Watfore Limited

Creamfields Residential Development

Site Infrastructure Report

252666-ARUP-XX-XX-RP-C-0001

Issue P03 | 16 February 2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 252666-00

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ARUP

Document verification

ARUP

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1 Introduction

Arup have been commissioned by Watfore Limited to undertake the design of site infrastructure to support the planning application for the redevelopment of the former CMP Dairies site at Kinsale Road/Tramore Road, Cork.

This report outlines the proposed site infrastructure works associated with the development including:

- Surface Water Drainage
- Foul Water Drainage
- Potable Water Supply

2 Existing Site

2.1 Existing site description

The site is a brownfield site located adjacent to the junction of Kinsale Road and Tramore Road. The site generally falls in a north to south direction from a high point of circa 12.5m at the Tramore Road entrance to 6.0m at the southern end of the site. The existing site is predominantly hardstanding.

The site was previously a Milk Distribution Centre.

2.2 Existing Services

There is an existing Irish Water 600mm diameter combined sewer which enters the site from the west and exits to the east before ultimately draining away from the site in a north-easterly direction. There are existing utilities on site that previously served the Dairygold Milk Distribution Centre (e.g. water, power, telecoms). These are assumed to be redundant.

There is existing potable watermain infrastructure located adjacent to the site within Kinsale Road (150mm dia) and Tramore Road (200mm dia).

It is understood there are 2 No. surface water outfalls into the Tramore River to the south of the site. These are understood to take surface water runoff from the roads and buildings located immediately north of the outfalls.

3 Proposed Development

The proposed development will consist of a Strategic Housing Development of 609no. dwellings (561no. apartments (of which 257no. are Build To Rent) and 48no. townhouses) in 12no. buildings of between 1-15 storeys in height over ground, to include a coffee kiosk; gym; café; retail use; creche and community hub; public square; car parking; cycle parking; and all associated site development, infrastructural, and landscaping works on the site of the former CMP Dairies site, Kinsale Road and Tramore Road, Cork.

4 Proposed Wet Services

4.1 Surface Water Drainage

4.1.1 Surface Water Drainage Design Criteria

The following design standards and guidelines have been followed in the design of the surface water drainage for the site:

- BS EN 752 – Drains and sewer system outside buildings.
- Greater Dublin Strategic Drainage Study (GDSDS) Volume 2 – New Developments.
- The network has been designed to the following criteria:
    - No surcharging of pipes for up to and including the 1 in 5-year return period rainfall event
    - No above ground flooding for up to and including the 1 in 30-year return period rainfall event
    - Managed above ground flooding for up to and including the 1 in 100year return period rainfall event plus a 10% allowance for climate change. This means no flooding of vulnerable developments (e.g. residential units), significant infrastructure (e.g. substations) and no increase of flood risk to neighbouring sites.
- Proposed minimum and maximum velocities shall be as follows:
    - Carrier pipe network – 1.0m/s to 3.0m/s
- Colebrook White roughness value of 0.6mm for all pipework

4.1.2 Proposed Surface Water Drainage Strategy

It is proposed to construct a new dedicated surface water system to serve the proposed development as described by drawing 252666-ARUP-ZZ-XX-DR-C-1000.

The intention is to discharge surface water off site to an existing surface water pipework located within Kinsale Road to the south of the site. This surface water pipe ultimately outfalls to the Tramore River nearby. A CCTV survey of this pipe was carried out (see Appendix F) which indicates a blockage along the existing pipework upstream of the outfall. From discussions with CCC we understand the existing gullies in the vicinity of the pipework may not be adequately connected to the existing pipework. As part of the proposed works the pipe blockage will be remedied and the existing gullies will be connected to the pipework.

The existing site is predominantly impermeable, and it is expected any existing positive drainage system on site is in a poor state of repair. The site falls from north to south and the section of site immediately inside the southern boundary appears to have ponding water. The proposed surface water strategy aims to greatly reduce the discharge rates by restricting run-off from site to a QBAR Greenfield Runoff rate of 3.17 l/s/ha, see Appendix A. Attenuation will be provided to cater for those instances where the runoff generated on site exceeds the restricted run-off rate. It will be sized to cater for storms up to and including the 1 in 100-year event + 10% allowance for climate change. Attenuation measures will be provided in the form of below ground geocellular storage which will be located beneath public realm areas/the under-croft car park. In addition to this, SuDS features will be key to the proposed surface water strategy for the site. This is described in further detail in section 4.1.3 below.

The surface water network has been modelled to assess indicative attenuation volume requirements. Results of this model are presented in Appendix A.

4.1.3 Sustainable Drainage Systems (SuDS)

SuDs measures will be incorporated into the development to minimise surface water runoff and mimic natural drainage. SuDS measured considered for the site are outlined in Table 1 below. Typical images/details of the SuDS measures proposed are included in Appendix B.

Table 1 Appraisal of SuDS Measures

SuDS Measure	**Appropriate for the development? (Y/N)**	
Attenuation ponds	N	Constrained urban site. Limited space available for attenuation ponds.
Green roofs	Y	Included where deemed feasible by architect & landscape architect (Building E & F).
Blue Roofs	N	There is a reluctance to put blue roofs above residential development.
Infiltration Planters/ Bioretention systems/Rain Gardens	Y	Runoff from adjacent sealed hardstanding areas will be directed to drain towards planters and roof runoff will discharge to rain gardens where possible. The runoff to the buried network will be

		greatly reduced during low intensity rainfall events while overflow points will be provided to direct more intense rainfall to the buried drainage network to mitigate against flood risk to buildings/streets.
Permeable paving	Y	Adjacent sealed hardstanding (e.g. footpaths/roads) will be graded towards permeable paving to maximise the runoff draining via permeable paving.
Soakaway systems	N	There is uncertainty surrounding permeability of ground and extent of contamination. All SuDS features are conservatively assumed to be lined and hence no infiltration is allowed for.
Swales	N	There is limited space within the street corridors to accommodate swales.
Wetlands and detention basins	N	Constrained urban site. Limited space in the public realm available for wetlands/basins. Due to the likely presence of relatively shallow contaminated ground and poor infiltration rates within the upper strata on site, deep excavations for wetlands and detention basins are not advised.

The above SuDS measures will contribute towards providing the attenuation volumes required as described in section 4.1.2 above but will also provide a water quality benefit. A treatment train approach will be taken in line with Ciria C753 – The SuDS Manual. Table 2 below outlines the suitability of the various SuDS components for use within the management train.

Table 2 Suitability of SuDS components within treatment train (Source CIRIA C753 2015, Table 26.7)

SuDS measure	**Interception**	**Close to source / primary treatment**	**Secondary treatment**	**Tertiary treatment**
Green roofs	Y	Y		
Infiltration Planters/ Bioretention systems/Rain Gardens	Y	Y	Y	
Permeable pavement	Y	Y		

Proprietary Treatment Systems		Y	Y	Y

The pollution hazard and SuDS hazard mitigation associated with the proposed SuDS measures will be assessed in defining the proposed treatment train in line with the Simple Index Approach as described in The SuDS Manual. Treatment will be achieved through soil or gravel infiltration or via planted conveyance where possible but due to the constrained nature of the site it is anticipated proprietary treatment systems will be required in some instances, e.g. hydrocarbon interceptors and/or downstream defenders.

In addition to the above all gullies/drainage channels on site will have sumps to allow for capture and removal of silt/sediment.

Runoff from the large under croft car parking area will be passed through a class 1 hydrocarbon interceptor prior to being discharged to the foul water network, i.e. it won't discharge to the surface water network.

4.1.4 Maintenance

The developer will employ a management company to operate and maintain the surface water infrastructure on site. Regular maintenance of the features described above will be employed, e.g., cleaning of gully/channel sumps and emptying of hydrocarbon interceptors. The attenuation tanks on site will require periodic maintenance and cleaning. To enable this the detail design will include access points at upstream and downstream ends. The attenuation tank located beneath the under-croft car park will be maintained as follows:

- Tanker reverses to the bottom of the ramp and runs long hoses in to access points at each end of the tank for the purpose of sucking out debris, silt etc. This activity will be carried out during off peak times.
- Access points will be located in car parking spaces which will be put out of commission for the duration of maintenance activities.
- A power washer can be parked locally in the space adjacent to the access point.

4.2 Foul Water Drainage

4.2.1 Foul Water Drainage Design Criteria

The design criteria used to develop the foul network includes the following:

- BS EN 752 – Drain and sewer systems outside buildings
- Part H Building Regulations
- Irish Water Code of Practice for Wastewater Infrastructure
- Minimum self-cleansing velocity – 0.75m/s
- Colebrook-White roughness value of 1.5mm for all pipework

- Sanitary DWF loadings are outlined below:
  - Residential -165 l/person/day as per Irish Water Code of Practice
  - Retail/Commercial - 300 l/100m2/day
- Residential unit density taken as 2.7 persons per property.
- EPA Wastewater Treatment Manuals

4.2.2 Foul Water Drainage Strategy

It is proposed to construct a dedicated below ground foul network to collect and convey all foul water generated by the development as described by drawing 252666-ARUP-ZZ-XX-DR-C-2000.

As described in section 2.2 there is an existing 600mm diameter combined sewer crossing the site from west to east. It is proposed to divert this sewer in order to accommodate the proposed building/site layout.

It is proposed to discharge all foul water from Block E in the northern section of the site via gravity to the diverted combined sewer. The remaining buildings to the south cannot discharge to the combined sewer via gravity due to the topography of the site. As a result, it is proposed to discharge foul runoff from the majority of the site to a centrally located Pumping Station (PS). A rising main from the PS will discharge to the combined sewer. Estimated foul water generated on site is described by tables 3 and 4 below. “Non-residential” refers to the proposed café/retail/crèche/gym/ coffee kiosk uses on site. For the purposes of the below estimates DWF is calculated assuming residential units have an operational duration of 16 hours and non-residential 10 hours.

