil Type (G1, G2, G3, G4 & G5)		G1= G2= G3= G4= G5=	0 0 0 100 0	% % % % %
4	Soil Index of Site $SOIL = \frac{0.15G1 + 0.30G2 + 0.4G3 + 0.45G4 + 0.5G5}{G1+G2+G3+G4+G5}$		SOIL=	0.45	
5	Mean Annual Flow (l/s) QBAR rural = 0.00108 (AREA)^0.89 x (SAAR)^1.17 x (SOIL)^2.17		QBARrural = QBARrural = 5.612299523 l/sec/ha	0.280614976 280.6149762	m^3/sec l/sec
6	Maximum Allowable Discharge Max Allowable Discharge (l/sec/ha) Max Allowable Discharge (l/sec)			5.61230 61.29080	

Ref:
Greater Dublin Strategic Drainage Study - Volume 2
Flood Studies Report, NERC (1975), Vol 1
Insitute of Hyrology No.124: Flood Estimation for Small Catchments, 1994

Surface Water Attenuation
Extreme Rainfall data from Met Eireann

RETURN PERIOD 100year

Impermeable Area 44115 sq.m
Max Allowable Discharge 61.3 l/sec

Storm Duration	(mins)	Rainfall Depth (mm)	Rainfall Intensity (mm/hr)	Rainfall Intensity (+10%) (mm/hr)	Discharge to Hydrobrake (L/s)	Net flow (L/s)	Flow to Storage (L/s)	Storage Vol Required (m^3)	
5 mins	5	13.4	160.80	176.88	61.30	2167.52	2106.22	631.87	
10 mins	10	18.7	112.20	123.42	61.30	1512.41	1451.11	870.67	
15 mins	15	22	88.00	96.80	61.30	1186.20	1124.90	1012.41	
30 mins	30	27.2	54.40	59.84	61.30	733.29	671.99	1209.58	
1 hour	60	33.6	33.60	36.96	61.30	452.91	391.61	1409.81	
2 hour	120	41.5	20.75	22.83	61.30	279.70	218.40	1572.49	
3 hour	180	47	15.67	17.23	61.30	211.18	149.88	1618.71	max
4 hour	240	51.3	12.83	14.11	61.30	172.88	111.58	1606.69	
6 hour	360	58.1	9.68	10.65	61.30	130.53	69.23	1495.31	
9 hour	540	65.8	7.31	8.04	61.30	98.55	37.25	1206.92	
12 hour	720	71.9	5.99	6.59	61.30	80.77	19.47	840.90	
18 hour	1080	81.4	4.52	4.97	61.30	60.96	-0.34	-22.18	
24 hour	1440	88.8	3.70	4.07	61.30	49.87	-11.43	-987.17	
2 days	2880	100.1	2.09	2.29	61.30	28.11	-33.19	-5735.14	

2.8 Attenuation

The attenuation system is sized using extreme rainfall data obtained from MET EIREANN for a 1% AEP event and with no infiltration to the surrounding subsoil due to the ground type. Attenuation volumes required for the various storm durations were calculated using information gathered from Irishsuds.com, Met Eireann extreme rainfall figures and a surface water attenuation system design spreadsheet. The rainfall data has been factored by 10% to allow for climate change, detailed calculations can be found in the previous section of this report – section 2.7.

A concrete underground tank storage system has been selected to provide the required volume for the 1% AEP event. The concrete tanks were selected due to the presence of a high water table and possible issues with sealing an underground attenuation system with an impermeable membrane to prevent it from been inundated with ground water.

Also refer to the below summary table 2.3. These indicate that the proposed development will require approximately 4682.57m³ of attenuation volume for the 1% AEP event, refer to Section 2.7 for calculations.

	Total Area	Impermeable Area (m^2)			Total Imp. Area	Storage required	Max Allowable Discharge	Attenuation System
		Roofs & Driveways	Roads & footpaths	Carpark bays				
Catchment 1	63725	14007	10251	1888	26146	965.49	35.76	1
Catchment 2	106479	33634.5	16750.5	2050	52435	2098.37	59.76	2
Catchment 3	109208	23796.5	16856	3462.5	44115	1618.71	61.30	3
Whole Site	279412	71438	43857.5	7400.5	122696	4682.57	156.82	

Table 2.3 – Attenuation Volume details

2.9 Attenuation Volumes

The below table shows the details of the proposed attenuation systems. As mentioned above the attenuation volumes required for the various storm durations were calculated using information from Met Eireann extreme rainfall figures and the proposed impermeable areas. The tank details shown in Table 2.4 were issued to JBA where they were entered into the Microdrainage software for the flood simulation modelling. The results of the modelling are located in JBA's report 2018s900 which is issued as a separate document to this report. To summarise, from JBA's report it can be concluded that there is sufficient capacity available in the proposed attenuation systems to handle a 1% AEP rainfall event with minimum 30% additional capacity available if required. The larger volume between JOR's & JBA's has been adopted for the attenuation volume for each attenuation system – (highlighted in yellow in table 2.4). The highest 1% AEP water level between JOR's & JBA's has been adopted for the T.W.L for each attenuation system – (highlighted in blue in table 2.4).

	Attenuation System		
	1	2	3
Downstream MH Cover Level	102.000	99.800	98.400
Concrete Tank Invert level	99.050	97.650	96.200
Concrete Tank Depth (m)	1.725	1.675	1.700
Concrete Tank Area (m^2)	1160	2114	1400
Concrete Tank Length (m)	52.00	211.00	125.80
Concrete Tank Width (m)	22.300	7m & 14m	11.260
JOR Storage Required (m^3)	965	2098	1619
JOR 1% AEP Water Level	99.881	98.642	97.356
JBA Storage Required (m^3)	1156.5	1748.3	1352.4
JBA 1% AEP Water Level	100.047	98.477	97.166

Table 2.4 – Attenuation System details

2.10 SUDS

The proposed developments drainage system has also been designed in accordance with the principles of Sustainable Urban Drainage Systems (SUDS) and in compliance with the principles outlined in the Greater Dublin Strategic Drainage Study. The following SUDS components were identified as being suitable to manage the stormwater from the proposed site:

- Reduce pollution impact

- Reduce stormwater runoff
- Attenuate stormwater runoff
- Replicate the natural characteristics of rainfall runoff for the site

To have an effective stormwater system the objectives of the “Treatment Train Concept” were integrated into the proposed stormwater system where possible. Below is the list of the four objectives and where they are implemented into the proposed stormwater system:

1. Pollution prevention
2. Source control
3. Site Control
4. Reginal Control

The above objectives are implemented as SUDS features where possible as follows:

1. All private driveways to be constructed in permeable paving with infiltration trenches which provides interception, treatment storage & infiltration.
2. Infiltration swales & filtration trenches to be installed alongside roads in green areas where suitable to provide infiltration & treatment of run-off – Refer to surface water layout drawings J18-01-012-3 & J18-01-013-3
3. Attenuation Storage provided within an online storage system to provide treatment of run-off.
4. A suitable bypass separator will be installed upstream of each inlet to the attenuation systems

The incorporation of the above SUDS elements will provide a sustainable manner in which to disperse the surface water from the proposed development and will encourage groundwater recharge and provide treatment of runoff and subsequent improvement of discharge quality.

2.11 Interception Volume

To prevent pollutants or sediments discharging into water courses the GDSDS requires ‘interception storage’ to be incorporated into the development. This interception storage is designed to receive the run-off for rainfall depths of 5mm or less. The permeable paving in the proposed private driveways along with the proposed swales & filtration trenches will

provide a combined interception volume of 1696.99m³. The interception storage required for the whole site is 613.48m³. See below table 2.5 showing the breakdown of the catchment areas, SUDS features and required/supplied volumes of treatment storage.