Table 3 Estimated Foul Water discharge rates – To Combined Sewer

Unit	Population	Area (m^2)	DWF Loading		DWF (l/s)	6DWF (l/s)
			(l/h/d)	(l/100m^2/d)		
Residential	311 (115 units x 2.7 persons per unit)	-	165	-	0.89	5.34
Non-residential	-	1040	-	300	0.09	0.54
Total	-	**-**	**-**	**-**	**0.98**	**5.88**

Table 4 Estimated Foul Water discharge rates – To Pumping Station

Unit	Population	Area (m^2)	DWF Loading		DWF (l/s)	6DWF (l/s)
			(l/h/d)	(l/100m^2/d)		
Residential	1,334 (494 units x 2.7 persons per unit)	-	165	-	3.82	22.92
Non-residential	-	937	-	300	0.08	0.48
Total	-	-	-	-	**3.90**	**23.4**

In addition to the above any rainwater runoff from the under-croft car park will be discharged to the foul water network via a class 1 hydrocarbon interceptor. This flow is anticipated to be very small as the car park is covered.

4.2.3 Foul Water Pumping Station

A pumping station (PS) will be located within the public realm area between blocks B, I and J. 182m^3 hours' worth of emergency storage will be provided within the pumping station design in line with Irish Water Code of Practice Section 5.11. It is intended this pumping station will be taken in charge by Irish Water. Due to the PS's proximity to both residential units and public realm areas the design has incorporated the following features:

- The pumping station will be carefully located/ configured to ensure the distance between access covers linked to the wet well and nearby dwellings is at least 15m. Covers will be double sealed to prevent odour escape.
- The landscaping design will take into account the requirement for the pumping station to ensure the above ground features (e.g. control kiosk) are screened appropriately while still maintaining adequate access for operations/ maintenance. Surfacing will be rated for vehicle loading where required to enable access for maintenance activities.
- The wet well will be circular and will incorporate steep benching to promote self-cleansing of the flow into the wet well and reduce the risk of solids settling out on the benching itself.
- The vent stack from the wet well will be taken to roof level of the nearest building and will be fitted with an activated carbon filter. Furthermore, an additional vent stack will be provided at the highest point on the gravity network which will similarly be vented to building roof level and fitted with an activated carbon filter. It is anticipated that specialist design input will be sought to design the venting system during detail design.
- The pumps themselves will be 2 No. Flygt Concertor XPC intelligent pumps in a duty/standby configuration. This specific pump type is proposed due its following features:

- Self-monitoring functionality
- Built in/automatic sump and pipe cleaning to reduce odour and maintenance
- Automatic clog detection and integrated pump cleaning functions to ensure clog-free operation.
- It can come with a smaller/simplified control kiosk design to reduce visual intrusion on surrounding landscaping.

Further information on the proposed pump is provided in Appendix G.

4.2.4 Irish Water consultation

Irish Water have been consulted regarding the proposed combined sewer diversion and have confirmed acceptance of the design. See Appendix D where diversion documentation in addition to the engineering drawings is presented and Appendix E containing the Irish Water confirmation of feasibility for the proposed diversion.

A pre-connection enquiry has been submitted to Irish Water and they have issued a Confirmation of Feasibility Letter confirming they have capacity within their network to serve the development without upgrade. Subsequent to this, the planning design drawings were shared with Irish Water, and they have issued a Statement of Design Acceptance. See Appendix C.

4.3 Potable Water Supply

4.3.1 Potable Water Design Criteria

The watermain has been designed in accordance with the following guidelines and standards:

- Irish Water Code of Practice for Water Supply
- Civil Engineering Specification for the Water Industry (CESWI)
- BS EN 805:2000 Water Supply – Requirements for systems and components outside buildings
- Part B of the Building Regulations
- Potable Water Demand loadings are outlined below:
  - Residential -150 l/person/day as per Irish Water Code of Practice
  - Retail/Commercial - 300 l/100m2/day

4.3.2 Proposed Potable Water Supply Strategy

It is proposed to construct a dedicated below ground potable water network serve the site as described by drawing 252666-ARUP-ZZ-XX-DR-C-3000.

It is proposed to provide a new connection from the existing watermain located in Kinsale Road. A bulk water meter will be provided immediately downstream of the 2 No. connections to the existing Irish Water watermain. Downstream of the bulk water meter a series of ring mains will be provided on site off which each development block will be fed. The metering strategy for the development will be as follows:

- For supply to high rise blocks with multiple apartments a below ground meter will be provided outside the building to allow for metering of the entire block and a water meter room is allowed for within the block to allow for metering of individual units.
- For supply to individual units (e.g. apartments with townhouse overhead as per Block L and retail/cafe units) a below ground meter will be provided outside the building.

External fire hydrants will be connected to the ring mains on site. The location/number of fire hydrants shall be confirmed during the fire certification stage.

Tables 5 below provides the breakdown of the water demand as part of the development and shows proposed average and peak demand rates. The peak demand is taken as five times the average daily demand in accordance with the Irish Water Code of Practice for Water Supply.

Table 5 Potable Water Demand Rates

Unit	Population	Area (m2)	Water Demand Rate (l/h/d)	Water Demand Rate (l/100m2/d)	Average Demand (l/s)	Peak Demand (5x) (l/s)
Residential	1,645 (609 units x 2.7 persons per unit)	-	165	-	4.71	23.55
Non-residential	-	1,977	-	300	0.17	0.85
Total	-	**-**	**-**	**-**	**4.88**	**24.4**

A pre-connection enquiry has been submitted to Irish Water and they have issued a Confirmation of Feasibility Letter confirming they have capacity within their network to serve the development without upgrade. Subsequent to this, the planning design drawings were shared with Irish Water and they have issued a Statement of Design Acceptance, See Appendix C.

Appendix A

Surface Water Drainage Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Richard Murphy
Site name:	Creamfields
Site location:	Kinsale Road, Cork

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

Site Details

Latitude:	51.87880° N
Longitude:	8.46999° W
Reference:	2074079383
Date:	Feb 12 2022 07:38

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 3.39

Methodology

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

SPR estimation method: Calculate from SOIL type

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

Hydrological characteristics	Default	Edited
SAAR (mm):	1123	1123
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	10.74	10.74
1 in 1 year (l/s):	9.13	9.13
1 in 30 years (l/s):	17.72	17.72
1 in 100 year (l/s):	20.94	20.94
1 in 200 years (l/s):	23.09	23.09

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

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	18.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.250	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	14.889	0.880	16.9	0.030	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	18.049	0.106	169.8	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	9.368	0.294	31.9	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	56.473	2.620	21.6	0.086	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.08	10.855	0.030	0.0	0.0	0.0	3.20	127.1	4.0
1.001	50.00	5.38	9.975	0.041	0.0	0.0	0.0	1.00	39.8	5.5
1.002	50.00	5.45	9.869	0.049	0.0	0.0	0.0	2.32	92.4	6.6
1.003	50.00	5.78	9.575	0.135	0.0	0.0	0.0	2.83	112.6	18.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	53.498	0.320	167.2	0.178	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	25.356	0.280	90.6	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	6.444	0.100	64.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	8.561	0.037	231.7	0.181	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	57.564	0.248	231.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	10.852	0.040	272.7	0.351	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	52.671	0.600	87.8	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	54.633	0.324	168.9	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	11.950	3.402	3.5	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	13.904	0.035	397.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	5.73	7.275	0.178	0.0	0.0	0.0	1.21	85.8	24.2
1.004	50.00	6.03	6.955	0.355	0.0	0.0	0.0	1.65	116.8	48.0
1.005	50.00	6.09	6.675	0.355	0.0	0.0	0.0	1.96	138.7	48.0
1.006	50.00	6.23	6.500	0.536	0.0	0.0	0.0	1.03	72.7	72.5
1.007	50.00	7.16	6.463	0.536	0.0	0.0	0.0	1.03	72.7	72.5
1.008	50.00	7.33	6.140	0.887	0.0	0.0	0.0	1.09	120.6	120.1
3.000	50.00	5.63	10.575	0.036	0.0	0.0	0.0	1.40	55.5	4.9
3.001	50.00	6.54	9.975	0.088	0.0	0.0	0.0	1.00	39.9	12.0
3.002	50.00	6.56	9.651	0.105	0.0	0.0	0.0	7.03	279.6	14.2
1.009	50.00	7.68	6.100	0.992	0.0	0.0	0.0	0.65	25.8«	134.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.010	74.086	0.265	279.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	32.463	0.194	167.2	0.159	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	21.228	0.194	109.3	0.048	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	39.277	0.235	167.2	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.000	29.550	0.177	167.2	0.099	5.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	21.439	0.252	85.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	32.371	0.134	241.9	0.086	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	68.736	0.563	122.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.010	50.00	9.27	6.065	0.992	0.0	0.0	0.0	0.78	30.9«	134.3
4.000	50.00	5.54	7.075	0.159	0.0	0.0	0.0	1.01	40.1	21.6
5.000	50.00	5.28	7.075	0.048	0.0	0.0	0.0	1.25	49.7	6.6
4.001	50.00	6.19	6.881	0.228	0.0	0.0	0.0	1.01	40.1	30.9
6.000	50.00	5.49	7.075	0.099	0.0	0.0	0.0	1.01	40.1	13.4
6.001	50.00	5.74	6.898	0.099	0.0	0.0	0.0	1.42	56.4	13.4
4.002	50.00	6.72	6.571	0.413	0.0	0.0	0.0	1.01	71.1	55.9
7.000	50.00	5.97	7.075	0.000	0.0	0.0	0.0	1.18	47.0	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.003	26.198	0.108	241.9	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
8.000	53.503	2.500	21.4	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
8.001	15.658	0.746	21.0	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.004	3.793	0.529	7.2	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.011	80.773	0.320	252.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.000	22.963	0.137	167.6	0.037	5.00	0.0	0.600	o	225	Pipe/Conduit	
9.001	5.347	0.032	167.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
10.000	19.954	0.140	142.6	0.116	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.003	50.00	7.16	6.437	0.459	0.0	0.0	0.0	1.01	71.1	62.1
8.000	50.00	5.31	9.575	0.132	0.0	0.0	0.0	2.84	113.0	17.9
8.001	50.00	5.40	7.075	0.178	0.0	0.0	0.0	2.87	114.1	24.2
4.004	50.00	7.17	6.329	0.667	0.0	0.0	0.0	4.92	195.5	90.4
1.011	46.87	10.92	5.800	1.659	0.0	0.0	0.0	0.82	32.5«	210.6
9.000	50.00	5.38	6.304	0.037	0.0	0.0	0.0	1.01	40.0	5.0
9.001	50.00	5.47	6.167	0.037	0.0	0.0	0.0	1.01	40.1	5.0
10.000	50.00	5.30	6.275	0.116	0.0	0.0	0.0	1.09	43.4	15.7