Surface Water Source	SUDS Feature	Impermeable Area (m^2)	Volume of treatment Storage required (first 5mm)	Volume of treatment Storage Provided (m^3)	Total Volume of Storage required	Total Storage Provided
Catchment 1						
Roofs & Driveways	Driveway Infiltration	14007	70.04	369.9	**70.04**	**369.9**
Public Areas						
Roads/Footpaths/Parking Bays		12139	60.70	N/A		
	Swales/Infiltration trenches	N/A	N/A	51.97		
	Swales	N/A	N/A	35.2	**60.70**	**87.17**
Catchment 2						
Roofs & Driveways	Driveway Infiltration	33634.5	168.17	671	168.17	671.00
Public Areas						
Roads/Footpaths/Parking Bays		18800	94.00	N/A		
	Infiltration trenches	N/A	N/A	61.12		
	Swales	N/A	N/A	92.7	**94.00**	**153.82**
Catchment 3						
Roofs & Driveways	Driveway Infiltration	23796.5	118.98	280.8	118.98	280.8
Public Areas						
Roads/Footpaths/Parking Bays		20318.5	101.59	N/A		
	Infiltration trenches	N/A	N/A	60.70		
	Swales	N/A	N/A	32.6		
	Swales (Green Area)	N/A	N/A	41	**101.59**	**134.30**
				Totals	**613.48**	**1696.99**

Table 2.5 – Treatment Storage Table

2.12 Design Standards

All services have been designed in accordance with the department of Environment 'Recommendations for site development works for Housing Areas'. The drainage network has been designed to cater for 100 year storms and for 10% additional increase for climate change for each pipe run. The following parameters apply:

- All access roads, hard-standing, parking and footpaths assumed to be 100% impermeable
- Landscaped areas and open space are not assumed to be contributing
- All roofs assumed to be 100% impermeable
- Return period 30 years
- Time of entry 5 minutes
- Pipe Friction 0.6mm
- Minimum velocity 1.0m/s

- Standard Average Annual Rainfall 863mm
- M5-60 15.5mm
- Ratio r 0.272
- Climate Change 10% for rainfall intensities

Surface water sewers have been designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).
Refer to drawing J18-001-012 & J18-001-013 for the proposed surface water for the development.

2.13 Climate Change

Surface water calculation for the proposed development made use of rainfall values provided by Met Eireann. Rainfall intensities were increased by a factor of 10% to take account of climate change, as required by the GDSDS for attenuation storage design.

3.0 Foul Drainage Design

3.1 Existing Foul Sewer

There are two existing foul pump stations (located near the site) and two existing 225mm dia gravity sewers located on the proposed site. The existing 225mm gravity sewer is in two sections, one section is gravitating southwards towards the R147 pumping station and the second section gravitates northwards through the adjacent land situated north of the site and to an existing pump station located north of the Lagore Road. It is proposed to connect the new development into the existing 225mm gravity sewers at various locations. The discharge from the proposed development will then gravitate to the existing pump stations.

Figure 3.1

Figure 3.2 - Layout of existing 225mm gravity sewer through proposed development

3.2 Proposed Foul Layout

It is proposed to discharge the wastewater from the proposed development into the existing 225mm gravity sewer main which runs through the proposed site. This gravity sewer was installed a number of years ago and discharges into two waste water pumping stations, one located adjacent to the development site on the R147 and the second located along Lagore Road which is north of the proposed site – Refer to Figure 3.1 & 3.2 above. The proposed foul layout will tie into the existing 225mm gravity sewers at several different locations. See Foul Layout drawing C002 for further information.

Due to the layout of the existing gravity sewer and the site, the proposed foul system is made up of 5 separate foul networks and 8 localised connections (collector systems) to the existing 225mm gravity sewer – Refer to sketch below. Foul Network 1 (286 units) will discharge into a new manhole located on the existing 225mm R147 gravity sewer. Foul Network 2 (162 units) will service the northern section and this will discharge into the existing 225mm gravity sewer at existing manhole EX.FMH 1 which gravitates to the Lagore pumping station. Foul Network 3 (44 units) will discharge into an existing manhole EX.FMH11 which gravitates to the R147 pumping station. Foul network 4 (66 units) discharges in to the previously installed Phase 1A & 1B foul network at foul manhole F.A-13 which gravitates to the R147 pumping station. Foul Network 5 will service 210 units, a crèche, café, retail unit, community facility, medical centre and gym. Due to existing levels this system will gravitate to a pumping station and then be pumped via a rising main to a rising main discharge manhole which will then discharge by gravity sewer to new foul manhole 17 which will be installed on the existing 225mm gravity foul main. The localised connections or collector mains will be installed adjacent to new buildings that are near the existing 225mm gravity foul main. To minimize disturbance/damage to the existing foul main the collector mains will discharge into existing manhole chambers only.

See Foul Layout drawing J18-01-010-A (Foul Sheet 1) and J18-01-011-A (Foul Sheet 2) for further clarification.