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
9.002	34.702	0.208	167.2	0.065	0.00	0.0	0.600	o	225	Pipe/Conduit	
11.000	21.835	0.647	33.7	0.052	5.00	0.0	0.600	o	225	Pipe/Conduit	
9.003	34.992	0.145	241.9	0.088	0.00	0.0	0.600	o	300	Pipe/Conduit	
9.004	12.473	0.052	241.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
9.005	27.260	0.113	241.2	0.058	0.00	0.0	0.600	o	300	Pipe/Conduit	
12.000	46.789	0.500	93.6	0.078	5.00	0.0	0.600	o	225	Pipe/Conduit	
12.001	16.525	0.532	31.1	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.006	4.848	0.063	77.0	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
9.002	50.00	6.04	6.135	0.218	0.0	0.0	0.0	1.01	40.1	29.6
11.000	50.00	5.16	6.575	0.052	0.0	0.0	0.0	2.26	89.8	7.1
9.003	50.00	6.62	5.853	0.359	0.0	0.0	0.0	1.01	71.1	48.6
9.004	50.00	6.83	5.708	0.359	0.0	0.0	0.0	1.01	71.1	48.6
9.005	50.00	7.28	5.656	0.416	0.0	0.0	0.0	1.01	71.2	56.4
12.000	50.00	5.58	6.575	0.078	0.0	0.0	0.0	1.35	53.8	10.6
12.001	50.00	5.69	6.075	0.113	0.0	0.0	0.0	2.36	93.7	15.3
9.006	50.00	7.33	5.543	0.543	0.0	0.0	0.0	1.49	59.3«	73.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.012	61.180	0.395	154.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
13.000	59.568	0.298	200.0	0.082	5.00	0.0	0.600	o	225	Pipe/Conduit	
13.001	3.199	0.016	200.0	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
14.000	62.122	0.304	204.3	0.151	5.00	0.0	0.600	o	225	Pipe/Conduit	
13.002	21.008	0.105	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
13.003	50.623	0.253	200.0	0.132	0.00	0.0	0.600	o	300	Pipe/Conduit	
15.000	20.085	0.102	196.9	0.032	5.00	0.0	0.600	o	225	Pipe/Conduit	
13.004	6.812	0.034	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.012	45.02	11.89	5.480	2.202	0.0	0.0	0.0	1.05	41.7«	268.5
13.000	50.00	6.08	6.250	0.082	0.0	0.0	0.0	0.92	36.6	11.1
13.001	50.00	6.14	5.952	0.115	0.0	0.0	0.0	0.92	36.6	15.5
14.000	50.00	6.14	6.240	0.151	0.0	0.0	0.0	0.91	36.2	20.5
13.002	50.00	6.52	5.936	0.266	0.0	0.0	0.0	0.92	36.6	36.0
13.003	50.00	7.28	5.831	0.398	0.0	0.0	0.0	1.11	78.3	53.9
15.000	50.00	5.36	5.680	0.032	0.0	0.0	0.0	0.93	36.9	4.3
13.004	50.00	7.38	5.578	0.430	0.0	0.0	0.0	1.11	78.3	58.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
16.000	24.189	0.126	192.0	0.035	5.00	0.0	0.600	o	225	Pipe/Conduit	
13.005	21.151	0.178	118.8	0.064	0.00	0.0	0.600	o	300	Pipe/Conduit	
17.000	40.755	0.274	148.7	0.091	5.00	0.0	0.600	o	225	Pipe/Conduit	
13.006	22.073	0.074	300.0	0.060	0.00	0.0	0.600	o	300	Pipe/Conduit	
13.007	20.545	0.067	306.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
18.000	29.796	0.149	200.0	0.021	5.00	0.0	0.600	o	225	Pipe/Conduit	
18.001	30.885	0.159	194.2	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
13.008	4.420	0.022	200.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
16.000	50.00	5.43	5.670	0.035	0.0	0.0	0.0	0.94	37.4	4.7
13.005	50.00	7.63	5.544	0.529	0.0	0.0	0.0	1.44	101.9	71.6
17.000	50.00	5.63	5.640	0.091	0.0	0.0	0.0	1.07	42.5	12.3
13.006	50.00	8.03	5.366	0.680	0.0	0.0	0.0	0.90	63.8«	92.0
13.007	50.00	8.42	5.292	0.680	0.0	0.0	0.0	0.89	63.1«	92.0
18.000	50.00	5.54	5.533	0.021	0.0	0.0	0.0	0.92	36.6	2.8
18.001	50.00	6.09	5.384	0.038	0.0	0.0	0.0	0.93	37.2	5.1
13.008	50.00	8.50	5.225	0.718	0.0	0.0	0.0	0.92	36.5«	97.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.013	20.942	0.105	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.014	23.334	0.120	194.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.015	16.164	0.122	132.5	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.016	12.292	0.156	78.8	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.017	6.270	0.104	60.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.013	44.36	12.27	5.203	2.920	0.0	0.0	0.0	0.92	36.6«	350.7
1.014	43.65	12.68	5.098	2.920	0.0	0.0	0.0	0.93	37.1«	350.7
1.015	43.26	12.92	4.978	2.945	0.0	0.0	0.0	1.13	45.1«	350.7
1.016	43.03	13.06	4.856	2.971	0.0	0.0	0.0	1.47	58.6«	350.7
1.017	42.94	13.12	4.700	2.971	0.0	0.0	0.0	1.69	67.1«	350.7

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.017	SWMH	5.850	4.596	4.596	225	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	4.510	20	4.510	35	4.510	50	4.510	65	4.510	80	4.510	95	4.510	110	4.510	125	4.510	140	4.510	155	4.510	170	4.510
10	4.510	25	4.510	40	4.510	55	4.510	70	4.510	85	4.510	100	4.510	115	4.510	130	4.510	145	4.510	160	4.510	175	4.510
15	4.510	30	4.510	45	4.510	60	4.510	75	4.510	90	4.510	105	4.510	120	4.510	135	4.510	150	4.510	165	4.510	180	4.510

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
185	4.510	290	4.510	395	4.510	500	4.510	605	4.510	710	4.510	815	4.510	920	4.510	1025	4.510	1130	4.510	1235	4.510	1340	4.510
190	4.510	295	4.510	400	4.510	505	4.510	610	4.510	715	4.510	820	4.510	925	4.510	1030	4.510	1135	4.510	1240	4.510	1345	4.510
195	4.510	300	4.510	405	4.510	510	4.510	615	4.510	720	4.510	825	4.510	930	4.510	1035	4.510	1140	4.510	1245	4.510	1350	4.510
200	4.510	305	4.510	410	4.510	515	4.510	620	4.510	725	4.510	830	4.510	935	4.510	1040	4.510	1145	4.510	1250	4.510	1355	4.510
205	4.510	310	4.510	415	4.510	520	4.510	625	4.510	730	4.510	835	4.510	940	4.510	1045	4.510	1150	4.510	1255	4.510	1360	4.510
210	4.510	315	4.510	420	4.510	525	4.510	630	4.510	735	4.510	840	4.510	945	4.510	1050	4.510	1155	4.510	1260	4.510	1365	4.510
215	4.510	320	4.510	425	4.510	530	4.510	635	4.510	740	4.510	845	4.510	950	4.510	1055	4.510	1160	4.510	1265	4.510	1370	4.510
220	4.510	325	4.510	430	4.510	535	4.510	640	4.510	745	4.510	850	4.510	955	4.510	1060	4.510	1165	4.510	1270	4.510	1375	4.510
225	4.510	330	4.510	435	4.510	540	4.510	645	4.510	750	4.510	855	4.510	960	4.510	1065	4.510	1170	4.510	1275	4.510	1380	4.510
230	4.510	335	4.510	440	4.510	545	4.510	650	4.510	755	4.510	860	4.510	965	4.510	1070	4.510	1175	4.510	1280	4.510	1385	4.510
235	4.510	340	4.510	445	4.510	550	4.510	655	4.510	760	4.510	865	4.510	970	4.510	1075	4.510	1180	4.510	1285	4.510	1390	4.510
240	4.510	345	4.510	450	4.510	555	4.510	660	4.510	765	4.510	870	4.510	975	4.510	1080	4.510	1185	4.510	1290	4.510	1395	4.510
245	4.510	350	4.510	455	4.510	560	4.510	665	4.510	770	4.510	875	4.510	980	4.510	1085	4.510	1190	4.510	1295	4.510	1400	4.510
250	4.510	355	4.510	460	4.510	565	4.510	670	4.510	775	4.510	880	4.510	985	4.510	1090	4.510	1195	4.510	1300	4.510	1405	4.510
255	4.510	360	4.510	465	4.510	570	4.510	675	4.510	780	4.510	885	4.510	990	4.510	1095	4.510	1200	4.510	1305	4.510	1410	4.510
260	4.510	365	4.510	470	4.510	575	4.510	680	4.510	785	4.510	890	4.510	995	4.510	1100	4.510	1205	4.510	1310	4.510	1415	4.510
265	4.510	370	4.510	475	4.510	580	4.510	685	4.510	790	4.510	895	4.510	1000	4.510	1105	4.510	1210	4.510	1315	4.510	1420	4.510
270	4.510	375	4.510	480	4.510	585	4.510	690	4.510	795	4.510	900	4.510	1005	4.510	1110	4.510	1215	4.510	1320	4.510	1425	4.510
275	4.510	380	4.510	485	4.510	590	4.510	695	4.510	800	4.510	905	4.510	1010	4.510	1115	4.510	1220	4.510	1325	4.510	1430	4.510
280	4.510	385	4.510	490	4.510	595	4.510	700	4.510	805	4.510	910	4.510	1015	4.510	1120	4.510	1225	4.510	1330	4.510	1435	4.510
285	4.510	390	4.510	495	4.510	600	4.510	705	4.510	810	4.510	915	4.510	1020	4.510	1125	4.510	1230	4.510	1335	4.510	1440	4.510

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SWMH14, DS/PN: 1.009, Volume (m³): 9.1

Unit Reference	MD-SHE-0084-3100-1000-3100	Sump Available	Yes
Design Head (m)	1.000	Diameter (mm)	84
Design Flow (l/s)	3.1	Invert Level (m)	6.100
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.1	Kick-Flo®	0.623	2.5
Flush-Flo™	0.297	3.1	Mean Flow over Head Range	-	2.7

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

Depth (m)	Flow (l/s)	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	2.5	0.600	2.6	1.600	3.8	2.600	4.8	5.000	6.6	7.500	7.9
0.200	3.0	0.800	2.8	1.800	4.1	3.000	5.2	5.500	6.9	8.000	8.2
0.300	3.1	1.000	3.1	2.000	4.3	3.500	5.5	6.000	7.1	8.500	8.4
0.400	3.0	1.200	3.4	2.200	4.5	4.000	5.9	6.500	7.4	9.000	8.7
0.500	2.9	1.400	3.6	2.400	4.6	4.500	6.2	7.000	7.7	9.500	8.9

Hydro-Brake® Optimum Manhole: SWMH26, DS/PN: 4.004, Volume (m³): 4.8

Unit Reference	MD-SHE-0061-2100-1700-2100	Sump Available	Yes
Design Head (m)	1.700	Diameter (mm)	61
Design Flow (l/s)	2.1	Invert Level (m)	6.329
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

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Hydro-Brake® Optimum Manhole: SWMH26, DS/PN: 4.004, Volume (m³): 4.8

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	2.1	Kick-Flo®	0.541	1.3
Flush-Flo™	0.267	1.5	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)	Depth (m)	Flow (l/s)
0.100	1.3	0.600	1.3	1.600	2.0	2.600	2.5	5.000	3.5	7.500	4.2
0.200	1.5	0.800	1.5	1.800	2.2	3.000	2.7	5.500	3.6	8.000	4.3
0.300	1.5	1.000	1.6	2.000	2.3	3.500	2.9	6.000	3.8	8.500	4.4
0.400	1.5	1.200	1.8	2.200	2.4	4.000	3.1	6.500	3.9	9.000	4.5
0.500	1.4	1.400	1.9	2.400	2.5	4.500	3.3	7.000	4.0	9.500	4.7

Hydro-Brake® Optimum Manhole: SWMH38, DS/PN: 9.006, Volume (m³): 4.7

Unit Reference	MD-SHE-0057-1700-1400-1700	Sump Available	Yes
Design Head (m)	1.400	Diameter (mm)	57
Design Flow (l/s)	1.7	Invert Level (m)	5.543
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	1.7	Kick-Flo®	0.508	1.1
Flush-Flo™	0.251	1.3	Mean Flow over Head Range	-	1.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	0.300	1.3	0.500	1.1	0.800	1.3	1.200	1.6	1.600	1.8
0.200	1.3	0.400	1.3	0.600	1.2	1.000	1.5	1.400	1.7	1.800	1.9

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Hydro-Brake® Optimum Manhole: SWMH38, DS/PN: 9.006, Volume (m³): 4.7

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)	Depth (m)	Flow (l/s)
2.000	2.0	2.600	2.3	4.000	2.7	5.500	3.2	7.000	3.6	8.500	3.9
2.200	2.1	3.000	2.4	4.500	2.9	6.000	3.3	7.500	3.7	9.000	4.0
2.400	2.2	3.500	2.6	5.000	3.0	6.500	3.4	8.000	3.8	9.500	4.1

Hydro-Brake® Optimum Manhole: SWMH54, DS/PN: 13.008, Volume (m³): 4.1

Unit Reference	MD-SHE-0071-2300-1100-2300	Sump Available	Yes
Design Head (m)	1.100	Diameter (mm)	71
Design Flow (l/s)	2.3	Invert Level (m)	5.225
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	2.3	Kick-Flo®	0.630	1.8
Flush-Flo™	0.310	2.2	Mean Flow over Head Range	-	2.0

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

Depth (m)	Flow (l/s)	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	1.8	0.600	1.9	1.600	2.7	2.600	3.4	5.000	4.6	7.500	5.6
0.200	2.1	0.800	2.0	1.800	2.9	3.000	3.6	5.500	4.8	8.000	5.8
0.300	2.2	1.000	2.2	2.000	3.0	3.500	3.9	6.000	5.0	8.500	5.9
0.400	2.2	1.200	2.4	2.200	3.2	4.000	4.2	6.500	5.2	9.000	6.1
0.500	2.1	1.400	2.6	2.400	3.3	4.500	4.4	7.000	5.4	9.500	6.3

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Storage Structures for Storm

Tank or Pond Manhole: SWMH10, DS/PN: 1.008

Invert Level (m) 6.140

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1000.0	0.750	1000.0	0.751	0.0

Tank or Pond Manhole: SWMH21, DS/PN: 4.002

Invert Level (m) 6.571

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	300.0	1.500	300.0	1.501	0.0

Tank or Pond Manhole: SWMH34, DS/PN: 9.004

Invert Level (m) 5.708

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	300.0	1.200	300.0	1.201	0.0

Tank or Pond Manhole: SWMH50, DS/PN: 13.006

Invert Level (m) 5.366

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	570.0	1.000	570.0	1.001	0.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 10