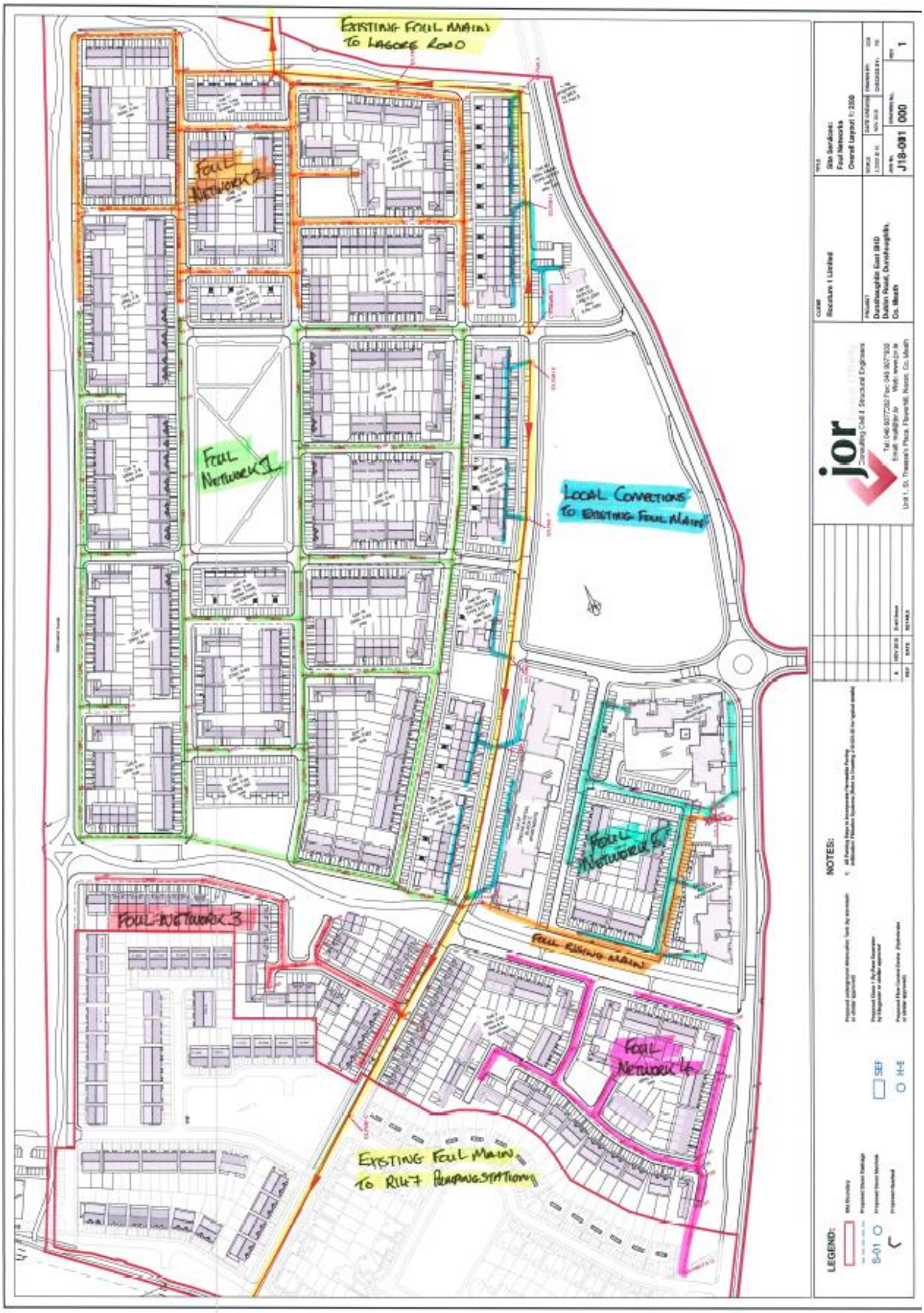


Figure 3.3 - Layout of proposed foul networks

3.3 Proposed Foul Volumes

The current proposal consists of 913 no. residential units, along with a neighborhood center retail area, a community facility, a café, a crèche, a gym and a medical centre. A breakdown of these units is in the below table. From Appendix D in the Irish Water Code of Practice for Wastewater, wastewater design flow rates have been applied to each person. The first foul discharge demand table (Table 3.1) is for the discharge to the R147 pumping station. The second foul discharge table (Table 3.2) is for the discharge to the Lagore Road pumping station.

R147 Pumping Station - Foul Discharge Demand Table

	No. Of Units	Occupancy	l/person/day	Daily Flow (l)	Average Flow Litres /sec **DWF**	Peak Flow Litres /sec **1.25 x DWF Average Flow**	Peak Flow Litres /sec **(6xDWF) For pipe sizing only**
Southern Section							
Foul Network 1	286	2.7	150	115830	1.34	1.68	8.04
Foul Network 3	44	2.7	150	17820	0.21	0.26	1.24
Foul Network 4	65	2.7	150	26325	0.30	0.38	1.83
Foul Network 5	210	2.7	150	85050	0.98	1.23	5.91
Local Connections	92	2.7	150	37260	0.43	0.54	2.59
Creche	1	180	50	9000	0.10	0.13	0.63
Staff	1	20	60	1200	0.01	0.02	0.08
Retail x 2 Staff	1	8	60	480	0.01	0.01	0.03
Café	1	300	15	4500	0.05	0.07	0.31
Staff	1	10	60	600	0.01	0.01	0.04
Community Facility	1	50	40	2000	0.02	0.03	0.14
Staff	1	4	60	240	0.00	0.00	0.02
Medical Centre/Gym	1	100	50	5000	0.06	0.07	0.35
Staff	1	10	60	600	0.01	0.01	0.04
TOTAL				**305905**	**3.54**	**4.43**	**21.24**

NOTE: The peak demand for foul is 1.25 times the average flow as stated in Section 3.7.2 of Irish Water Code of Practice

Table 3.1

Lagore Road Pumping Station - Foul Discharge Demand Table

	No. Of Units	Occupancy	l/person/day	Daily Flow (l)	Average Flow Litres /sec **DWF**	Peak Flow Litres /sec **1.25 x DWF Average Flow**	Peak Flow Litres /sec **(6xDWF) For pipe sizing only**
Northern Section (Foul Network 2)	162	2.7	150	65610	0.76	0.95	4.56
Local Connections	54	2.7	150	21870	0.25	0.32	1.52
TOTAL				**87480**	**1.01**	**1.27**	**6.08**

NOTE: The peak demand for foul is 1.25 times the average flow as stated in Section 3.7.2 of Irish Water Code of Practice

Table 3.2

3.4 Foul Pumping Station

Due to existing ground levels, proposed levels and the levels of the existing 225mm gravity foul main, a pumping station is required in the southern section of the development around Block B apartments. Foul network 5 will discharge into the pumping station only. The only suitable location available where a 15m buffer zone from the nearest residential unit (Irish Water requirement for type 3 pumping station) could be achieved is between Block A & Block B apartments. The pumping station has been designed to cater for 147 residential units – Refer to Appendix G for Molloy Precast design report.

3.5 Design Calculations

All proposed foul sewers are designed to discharge by gravity. Minimum gradients and pipe diameters for collector and main sewers are designed in accordance with Irish Water Code of Practice for Wastewater, the Building Regulations and in accordance with the principles and methods set out in the DOE “Recommendations for Site Development Works for Housing Areas”, BS8301: 1985, IS EN752 (2008), IS EN12056: Part 2 (2000) and the recommendations of the ‘Greater Dublin Strategic Drainage Study’.

3.6 Irish Water Design Acceptance

Following on from the pre-planning application the proposed foul layout and details were submitted to Irish Water for design acceptance. After revising the layout as per Irish Water recommendations a statement of Design Acceptance was received on the 07/11/2018. Refer to Appendix D for design acceptance statement.

4.0 Water Supply and Distribution

4.1 Existing Watermain

During Phase 1A & 1B of The Willows development a connection was made to the existing 200mm public watermain in the R147 road. A 200mm tee was installed with a 200mm watermain installed into the site. Located after the bulk/flow meter is a tee and valve set up – See below. A branch was connected to the tee to supply Phase 1A & 1B. For phase 1C it is proposed to extend the 200mm watermain from the valve to the northern boundary of phase 1C.

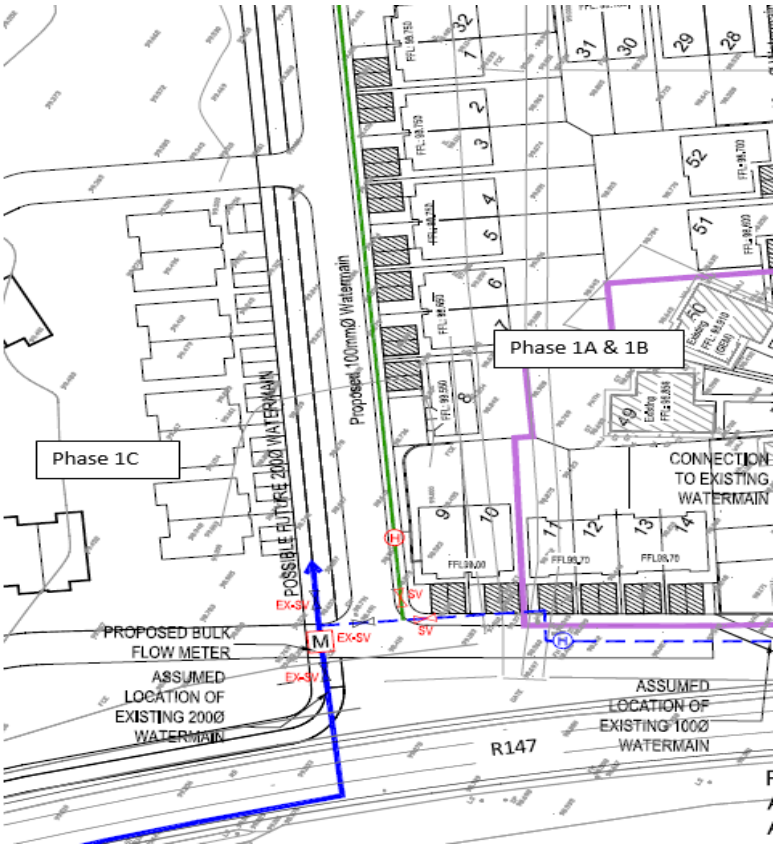


Figure 4.1

4.2 Proposed Watermain Layout

It is proposed to connect to the 200mm watermain installed during phase 1C and extend it through the SHD site to the northern site boundary where it will be terminated in such a way that future connection can be made to link to the water main on the Lagore Road.

It is proposed to connect 100mm branches to the 200mm water main at various locations to service the different areas within the SHD development. Each one of these 100mm branches will be looped or will terminate with a loop as per Irish Water Code of Practice. There will be 1 x 150mm branch connected to the proposed 200mm watermain and this will service the proposed neighborhood development centre and a possible future connection. Refer to drawings J18-001-016, J18-001-017 & J18-001-018 for proposed water main layout.