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH1	15 Winter	2	+0%					10.883	-0.197	0.000	0.04			4.3	OK	
1.001	SWMH2	15 Winter	2	+0%					10.035	-0.165	0.000	0.16			5.6	OK	
1.002	SWMH3	15 Winter	2	+0%					9.913	-0.180	0.000	0.09			6.6	OK	
1.003	SWMH4	15 Winter	2	+0%					9.635	-0.165	0.000	0.16			17.0	OK	
2.000	SWMH5	15 Winter	2	+0%	100/15 Summer				7.392	-0.183	0.000	0.31			25.1	OK	
1.004	SWMH6	15 Winter	2	+0%	30/15 Summer				7.096	-0.159	0.000	0.45			46.6	OK	
1.005	SWMH7	15 Winter	2	+0%	30/15 Summer				6.846	-0.129	0.000	0.59			46.8	OK	
1.006	SWMH8	15 Winter	2	+0%	2/15 Summer				6.823	0.023	0.000	1.22			67.3	SURCHARGED	
1.007	SWMH9	15 Winter	2	+0%	30/15 Summer				6.700	-0.063	0.000	0.98			67.4	OK	
1.008	SWMH10	1440 Winter	2	+0%	30/480 Winter				6.399	-0.115	0.000	0.03			3.0	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	SWMH11	15 Winter	2	+0%					10.622	-0.178	0.000	0.10			5.1	OK	
3.001	SWMH12	15 Winter	2	+0%					10.059	-0.141	0.000	0.29			11.0	OK	
3.002	SWMH13	15 Winter	2	+0%					9.685	-0.191	0.000	0.05			12.9	OK	
1.009	SWMH14	1440 Winter	2	+0%	2/360 Winter				6.398	0.073	0.000	0.16			3.1	SURCHARGED	
1.010	SWMH15	1440 Winter	2	+0%					6.113	-0.177	0.000	0.10			3.1	OK	
4.000	SWMH16	15 Winter	2	+0%	30/15 Summer				7.203	-0.097	0.000	0.60			22.6	OK	
5.000	SWMH17	15 Winter	2	+0%	30/360 Winter				7.134	-0.166	0.000	0.15			6.9	OK	
4.001	SWMH18	1440 Winter	2	+0%	2/1440 Winter				7.121	0.015	0.000	0.08			2.9	SURCHARGED	
6.000	SWMH19	15 Winter	2	+0%	30/360 Winter				7.172	-0.128	0.000	0.37			14.0	OK	
6.001	SWMH20	1440 Winter	2	+0%	30/120 Winter				7.120	-0.003	0.000	0.02			1.3	OK	
4.002	SWMH21	1440 Winter	2	+0%	2/120 Winter				7.120	0.249	0.000	0.02			1.4	SURCHARGED	
7.000	SWMH22	1440 Winter	2	+0%	30/360 Winter				7.119	-0.181	0.000	0.00			0.0	OK	
4.003	SWMH23	1440 Winter	2	+0%	2/15 Summer				7.119	0.381	0.000	0.02			1.5	SURCHARGED	
8.000	SWMH24	15 Winter	2	+0%					9.639	-0.161	0.000	0.17			18.8	OK	
8.001	SWMH25	15 Winter	2	+0%	30/15 Summer				7.151	-0.149	0.000	0.24			24.5	OK	
4.004	SWMH26	1440 Winter	2	+0%	2/15 Summer				7.117	0.563	0.000	0.01			1.5	SURCHARGED	
1.011	SWMH27	1440 Winter	2	+0%					5.856	-0.169	0.000	0.14			4.6	OK	
9.000	SWMH28	15 Winter	2	+0%	30/15 Winter				6.362	-0.167	0.000	0.14			5.3	OK	
9.001	SWMH29	15 Winter	2	+0%	30/15 Summer				6.289	-0.103	0.000	0.19			5.5	OK	
10.000	SWMH30	15 Winter	2	+0%	30/15 Summer				6.378	-0.122	0.000	0.42			16.5	OK	
9.002	SWMH31	15 Winter	2	+0%	30/15 Summer				6.284	-0.076	0.000	0.76			28.7	OK	
11.000	SWMH32	15 Winter	2	+0%	100/960 Winter				6.621	-0.179	0.000	0.09			7.5	OK	
9.003	SWMH33	1440 Winter	2	+0%	2/1440 Winter				6.161	0.009	0.000	0.07			4.6	SURCHARGED	
9.004	SWMH34	1440 Winter	2	+0%	2/240 Winter				6.160	0.152	0.000	0.08			4.6	SURCHARGED	
9.005	SWMH35	1440 Winter	2	+0%	2/15 Summer				6.160	0.204	0.000	0.04			2.7	SURCHARGED	
12.000	SWMH36	15 Winter	2	+0%	100/960 Winter				6.647	-0.153	0.000	0.22			11.1	OK	
12.001	SWMH37	1440 Winter	2	+0%	30/360 Winter				6.159	-0.141	0.000	0.02			1.4	OK	
9.006	SWMH38	1440 Winter	2	+0%	2/15 Summer				6.159	0.391	0.000	0.04			1.3	SURCHARGED	
1.012	SWMH39	1440 Winter	2	+0%					5.536	-0.169	0.000	0.14			5.7	OK	
13.000	SWMH40	15 Winter	2	+0%	100/15 Summer				6.340	-0.135	0.000	0.32			11.2	OK	
13.001	SWMH41	15 Winter	2	+0%	30/15 Summer				6.130	-0.047	0.000	0.53			14.1	OK	
14.000	SWMH42	15 Winter	2	+0%	30/15 Summer				6.370	-0.095	0.000	0.59			20.5	OK	
13.002	SWMH43	15 Winter	2	+0%	30/15 Summer				6.122	-0.039	0.000	1.00			33.2	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
13.003	SWMH44	15 Winter	2	+0%	30/15 Winter				6.006	-0.125	0.000	0.63			46.5	OK	
15.000	SWMH45	15 Winter	2	+0%	30/15 Summer				5.800	-0.105	0.000	0.12			4.1	OK	
13.004	SWMH46	15 Winter	2	+0%	30/15 Summer				5.795	-0.083	0.000	0.87			48.8	OK	
16.000	SWMH47	15 Winter	2	+0%	30/960 Winter				5.737	-0.158	0.000	0.14			4.8	OK	
13.005	SWMH48	15 Winter	2	+0%	30/15 Winter				5.720	-0.124	0.000	0.65			57.7	OK	
17.000	SWMH49	15 Winter	2	+0%	30/960 Winter				5.728	-0.137	0.000	0.32			13.0	OK	
13.006	SWMH50	1440 Winter	2	+0%	30/120 Winter				5.665	-0.001	0.000	0.04			2.2	OK	
13.007	SWMH51	1440 Winter	2	+0%	2/360 Winter				5.663	0.071	0.000	0.04			2.2	SURCHARGED	
18.000	SWMH52	1440 Winter	2	+0%	30/240 Summer				5.661	-0.097	0.000	0.01			0.3	OK	
18.001	SWMH53	1440 Winter	2	+0%	2/360 Winter				5.661	0.052	0.000	0.01			0.4	SURCHARGED	
13.008	SWMH54	1440 Winter	2	+0%	2/30 Summer				5.661	0.211	0.000	0.09			2.2	SURCHARGED	
1.013	SWMH55	1440 Winter	2	+0%					5.277	-0.151	0.000	0.24			7.9	OK	
1.014	SWMH56	1440 Winter	2	+0%					5.171	-0.152	0.000	0.23			7.9	OK	
1.015	SWMHEx.	30 Winter	2	+0%					5.050	-0.153	0.000	0.23			9.0	OK	
1.016	SWMHEx.	30 Winter	2	+0%					4.930	-0.151	0.000	0.23			11.8	OK	
1.017	SWMHEx.	30 Winter	2	+0%					4.778	-0.147	0.000	0.26			11.8	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 10

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH1	15 Winter	30	+0%					10.894	-0.186	0.000	0.07			7.9	OK	
1.001	SWMH2	15 Winter	30	+0%					10.061	-0.139	0.000	0.30			10.8	OK	
1.002	SWMH3	15 Winter	30	+0%					9.932	-0.162	0.000	0.17			13.0	OK	
1.003	SWMH4	15 Winter	30	+0%					9.666	-0.134	0.000	0.34			37.0	OK	
2.000	SWMH5	15 Winter	30	+0%	100/15 Summer				7.567	-0.008	0.000	0.54			44.1	OK	
1.004	SWMH6	15 Winter	30	+0%	30/15 Summer				7.494	0.239	0.000	0.72			74.8	SURCHARGED	
1.005	SWMH7	15 Winter	30	+0%	30/15 Summer				7.358	0.383	0.000	0.95			75.2	SURCHARGED	
1.006	SWMH8	15 Winter	30	+0%	2/15 Summer				7.271	0.471	0.000	1.93			106.2	SURCHARGED	
1.007	SWMH9	15 Winter	30	+0%	30/15 Summer				7.090	0.327	0.000	1.54			106.1	SURCHARGED	
1.008	SWMH10	1440 Winter	30	+0%	30/480 Winter				6.612	0.098	0.000	0.07			6.0	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	SWMH11	15 Winter	30	+0%					10.639	-0.161	0.000	0.18			9.4	OK	
3.001	SWMH12	15 Winter	30	+0%					10.105	-0.095	0.000	0.60			22.9	OK	
3.002	SWMH13	15 Winter	30	+0%					9.702	-0.174	0.000	0.11			27.0	OK	
1.009	SWMH14	1440 Winter	30	+0%	2/360 Winter				6.702	0.377	0.000	0.16			3.1	SURCHARGED	
1.010	SWMH15	1440 Winter	30	+0%					6.113	-0.177	0.000	0.10			3.1	OK	
4.000	SWMH16	1440 Winter	30	+0%	30/15 Summer				7.582	0.282	0.000	0.08			3.2	SURCHARGED	
5.000	SWMH17	1440 Winter	30	+0%	30/360 Winter				7.581	0.281	0.000	0.02			1.0	SURCHARGED	
4.001	SWMH18	1440 Winter	30	+0%	2/1440 Winter				7.581	0.475	0.000	0.11			4.2	SURCHARGED	
6.000	SWMH19	1440 Winter	30	+0%	30/360 Winter				7.580	0.280	0.000	0.05			2.0	SURCHARGED	
6.001	SWMH20	1440 Winter	30	+0%	30/120 Winter				7.579	0.456	0.000	0.03			1.8	SURCHARGED	
4.002	SWMH21	1440 Winter	30	+0%	2/120 Winter				7.579	0.708	0.000	0.03			1.8	SURCHARGED	
7.000	SWMH22	1440 Winter	30	+0%	30/360 Winter				7.577	0.277	0.000	0.00			0.0	SURCHARGED	
4.003	SWMH23	1440 Winter	30	+0%	2/15 Summer				7.577	0.840	0.000	0.03			1.8	SURCHARGED	
8.000	SWMH24	15 Winter	30	+0%					9.663	-0.137	0.000	0.32			34.7	OK	
8.001	SWMH25	1440 Winter	30	+0%	30/15 Summer				7.577	0.277	0.000	0.04			3.6	SURCHARGED	
4.004	SWMH26	1440 Winter	30	+0%	2/15 Summer				7.576	1.022	0.000	0.02			1.8	SURCHARGED	
1.011	SWMH27	1440 Winter	30	+0%					5.858	-0.167	0.000	0.15			4.8	OK	
9.000	SWMH28	15 Winter	30	+0%	30/15 Winter				6.560	0.031	0.000	0.23			8.3	SURCHARGED	
9.001	SWMH29	15 Winter	30	+0%	30/15 Summer				6.542	0.150	0.000	0.41			12.1	SURCHARGED	
10.000	SWMH30	15 Winter	30	+0%	30/15 Summer				6.603	0.103	0.000	0.68			26.7	SURCHARGED	
9.002	SWMH31	15 Winter	30	+0%	30/15 Summer				6.537	0.177	0.000	1.25			47.0	SURCHARGED	
11.000	SWMH32	15 Winter	30	+0%	100/960 Winter				6.637	-0.163	0.000	0.17			13.9	OK	
9.003	SWMH33	1440 Winter	30	+0%	2/1440 Winter				6.534	0.382	0.000	0.11			7.0	SURCHARGED	
9.004	SWMH34	1440 Winter	30	+0%	2/240 Winter				6.533	0.525	0.000	0.02			1.4	SURCHARGED	
9.005	SWMH35	1440 Winter	30	+0%	2/15 Summer				6.532	0.576	0.000	0.02			1.4	SURCHARGED	
12.000	SWMH36	15 Winter	30	+0%	100/960 Winter				6.675	-0.125	0.000	0.40			20.4	OK	
12.001	SWMH37	1440 Winter	30	+0%	30/360 Winter				6.531	0.231	0.000	0.03			2.2	SURCHARGED	
9.006	SWMH38	1440 Winter	30	+0%	2/15 Summer				6.531	0.763	0.000	0.04			1.4	SURCHARGED	
1.012	SWMH39	1440 Winter	30	+0%					5.539	-0.166	0.000	0.15			6.2	OK	
13.000	SWMH40	15 Winter	30	+0%	100/15 Summer				6.465	-0.010	0.000	0.56			19.8	OK	
13.001	SWMH41	15 Winter	30	+0%	30/15 Summer				6.413	0.236	0.000	0.77			20.3	SURCHARGED	
14.000	SWMH42	15 Winter	30	+0%	30/15 Summer				6.635	0.170	0.000	0.96			33.7	SURCHARGED	
13.002	SWMH43	15 Winter	30	+0%	30/15 Summer				6.402	0.241	0.000	1.55			51.5	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
13.003	SWMH44	15 Winter	30	+0%	30/15 Winter				6.163	0.032	0.000	0.94			69.5	SURCHARGED	
15.000	SWMH45	15 Winter	30	+0%	30/15 Summer				5.946	0.041	0.000	0.21			7.0	SURCHARGED	
13.004	SWMH46	15 Winter	30	+0%	30/15 Summer				5.933	0.055	0.000	1.33			75.0	SURCHARGED	
16.000	SWMH47	1440 Winter	30	+0%	30/960 Winter				5.932	0.037	0.000	0.02			0.7	SURCHARGED	
13.005	SWMH48	1440 Winter	30	+0%	30/15 Winter				5.932	0.088	0.000	0.12			10.4	SURCHARGED	
17.000	SWMH49	1440 Winter	30	+0%	30/960 Winter				5.932	0.067	0.000	0.04			1.8	SURCHARGED	
13.006	SWMH50	1440 Winter	30	+0%	30/120 Winter				5.932	0.266	0.000	0.54			30.6	SURCHARGED	
13.007	SWMH51	1440 Winter	30	+0%	2/360 Winter				6.219	0.627	0.000	0.22			12.1	SURCHARGED	
18.000	SWMH52	1440 Winter	30	+0%	30/240 Summer				6.187	0.429	0.000	0.15			5.0	SURCHARGED	
18.001	SWMH53	1440 Winter	30	+0%	2/360 Winter				6.204	0.595	0.000	0.16			5.5	SURCHARGED	
13.008	SWMH54	1440 Winter	30	+0%	2/30 Summer				6.270	0.820	0.000	0.09			2.2	SURCHARGED	
1.013	SWMH55	1440 Winter	30	+0%					5.279	-0.149	0.000	0.25			8.4	OK	
1.014	SWMH56	1440 Winter	30	+0%					5.173	-0.150	0.000	0.25			8.4	OK	
1.015	SWMHEx.	30 Summer	30	+0%					5.066	-0.137	0.000	0.32			12.9	OK	
1.016	SWMHEx.	30 Summer	30	+0%					4.954	-0.127	0.000	0.39			19.7	OK	
1.017	SWMHEx.	30 Summer	30	+0%					4.804	-0.121	0.000	0.43			19.8	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 10

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH1	15 Winter	100	+10%					10.903	-0.177	0.000	0.10			11.3	OK	
1.001	SWMH2	15 Winter	100	+10%					10.080	-0.120	0.000	0.43			15.4	OK	
1.002	SWMH3	15 Winter	100	+10%					9.945	-0.149	0.000	0.24			18.6	OK	
1.003	SWMH4	15 Winter	100	+10%					9.687	-0.113	0.000	0.49			52.9	OK	
2.000	SWMH5	15 Winter	100	+10%	100/15 Summer				8.465	0.890	0.000	0.63			50.9	FLOOD RISK	
1.004	SWMH6	15 Winter	100	+10%	30/15 Summer				8.325	1.070	0.000	0.95			99.7	SURCHARGED	
1.005	SWMH7	15 Winter	100	+10%	30/15 Summer				8.075	1.100	0.000	1.26			100.2	FLOOD RISK	
1.006	SWMH8	15 Winter	100	+10%	2/15 Summer				7.920	1.120	0.000	2.62			144.4	FLOOD RISK	
1.007	SWMH9	15 Winter	100	+10%	30/15 Summer				7.587	0.824	0.000	2.08			143.6	SURCHARGED	
1.008	SWMH10	1440 Winter	100	+10%	30/480 Winter				6.838	0.323	0.000	0.07			5.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	SWMH11	15 Winter	100	+10%					10.652	-0.148	0.000	0.25			13.4	OK	
3.001	SWMH12	15 Winter	100	+10%					10.142	-0.058	0.000	0.85			32.7	OK	
3.002	SWMH13	15 Winter	100	+10%					9.712	-0.164	0.000	0.16			38.5	OK	
1.009	SWMH14	1440 Winter	100	+10%	2/360 Winter				6.926	0.601	0.000	0.16			3.1	SURCHARGED	
1.010	SWMH15	1440 Winter	100	+10%					6.113	-0.177	0.000	0.10			3.1	OK	
4.000	SWMH16	1440 Winter	100	+10%	30/15 Summer				8.035	0.735	0.000	0.11			4.1	SURCHARGED	
5.000	SWMH17	1440 Winter	100	+10%	30/360 Winter				8.034	0.734	0.000	0.03			1.2	SURCHARGED	
4.001	SWMH18	1440 Winter	100	+10%	2/1440 Winter				8.034	0.928	0.000	0.15			5.8	SURCHARGED	
6.000	SWMH19	1440 Winter	100	+10%	30/360 Winter				8.033	0.733	0.000	0.07			2.5	SURCHARGED	
6.001	SWMH20	1440 Winter	100	+10%	30/120 Winter				8.032	0.909	0.000	0.05			2.5	SURCHARGED	
4.002	SWMH21	1440 Winter	100	+10%	2/120 Winter				8.032	1.161	0.000	0.03			2.0	SURCHARGED	
7.000	SWMH22	1440 Winter	100	+10%	30/360 Winter				8.030	0.730	0.000	0.00			0.0	SURCHARGED	
4.003	SWMH23	1440 Winter	100	+10%	2/15 Summer				8.030	1.293	0.000	0.03			2.1	SURCHARGED	
8.000	SWMH24	15 Winter	100	+10%					9.683	-0.117	0.000	0.46			49.6	OK	
8.001	SWMH25	1440 Winter	100	+10%	30/15 Summer				8.029	0.729	0.000	0.05			4.7	SURCHARGED	
4.004	SWMH26	1440 Winter	100	+10%	2/15 Summer				8.028	1.474	0.000	0.02			2.1	SURCHARGED	
1.011	SWMH27	1440 Winter	100	+10%					5.859	-0.166	0.000	0.16			4.9	OK	
9.000	SWMH28	15 Winter	100	+10%	30/15 Winter				7.008	0.479	0.000	0.32			11.8	SURCHARGED	
9.001	SWMH29	15 Winter	100	+10%	30/15 Summer				6.985	0.593	0.000	0.49			14.6	SURCHARGED	
10.000	SWMH30	15 Winter	100	+10%	30/15 Summer				7.099	0.599	0.000	0.93			36.4	SURCHARGED	
9.002	SWMH31	15 Winter	100	+10%	30/15 Summer				6.978	0.618	0.000	1.70			64.1	SURCHARGED	
11.000	SWMH32	1440 Winter	100	+10%	100/960 Winter				6.901	0.101	0.000	0.02			1.4	SURCHARGED	
9.003	SWMH33	1440 Winter	100	+10%	2/1440 Winter				6.901	0.749	0.000	0.14			9.0	SURCHARGED	
9.004	SWMH34	1440 Winter	100	+10%	2/240 Winter				6.900	0.892	0.000	0.03			1.6	SURCHARGED	
9.005	SWMH35	1440 Winter	100	+10%	2/15 Summer				6.899	0.943	0.000	0.03			1.6	SURCHARGED	
12.000	SWMH36	1440 Winter	100	+10%	100/960 Winter				6.898	0.098	0.000	0.04			2.1	SURCHARGED	
12.001	SWMH37	1440 Winter	100	+10%	30/360 Winter				6.898	0.598	0.000	0.03			2.8	SURCHARGED	
9.006	SWMH38	1440 Winter	100	+10%	2/15 Summer				6.897	1.129	0.000	0.05			1.7	SURCHARGED	
1.012	SWMH39	1440 Winter	100	+10%					5.541	-0.164	0.000	0.16			6.6	OK	
13.000	SWMH40	15 Winter	100	+10%	100/15 Summer				7.100	0.625	0.000	0.62			21.7	FLOOD RISK	
13.001	SWMH41	15 Winter	100	+10%	30/15 Summer				6.997	0.820	0.000	1.00			26.6	FLOOD RISK	
14.000	SWMH42	15 Winter	100	+10%	30/15 Summer				7.398	0.933	0.000	1.15			40.2	SURCHARGED	
13.002	SWMH43	15 Winter	100	+10%	30/15 Summer				6.978	0.817	0.000	2.02			67.1	FLOOD RISK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
13.003	SWMH44	15 Winter	100	+10%	30/15 Winter				6.587	0.456	0.000	1.25			92.5	SURCHARGED	
15.000	SWMH45	1440 Winter	100	+10%	30/15 Summer				6.199	0.294	0.000	0.02			0.8	SURCHARGED	
13.004	SWMH46	1440 Winter	100	+10%	30/15 Summer				6.199	0.321	0.000	0.20			11.5	SURCHARGED	
16.000	SWMH47	1440 Winter	100	+10%	30/960 Winter				6.198	0.303	0.000	0.03			0.9	SURCHARGED	
13.005	SWMH48	1440 Winter	100	+10%	30/15 Winter				6.199	0.355	0.000	0.16			14.0	SURCHARGED	
17.000	SWMH49	1440 Winter	100	+10%	30/960 Winter				6.197	0.332	0.000	0.06			2.4	SURCHARGED	
13.006	SWMH50	1440 Winter	100	+10%	30/120 Winter				6.197	0.531	0.000	0.63			35.5	SURCHARGED	
13.007	SWMH51	1440 Winter	100	+10%	2/360 Winter				6.533	0.941	0.000	0.25			14.0	SURCHARGED	
18.000	SWMH52	1440 Winter	100	+10%	30/240 Summer				6.496	0.738	0.000	0.18			6.1	SURCHARGED	
18.001	SWMH53	1440 Winter	100	+10%	2/360 Winter				6.514	0.905	0.000	0.19			6.7	SURCHARGED	
13.008	SWMH54	1440 Winter	100	+10%	2/30 Summer				6.592	1.142	0.000	0.09			2.3	FLOOD RISK	
1.013	SWMH55	1440 Winter	100	+10%					5.282	-0.146	0.000	0.26			8.8	OK	
1.014	SWMH56	1440 Winter	100	+10%					5.175	-0.148	0.000	0.26			8.8	OK	
1.015	SWMHEx.	30 Summer	100	+10%					5.078	-0.125	0.000	0.40			16.1	OK	
1.016	SWMHEx.	30 Summer	100	+10%					4.972	-0.109	0.000	0.52			25.9	OK	
1.017	SWMHEx.	30 Summer	100	+10%					4.823	-0.102	0.000	0.57			26.1	OK	