The maximum daily water demand is 393,385 l/day – See below water demand table 4.1

Water Demand Table

	No. Of Buildings	Occupancy No.	l/person/day	Daily Flow (l)	Average Flow Litres /sec	Peak Flow Litres /sec **1.25 x Average Flow**	**For pipe sizing only (5xDWF)**
Southern Section							
Proposed Development	913	2.7	150	369765	4.280	5.350	21.398
Creche	1	180	50	9000	0.104	0.130	0.521
Staff	1	20	60	1200	0.014	0.017	0.069
Retail x 2 Staff	1	8	60	480	0.006	0.007	0.028
Café	1	300	15	4500	0.052	0.065	0.260
Staff	1	10	60	600	0.007	0.009	0.035
Community Facility	1	50	40	2000	0.023	0.029	0.116
Staff	1	4	60	240	0.003	0.003	0.014
Medical Centre/Gym	1	100	50	5000	0.058	0.072	0.289
Staff	1	10	60	600	0.007	0.009	0.035
TOTAL				**393385**	**4.55**	**5.69**	**22.765**

NOTE: The peak demand for water is 1.25 times the average flow as stated in Section 3.7.2 of Irish Water Code of Practice

Table 4.1

Water works for the proposed development shall be in accordance with Irish water connections and developer service code of practice for water infrastructure (A Design and Construction Guide for Developers).

4.3 Watermain SHD Requirements

To satisfy requirements for the pre-planning application Irish Water have issued a "Confirmation of Feasibility" statement (See Appendix C) confirming capacity for the proposed SHD. Prior to the submission of the full planning application the proposed watermain design and layout will be approved by Irish water and the developer will enter

into a “Project Works Services Agreement” with Irish Water to assist in carrying out investigation works stated in the Confirmation of Feasibility

4.4 Irish Water Condition A – Statement of Design Acceptance

Following on from the pre-planning application the proposed watermain layout and details were submitted to Irish Water for design acceptance. After revising the layout as per Irish Water recommendations a statement of Design Acceptance was received on the 07/11/2018. Refer to Appendix D for design acceptance statement.

4.5 Irish Water – Investigation work agreement condition

As stated in the Confirmation of Feasibility from Irish Water, investigation work and possible upgrade of existing water main may be required where it shows a break in the existing water main along the R147. This has been confirmed by email that this will be resolved as part of the connection agreement with Irish Water - Refer to Appendix E of this report for the email confirmation.

5.0 Appendix A – Met Eireann Rainfall Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 297250, Northing: 251296,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.5,	4.1,	4.9,	5.4,	5.8,	7.2,	8.7,	9.7,	11.2,	12.4,	13.4,	14.9,	16.1,	17.0,	N/A ,
10 mins	3.5,	4.9,	5.7,	6.8,	7.5,	8.1,	10.0,	12.2,	13.6,	15.6,	17.3,	18.7,	20.8,	22.4,	23.7,	N/A ,
15 mins	4.1,	5.8,	6.7,	8.0,	8.9,	9.6,	11.8,	14.3,	16.0,	18.3,	20.4,	22.0,	24.4,	26.3,	27.9,	N/A ,
30 mins	5.5,	7.5,	8.6,	10.3,	11.4,	12.2,	14.9,	18.0,	20.0,	22.8,	25.3,	27.2,	30.1,	32.3,	34.2,	N/A ,
1 hours	7.2,	9.8,	11.2,	13.2,	14.6,	15.6,	18.9,	22.6,	25.1,	28.4,	31.3,	33.6,	37.0,	39.7,	41.9,	N/A ,
2 hours	9.6,	12.8,	14.5,	17.0,	18.7,	20.0,	24.0,	28.5,	31.4,	35.4,	38.9,	41.5,	45.6,	48.7,	51.3,	N/A ,
3 hours	11.3,	15.0,	16.9,	19.7,	21.6,	23.0,	27.6,	32.6,	35.8,	40.2,	44.1,	47.0,	51.5,	54.9,	57.7,	N/A ,
4 hours	12.6,	16.7,	18.9,	21.9,	24.0,	25.5,	30.4,	35.8,	39.3,	44.0,	48.2,	51.3,	56.1,	59.8,	62.8,	N/A ,
6 hours	14.9,	19.6,	22.0,	25.4,	27.7,	29.4,	35.0,	41.0,	44.8,	50.1,	54.6,	58.1,	63.4,	67.4,	70.7,	N/A ,
9 hours	17.5,	22.8,	25.6,	29.5,	32.0,	34.0,	40.2,	46.9,	51.1,	56.9,	62.0,	65.8,	71.6,	76.0,	79.6,	N/A ,
12 hours	19.7,	25.5,	28.5,	32.7,	35.5,	37.6,	44.3,	51.5,	56.1,	62.4,	67.8,	71.9,	78.0,	82.7,	86.5,	N/A ,
18 hours	23.2,	29.8,	33.1,	38.0,	41.1,	43.5,	50.9,	58.9,	64.0,	70.9,	76.9,	81.4,	88.1,	93.3,	97.4,	N/A ,
24 hours	26.0,	33.3,	36.9,	42.1,	45.5,	48.1,	56.2,	64.8,	70.3,	77.7,	84.0,	88.8,	96.1,	101.5,	106.0,	121.0,
2 days	32.6,	40.8,	44.9,	50.7,	54.4,	57.2,	65.9,	75.1,	80.8,	88.6,	95.2,	100.1,	107.6,	113.1,	117.7,	132.8,
3 days	38.1,	47.1,	51.5,	57.8,	61.8,	64.8,	74.0,	83.8,	89.8,	97.9,	104.8,	110.0,	117.7,	123.4,	128.1,	143.6,
4 days	43.0,	52.7,	57.4,	64.1,	68.3,	71.5,	81.3,	91.5,	97.8,	106.3,	113.5,	118.8,	126.7,	132.7,	137.5,	153.5,
6 days	51.7,	62.6,	67.9,	75.3,	80.0,	83.5,	94.1,	105.2,	112.0,	121.1,	128.8,	134.4,	142.9,	149.1,	154.2,	171.0,
8 days	59.6,	71.6,	77.3,	85.3,	90.4,	94.1,	105.6,	117.4,	124.6,	134.3,	142.3,	148.3,	157.2,	163.8,	169.1,	186.6,
10 days	67.0,	79.9,	86.0,	94.6,	99.9,	103.9,	116.1,	128.6,	136.2,	146.3,	154.8,	161.1,	170.3,	177.2,	182.7,	200.9,
12 days	74.0,	87.7,	94.2,	103.3,	109.0,	113.2,	126.0,	139.1,	147.1,	157.6,	166.4,	173.0,	182.6,	189.7,	195.4,	214.2,
16 days	87.1,	102.4,	109.6,	119.5,	125.8,	130.4,	144.3,	158.5,	167.1,	178.5,	187.9,	194.9,	205.2,	212.7,	218.8,	238.7,
20 days	99.5,	116.1,	123.9,	134.7,	141.4,	146.4,	161.4,	176.5,	185.7,	197.8,	207.8,	215.2,	226.0,	234.0,	240.4,	261.3,
25 days	114.2,	132.4,	140.9,	152.6,	159.9,	165.2,	181.3,	197.6,	207.4,	220.3,	230.9,	238.8,	250.2,	258.7,	265.4,	287.5,

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

6.0 Appendix B – Infiltration Test Results

INFILTRATION RATE TESTING

Per

BRE Digest 365 TEST METHOD

Applicant: Rockture One Limited

Site Location: 'Proposed Strategic Housing Development at Dunshaughlin East'

DATE OF REPORT: 12th February 2018

Prepared by

HYDROCARE ENVIRONMENTAL LTD

HYDROCARE ENVIRONMENTAL LTD

Environmental Consultants
Cooperhill Rd., Beamore,
Drogheda, Co. Meath

Tel: 0419842378

Email: info@hydrocareenvironmental.ie

HCE Ref: 18-030

Joseph O'Reilly Engineer
Unit 1,
St. Therese's Place,
Flowerhill,
Navan, Co. Meath

12th February 2018

FAO: Joseph O'Reilly, Engineer

Applicant: Rockture One Limited
Site Location: 'Proposed Strategic Housing Development at Dunshaughlin East'

Infiltration testing was carried out on 17th January 2018 at the above location per BRE digest 365 method. Results of testing are summarised below for your information.

Test Hole No.	*Depth of Hole [mBGL]*	*Water Table Level [mBGL] (N/A if not encountered)*	*Bedrock Level [mBGL] (N/A if not encountered)*	*Infiltration Rate [m/s]*
1	1.50	1.80	n/a	1.18E-07
2	1.50	1.70	n/a	1.32E-07
3	1.50	0.85	n/a	-2.29E-07
4	1.50	n/a	n/a	2.25E-07

Further information relating to specific test details are appended herewith for your information.

Yours sincerely,

Daniel Nolan, BA BAI, Msc Environmental Engineering, FETAC Site Assessor, MIEI

Hydrocare Environmental Ltd. - **BRE365 Design Calculations**

CLIENT:	**Rockture One Limited**
LOCATION:	'Proposed Strategic Housing Development at Dunshaughlin East'
TEST HOLE NO.:	**1**

Infiltration Rate

Test Hole Information:	
Length (m)	1.20
Width (m)	0.30
Depth of hole (m)	1.50
Water filled to (mBGL)	0.30
Water Table (mBGL)	1.80
Base of Test (mBGL)	1.50
Bedrock (mBGL)	n/a
Drop Time (min)	14173

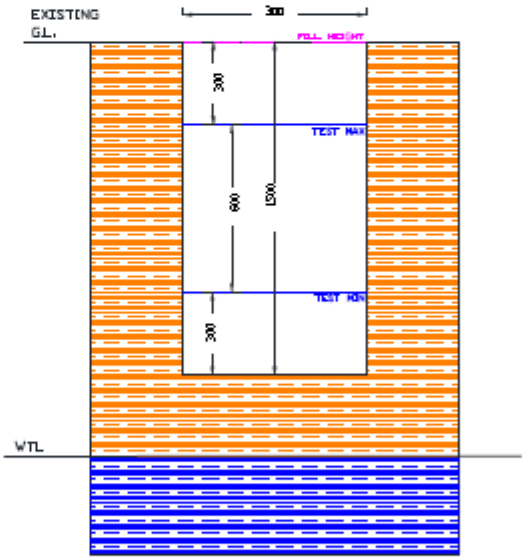
$V_{p75-25} = 1.2 \times 0.3 \times (0.9 - 0.3) = 0.216\ m^3$

$A_{p50} = (1.2 \times 0.6 \times 2) + (0.3 \times 0.6 \times 2) + (1.2 \times 0.3) = 2.16\ m^2$

$f = \frac{0.216}{2.16 \times 14173.2283464567 \times 60} = 1.18E\text{-}07\ m/s$

estimated finish following 24 hour monitoring... very slow percolation

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 17th January 2018
Client: Rockture One Limited
Location: 'Proposed Strategic Housing Development at Dunshaughlin East'

Unit 1, St. Therese's Place, Flowerhill, Navan, Co Meath.
Phone: 046-9077032 Fax: 046 9077932, e-mails: mail@jor.ie

Hydrocare Environmental Ltd. - **BRE365 Design Calculations**

CLIENT:	**Rockture One Limited**
LOCATION:	'Proposed Strategic Housing Development at Dunshaughlin East'
TEST HOLE NO.:	**2**

Infiltration Rate

Test Hole Information:	
Length (m)	1.10
Width (m)	0.35
Depth of hole (m)	1.50
Water filled to (mBGL)	0.35
Water Table (mBGL)	1.70
Base of Test (mBGL)	1.50
Bedrock (mBGL)	n/a
Drop Time (min)	13583

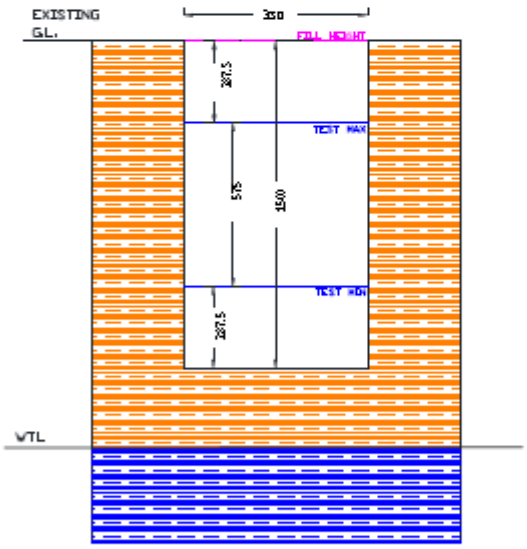
$V_{75-25} = 1.1 \times 0.35 \times (0.8625 - 0.2875) = 0.221375\ m^3$

$A_{50} = (1.1 \times 0.575 \times 2) + (0.35 \times 0.575 \times 2) + (1.1 \times 0.35) = 2.0525\ m^2$

$f = \frac{0.221375}{2.0525 \times 13582.6771653543 \times 60} = 1.32E\text{-}07\ m/s$

estimated finish following 24 hour monitoring .. very slow percolation

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 17th January 2018
Client: Rockture One Limited
Location: 'Proposed Strategic Housing Development at Dunshaughlin East'

Hydrocare Environmental Ltd. - **BRE365 Design Calculations**

CLIENT:	**Rockture One Limited**
LOCATION:	'Proposed Strategic Housing Development at Dunshaughlin East'
TEST HOLE NO.:	**3**

Infiltration Rate

Test Hole Information:	
Length (m)	1.20
Width (m)	0.30
Depth of hole (m)	1.50
Water filled to (mBGL)	0.35
Water Table (mBGL)	0.85
Base of Test (mBGL)	0.85
Bedrock (mBGL)	n/a
Drop Time (min)	-5906

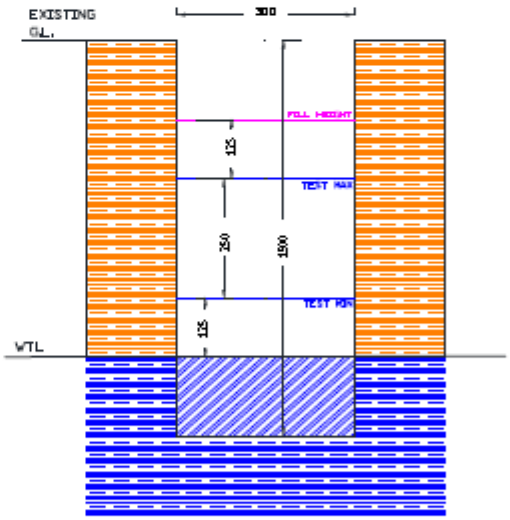
Note: Base of test is bottom of test hole unless water table is encountered

$V_{75\%-25\%}$ = 1.2 x 0.3 x (0.375 - 0.125) = 0.09 m^3

A_{p50} = (1.2 x 0.25 x 2) + (0.3 x 0.25 x 2) + (1.2 x 0.3) = 1.11 m^2

$$f = \frac{0.09}{1.11 \times -5905.51181102362 \times 60} = -2.29E\text{-}07 \text{ m/s}$$

water level increased during test, hence negative estimated end time following 24 hrs..
Very slow percolation



BRE 365 TEST HOLE

Date: 17th January 2018
Client: Rockture One Limited
Location: 'Proposed Strategic Housing Development at Dunshaughlin East'