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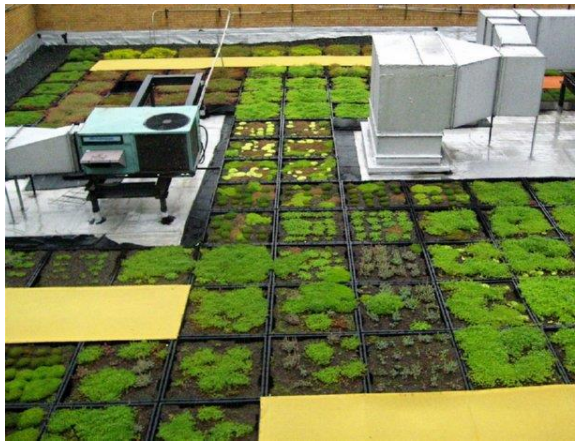
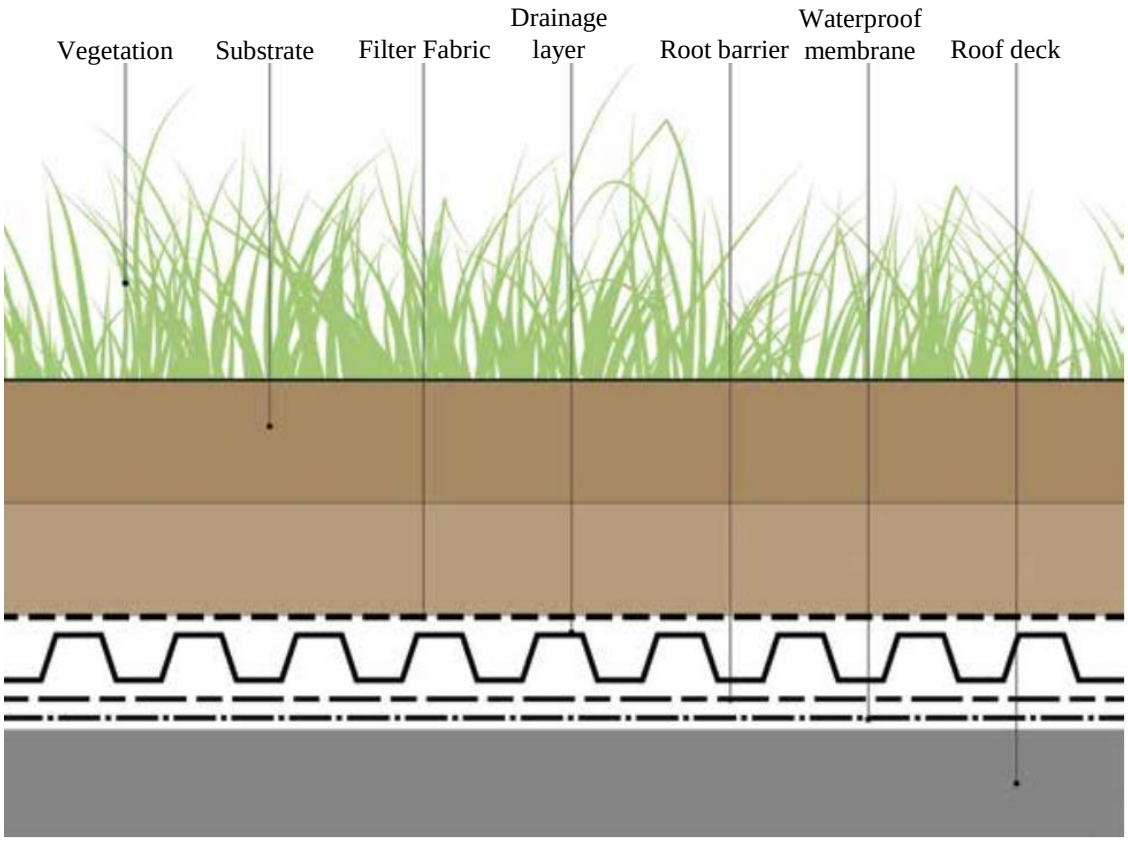
Appendix B