Hydrocare Environmental Ltd. - **BRE365 Design Calculations**

CLIENT:	**Rockture One Limited**
LOCATION:	'Proposed Strategic Housing Development at Dunshaughlin East'
TEST HOLE NO.:	4

Infiltration Rate

Test Hole Information:	
Length (m)	1.30
Width (m)	1.00
Depth of hole (m)	1.50
Water filled to (mBGL)	0.60
Water Table (mBGL)	n/a
Base of Test (mBGL)	1.50
Bedrock (mBGL)	n/a
Drop Time (min)	12844

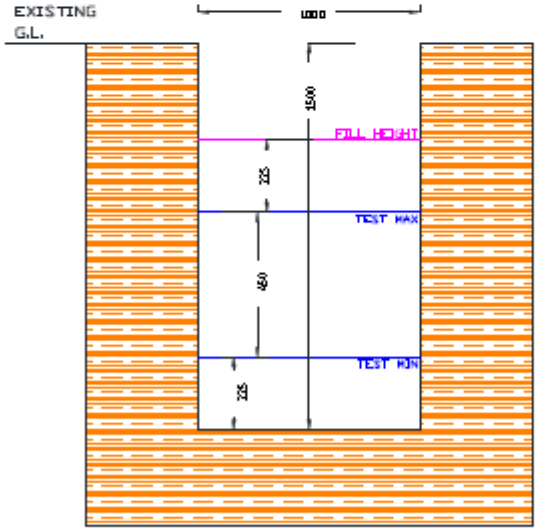
V_{75-25} = 1.3 x 1 x (0.675 - 0.225) = 0.585 m^3

A_{50} = (1.3 x 0.45 x 2) + (1 x 0.45 x 2) + (1.3 x 1) = 3.37 m^2

$$f = \frac{0.585}{3.37 \times 12844.4881889764 \times 60} = 2.25E\text{-}07 \ m/s$$

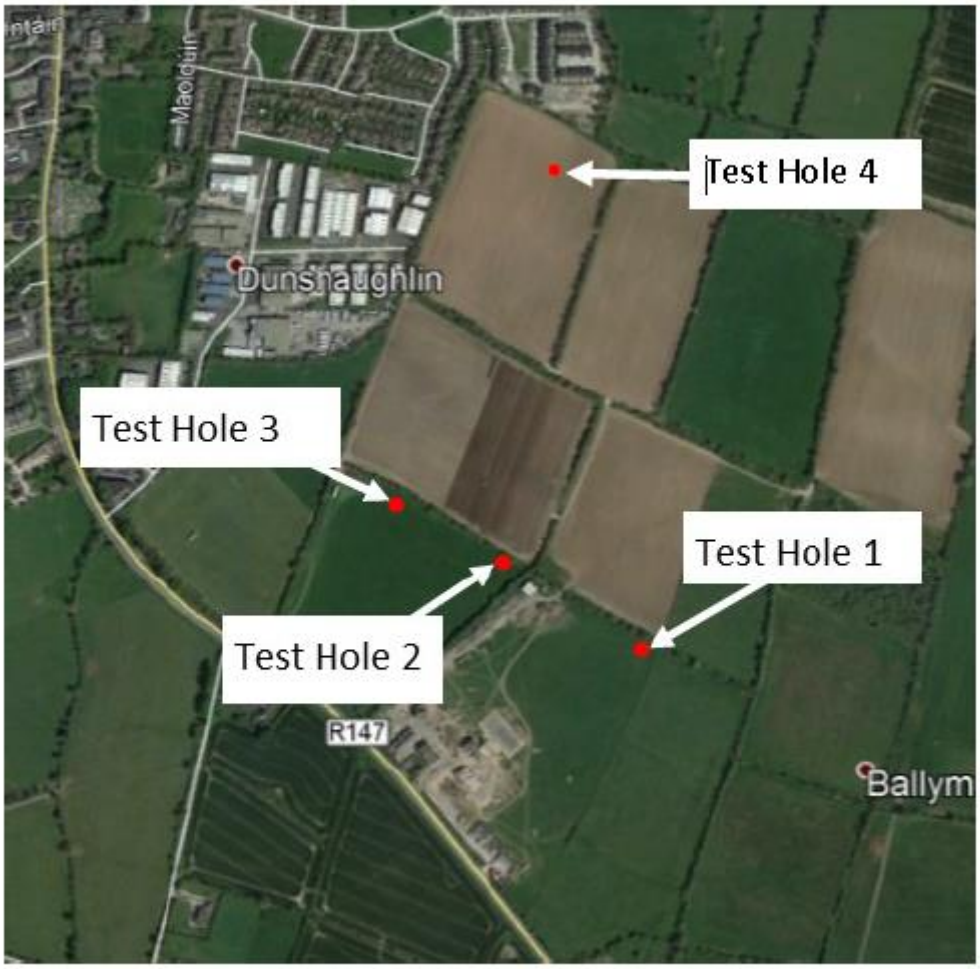
estimated finish following 24 hour monitoring.. very slow percolation

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 1st February 2018
Client: Rockture One Limited
Location: 'Proposed Strategic Housing Development at Dunshaughlin East'



Unit 1, St. Therese's Place, Flowerhill, Navan, Co Meath.
Phone: 046-9077032 Fax: 046 9077932, e-mails: mail@jor.ie

7.0 Appendix C – Confirmation of Feasibility from Irish Water

Joesph O'Reilly
JOR Consultants
Unit 1
St. Therese's Place,
Flower Hill,
Navan,
Co. Meath

Letter Ref: CUSTO180157

Uisce Eireann
Bosca OP 860
Oifig Sheachadta
na Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 860
South City
Delivery Office
Cork City

www.water.ie

14/02/2018

Dear Sir/Madam,

Re: 3522128496 pre-connection enquiry – Subject to contract | Contract denied
Water and wastewater connections for 844 residential units at Willows, Dunshaughlin, Co. Meath

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at **Willows, Dunshaughlin, Co. Meath** (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place and the conditions listed below, your proposed connection to the Irish Water network can be facilitated.

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

A. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.
B. You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed and appropriate connection fee paid at a later date.
C. In advance of submitting this development to An Bord Pleanala for full assessment, the Developer is required to have entered into a Project Works Services Agreement to deliver an investigation to confirm the available capacity in the water network and to determine the full extent of any upgrades which may be required to be completed to Irish Water infrastructure.

Wastewater: There is adequate capacity in the local wastewater network to cater for this development.There is adequate capacity in wastewater treatment plant to cater for this development.

Water: Irish Water's GIS shows a reduction in watermain size from 200mm DI to 100mm DI size for 4 meters on the R147 local to the proposed development. An investigation is required to determine if this break exists. The developer shall pay for this investigation and shall pay for the upsizing of the 4 meters of 100mm to 200mm DI watermain. There is adequate capacity in the water treatment plant to cater for this development.

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

Should you wish to have any of the above progressed by Irish Water or if you have any further questions, please contact Pat O'Neill from the design team on 018925250 or email patoneil@water.ie For further information, visit **www.water.ie/connections**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

8.0 Appendix D – Irish Water Design Acceptance

Letter Ref: CDSSDA1

Joesph O'Reilly Consulting Civil & Structural Engineers,
Unit 1,
St Therese's Place,
Flowerhill,
Navan,
Co. Meath

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

Irish Water
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

07 November 2018

Re: Design Submission for (Phase 2 & 3, The Willows, Dunshaughlin, Co. Meath)(the "Development")(the "Design Submission")/Customer Reference No. 3522128496

Dear Joe,

Many thanks for your recent Design Submission.

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

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to an our network you must sign a connection agreement with Irish Water.This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

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

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

Name: Aidan Tierney
Phone: 022 52257
Email: aitierney@water.ie

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services

Appendix A

Document Title & Revision

1. *DRG Foul Water Management Sheet 1: J18-001-010-2*
2. *DRG Foul Water Management Sheet 2: J18-001-011-2*
3. *DRG Master Watermain Layout: J18-001-014-2*
4. *DRG Watermain Layout Sheet 1: J18-001-015-2*
5. *DRG Watermain Layout Sheet 2: J18-001-016-2*

Standard Details/Code of Practice Exemption:

N/A

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

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

9.0 Appendix E – Email confiration from Irish Water

Damien O'Brien

From: Damien O'Brien <damien@jor.ie>
Sent: 18 December 2018 14:22
To: damien@jor.ie
Subject: FW: SHD Development in Dunshaughlin

From: Patrick O'Neill [mailto:patoneil@water.ie]
Sent: 29 August 2018 10:42
To: 'Joseph O'Reilly'; LA_daoreilly
Cc: Chris Smith
Subject: RE: SHD Development in Dunshaughlin

Hi Joe,

Apologies for the delay, our COF still stands, the work required for this upgrade is minimal and will be resolved as part of the connection agreement with Irish Water. Any queries ABP have regarding this will be communicated back to IW during the SHD process where we will comment.

Thanks,
Pat

Kind Regards
Patrick O'Neill
Design Engineer
Connection & Developers Services - Greater Dublin Region

Uisce Éireann
Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, Éire
Irish Water
Colvill House, 24-26 Talbot Street, Dublin 1, Ireland

T: +353 1 8925250

E: patoneil@water.ie
www.water.ie

10.0 Appendix F - Manhole Schedules & Longsections

Refer to the below documents that will be issued as separate documents to this report:

- Document no. WS-03 - Foul Longsections and manhole schedules
- Document no. WS-04 - Storm Longsections and manhole schedules

11.0 Appendix G – Foul Pumping Station Details

MOLLOY
ENVIRONMENTAL SYSTEMS

MES2238_Report_101218

1. Introduction

This report details a proposal for the installation of a foul water pump sump for a housing development in Dunshaughlin, Co. Meath. This pump sump is designed as per part 5 of the Irish Water Code of Practice for wastewater infrastructure, IW-CDS-5030-03, December 2017.

2. Design Criteria

The design conditions are as following:

Hydraulic load:	60m³/day
Rising main length:	213m (estimated)
Static head:	6.5m (estimated)
Total Head:	10.6m
Flow rate:	8l/s
Rising main:	110mm SDR17 HDPE
Inlet pipe:	225mm
Inlet invert:	2.5m below ground level (estimated)

3. Proposed Tankage

This proposal consists of approximately 74,500 litres of emergency storage (>24hr capacity), which is made up of two holding tanks and a pump sump. In general, day-to-day operation influent enters the pump sump and is pumped via the rising main into the receiving sewer line. Flow is prevented from entering the holding tanks by flap valves. In the event of power or equipment failure the pump sump overflows into the holding tanks. When the system returns to normal operation flow moves from the holding tanks into the pump sump via the flap valve by gravity. A summary of the tankage is as follows:

- 1 no. precast concrete pump sump
- 2 no. precast concrete holding tanks
- 1 no. precast concrete valve chamber
- 1 no. precast concrete meter chamber

Calculations will need to be carried out to determine if anti-buoyancy measures are required.

3.1. Pump sump

The pump sump should follow the following specifications:

- 6m deep 1.9m diameter precast concrete pump sump
- The precast concrete unit shall conform to BS 5911-4 and IS EN 1917. Joints shall provide equivalent water resistance as required in IS EN1992 – Part 3 (2006). The tank joints should be surrounded with not less than 150mm thickness of C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620.

Unit 1, St. Therese's Place, Flowerhill, Navan, Co Meath.
Phone: 046-9077032 Fax: 046 9077932, e-mails: mail@jor.ie

- For odour control a 4-5m ventilation stack is to be connected to the pump sump and holding tank (to be supplied and installed by others)
- The proposed pumps are 2 no. Flygt NP 3085 three phase foul submersible pumps (or similar)
- Pumps to be equipped with an automatic decoupling arrangement complete with twin guide rails, easy lift, etc
- Automatic selection rotation of the duty/standby to be provided on an hours run basis with manual over-ride
- Pumps to be ex rated in accordance to hazardous area classification for foul wastewater
- Pumps to be operated as duty/standby
- The proposed pumps have an 80mm solids passage with Flygt's latest NP technology
- The design should limit the number of starts to 10 per hour
- Pumps to be labelled at the top of pump sump
- Pumps to be equipped with certified stainless-steel lifting chain (IS EN 818-Part 7 (2009), suitably sized, with 8mm thick links and large links at 1m centres
- EN598 ductile iron pipework within the wet well to be bracketed using stainless steel brackets
- Pump motors to be high efficiency with Class F insulation and IP68 rating and meet IE3 efficiency standards and maintained within 15% of maximum efficiency over whole of the specified duty range
- Motors to include stator over temperature protection which automatically re-set when temperature returns to normal
- An ultrasonic level sensor is used to communicate adjustable set points for pump unit cut in and cut out as well as top level liquid level cut in and low-level over-ride cut out to the control panel

3.2. Emergency Overflow and Storage

Separate emergency overflow tanks (holding tanks) are required to create 24 hours emergency storage. This together with the storage above the cut in level is used to create this storage.

- 2 no. precast concrete holding tanks
- A 225mm dia. high level overflow is to be provided
- A 225mm dia. return pipe feeding back to the pump sump fitted with a proprietary non-return valve within the wet well chamber
- Tanks require an underlying reinforced insitu concrete slab and concrete backfilling

3.3. Valve chamber

A separate valve chamber is required and should have the following specifications:

- The precast concrete unit shall conform to BS 5911-4 and IS EN 1917. Joints should be surrounded with not less than 150mm thickness of C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620
- EN598 ductile iron pipework complete with bends, valves, fittings, etc. to link all fittings
- A gate valve for each pump mounted horizontally

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Phone: 046-9077032 Fax: 046 9077932, e-mails: mail@jor.ie

- A non-return valve for each pump mounted horizontally
- A gate valve mounted vertically equipped with a Bauer coupling linked to the rising main for pumping out of the rising main
- The chamber should be equipped with a drain to allow draining of the chamber into the pump sump

3.4. Meter chamber

A separate meter chamber is required and should have the following specifications:

- The precast concrete unit shall conform to BS 5911-4 and IS EN 1917. Joints should be surrounded with not less than 150mm thickness of C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620
- 1 no. magnetic flow meter
- EN598 ductile iron pipework complete with fittings, etc. to link valve chamber to rising main

3.1. Control Kiosk

Control kiosk as per Irish water standard drawing STD-WW-30 rev 1.

Wet kiosk as per Irish water standard drawing STD-WW-30 rev 1 to house health and welfare facilities for plant operatives, including a small wash-hand basin and water heater.

3.1. ESB chamber

A metered (double chamber) galvanised steel kiosk will be provided. A cable between it and the main kiosk will be supplied (<15m).

All consultation and dealing with the ESB by others.

3.2. Safety Equipment

Safety equipment to be provided for controlled and planned safe access to the wet well. Lifting davits and lifting tackle, suitable for safe lifting of the pump installation, shall be provided. This equipment should have a safe working load (SWL) of 500kg. A load testing test certificate should be made available. The manufacturer's name and the SWL of the lifting equipment shall be provided. The equipment should be galvanised mild steel or stainless steel and each component should not weigh more than 35Kg.

3.3. Control Panel

The following will be provided on the main control panel and within the control kiosk

Control panel to be constructed to Form 2 and incorporate the following:

- A hand/off/reverse (with spring return) selector for each pump
- Ammeter and hours run meter for each pump

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Phone: 046-9077032 Fax: 046 9077932, e-mails: mail@jor.ie

- Run light and trip lights for each pump (one for temperature and one for seal failure)
- Reset button for each pump
- Duty/assist selector for each set of pumps
- Lockable door interlock isolators
- A sump level indicator for recording the wastewater surface in the pump sump
- Flow indication – both instantaneous and totalised
- Electrical heater, light 220v and 110v electrical weatherproof socket
- Spare indictor lamp bulbs
- Power meter with volts, power factor, Kw, Kwh, power outage for Kwh, etc displays
- Telemetry system with an UPS as per telemetry section
- 3 phase power supply, to be provided by others
- GSM dial out system

4. Access

Galvanised steel lift assist covers will be provided to the following components:

Pump sump: 1 No. 1,400 X 800mm clear opening

Valve chamber: 1 No. 1,000 X 1,000mm clear opening

Meter chamber: 1 No. 600 X 600mm clear opening

All covers should be as follows:

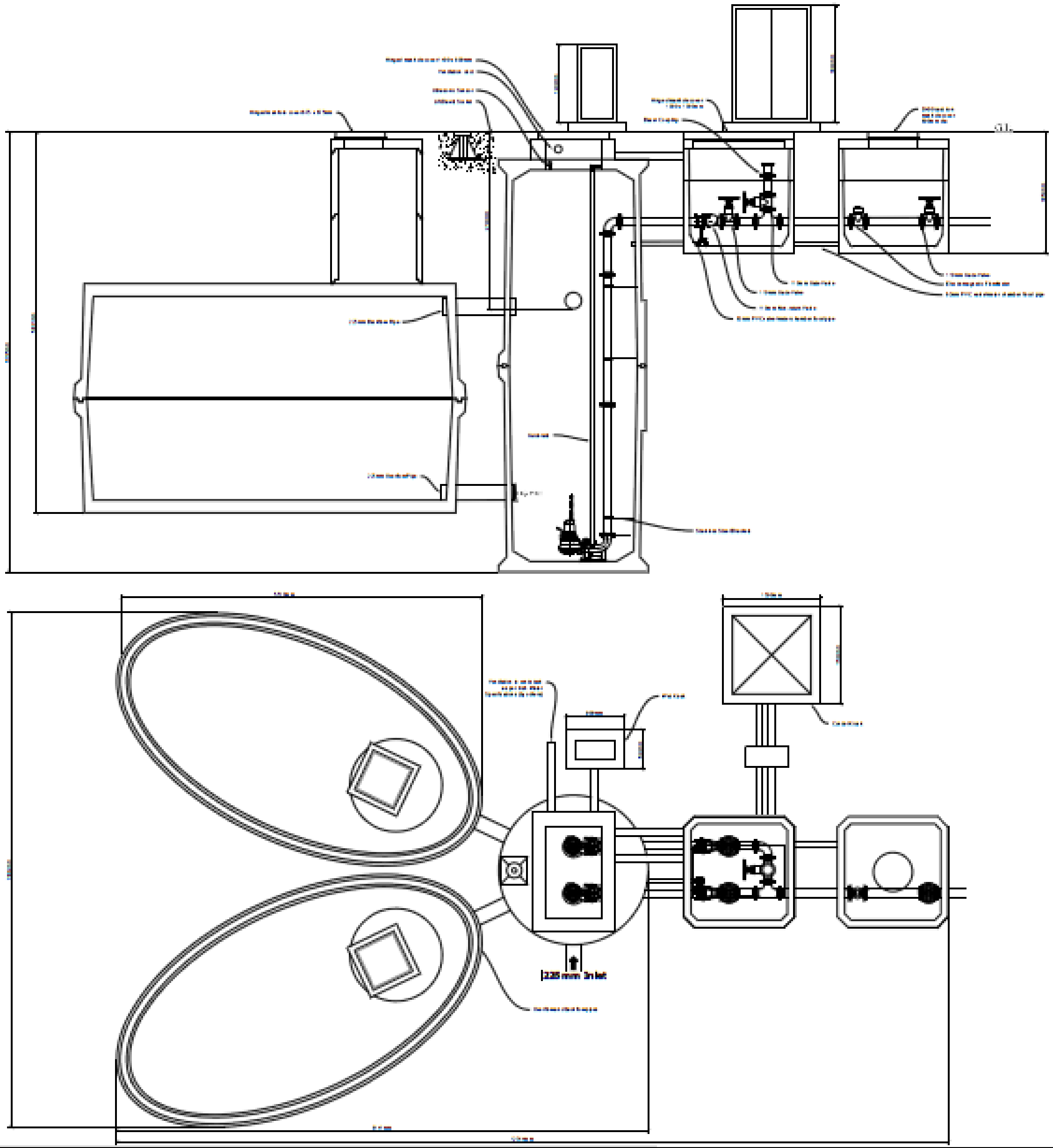
- lockable, fabricated from steel, galvanised to IS EN 1461 (2009) with non-slip surface and finished flush with roof slab of chamber
- Hinged with recessed padlock
- Each leaf to have assistance to ensure a lifting effort of 25kg
- Double, hinged access covers to be provided with inert gas charged or hydraulic operated springs suitable for solo lift

5. System Guarantee

Molloy Environmental Systems provides a 2-year warranty to remedy any fault in products provided:

- That the fault is due to defects in design, materials or workmanship
- That the fault is reported to Molloy Environmental Systems during the guarantee period
- That the product has been used only under the conditions described in the care and maintenance instructions, and in applications for which it is intended
- That all service and repair is carried out by Molloy environmental personnel as per the maintenance requirements
- Therefore, this warrantee does not apply to faults resulting from lack of maintenance, inadequate civil works, repair works carried out improperly or normal wear and tear
- Furthermore, Molloy Environmental Systems disclaims any liability in case of physical injuries, material or economic damages for those mentioned above

Unit 1, St. Therese's Place, Flowerhill, Navan, Co Meath.
Phone: 046-9077032 Fax: 046 9077932, e-mails: mail@jor.ie



NOTES:

Note: Precast concrete units confrom to BS 5911-4 and IS EN 1917. Joints between precast components shall provide equivalent resistance as required in IS EN 1992 - Part 3 (2006).
Note: The valve chamber shall be full sealed from the wet well and have a manually operated drain valve to allow the discharge of water back to the wet well.
Note: The minimum factor of safety against flotation for the empty structure subject to groundwater pressure should be 1.2.
Note: Magnetic flow meters should be provided in a separate flow meter chamber, located a sufficient distance from all fittings and bends, to ensure that interference of the measurement does not arise from flow turbulence associated with such fittings. Sluice valves shall be provided adjacent to the flow meter to allow isolation, removal and servicing of such meter.

Note: The wet well should be vented via a duct extending from the high points of the wet well and connected to free-standing vent stacks.

Note: The minimum rating of the davit, lifting tackle, etc. shall be 500kg SWL. All lifting equipment must be rated to lift at least twice the weight of each pump unit. Davit, lifting tackle and sockets should be tested and certified in accordance with Irish Water's requirements. The manufacturer's name and the SWL of the lifting equipment shall be stamped on a stainless steel plate attached to the equipment. Davits, lifting tackle, sockets shall be of stainless steel or galvanised mild steel in accordance with the safety certificate requirements and shall not weigh more than 35kg.
Note: Observe all safety regulations in regard to excavation and lifting requirements. Never leave opening uncovered or unattended at any time.
Note: The kiosk shall provide wash down facilities for cleaning of equipment during maintenance and servicing.
Note: Specify any specific requirements prior to ordering. All civil works by customer.
Note: Do not scale from this drawing. Only for illustration purposes.

For tender only,
NOT CONSTRUCTION DRAWINGS

MOLLOY
ENVIRONMENTAL SYSTEMS

Clara Road, Tullamore, Co. Offaly, Ireland
Tel: 057 9 326000 info@molloyprecast.com
Fax: 057 9326060 www.molloyprecast.com

Title: Foul water pump station

Date: 15/11/2018

Drg. No.: FS-6m023-151118

Drawn By: KR

Drg. Size: A1