SuDS features

SuDS components

Green Roofs

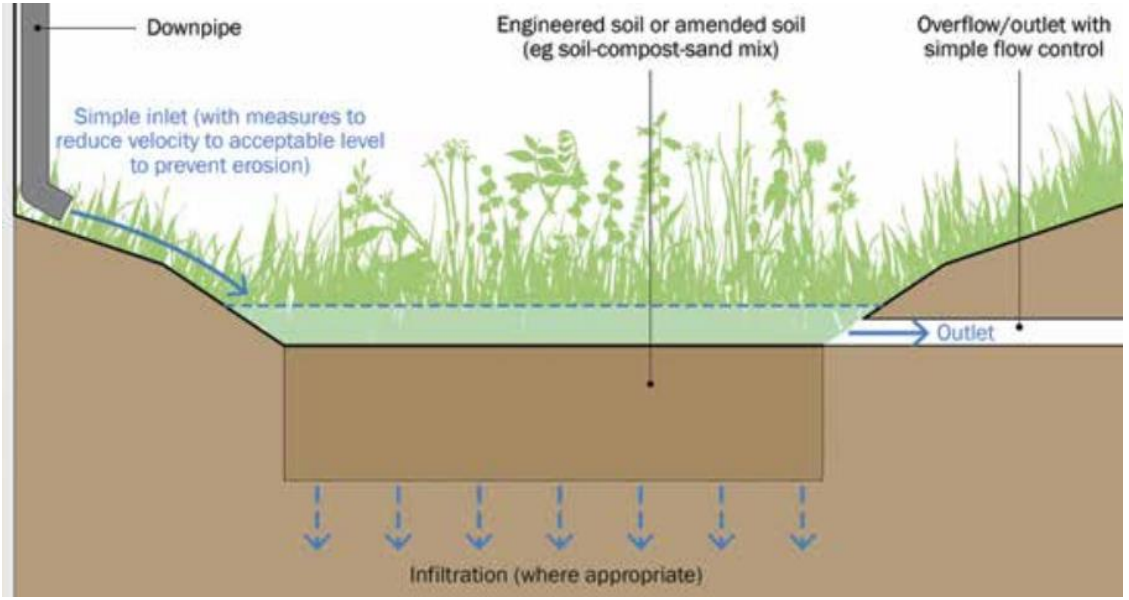




ARUP

SuDS components

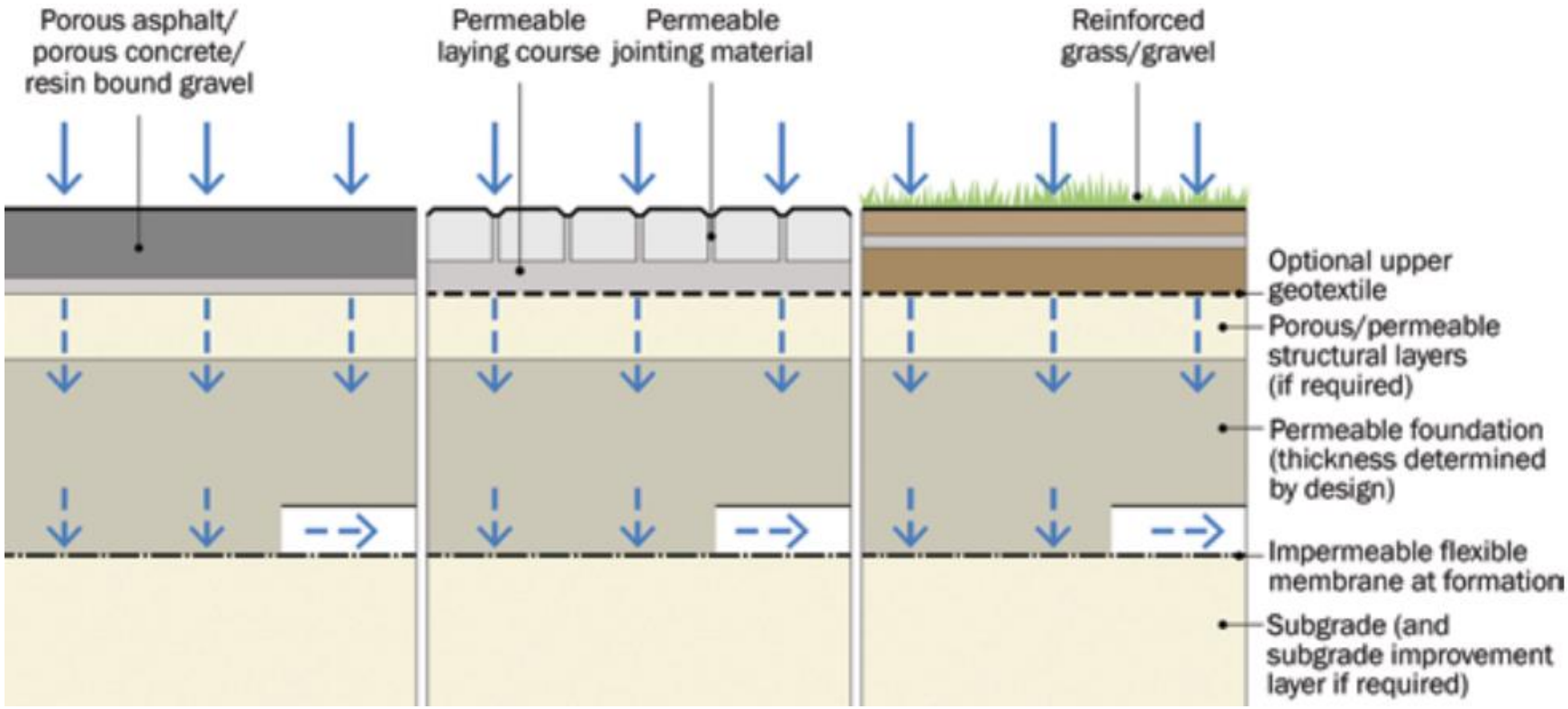
Rain garden



ARUP

SuDS components

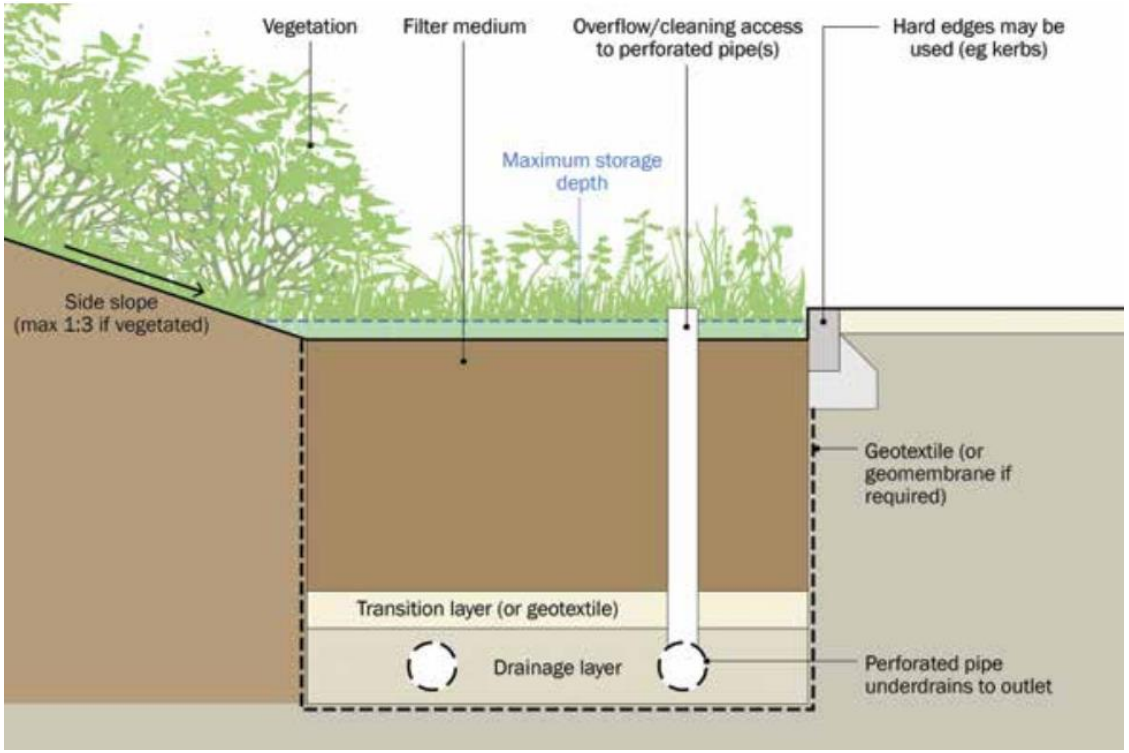
Permeable Paving (no infiltration)



ARUP

SuDS components

Bioretention systems

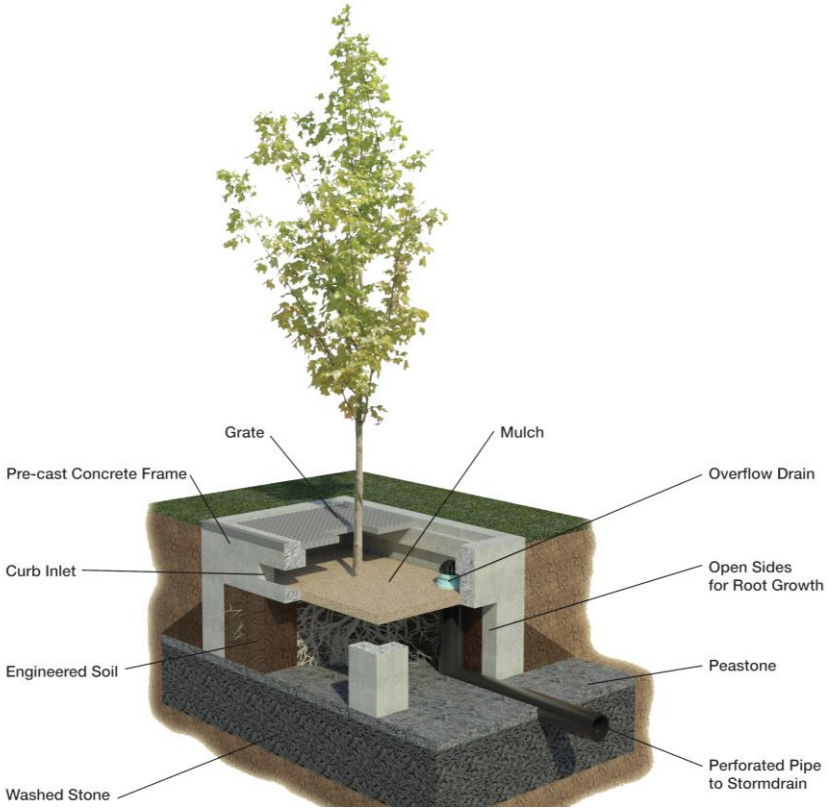


ARUP

SuDS components

Bioretention systems – Stockholm tree pits

[Image courtesy of Davies Landscape Architects]



ARUP

Appendix C

Irish Water Pre-Connection Enquiry, Confirmation of Feasibility and Statement of Design Acceptance Correspondence

Note, drawings included within the Statement of Design Acceptance are superseded by the planning drawings as the red line boundary changed to incorporate the surface water discharge point to the south of the site.

Pre-connection enquiry form

Business developments, mixed use developments, housing developments

This form is to be filled out by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure. If completing this form by hand, please use BLOCK CAPITALS and black ink.

Please refer to the **Guide to completing the pre-connection enquiry form** on page 13 of this document when completing the form.

*** Denotes mandatory/ required field. Please note, if mandatory fields are not completed the application will be returned.**

Section A | Applicant details

1 *Applicant details:

Registered company name (if applicable): WATFORE LIMITED

Trading name (if applicable): WATFORE LIMITED

Company registration number (if applicable):

If you are not a registered company/business, please provide the applicant's name:

*Contact name:

*Postal address: DAIRYGOLD CO-OPERATIVE SOCIETY LIMITED
CLONMEL ROAD MITCHELSTOWN CORK

*Eircode:

*Telephone:

Mobile:

*Email:

2 Agent details (if applicable):

Contact name: RICHARD MURPHY

Company name (if applicable): ARUP

Postal address: ONE ALBERT QUAY
CORK

Eircode: T12 8XN

Telephone: 021 4223266

Email: richard.murphy@arup.com

3 ***Please indicate whether it is the applicant or agent who should receive future correspondence in relation to the enquiry:**

Applicant [ ] Agent [X]

Section B | Site details

4 ***Site address:** KINSLAE ROAD

CORK

5 ***Irish Grid co-ordinates of site:** Eastings (X) 167657 Northings (Y) 069676

Eg. co-ordinates of GPO, O'Connell St., Dublin: E(X) 315,878 N(Y) 234,619

6 ***Local Authority:**

Local Authority that granted planning permission (if applicable):

N/A

7 ***Has full planning permission been granted?** Yes [ ] No [X]

If 'Yes', please provide the current or previous planning reference number:

Section C | Development details

8 Please outline the domestic and/or industry/business use proposed:

Property type	Number of units	Property type	Number of units	Property type	Number of units
House	810	Apartments		Agricultural	
Office		School		Retail unit	
Residential care home		Institution		Industrial unit	
Hotel		Factory		Other	
Other (please specify type)	1500 m2 of mixed uses (retail/gym/creche/community facility)				

9 *Approximate start date of proposed development: 0 1 / 0 6 / 2 0 2 2

10 *Is the development multi-phased? Yes ☐ No ☒

If 'Yes', application must include a master-plan identifying the development phases and the current phase number.

If 'Yes', please provide details of variations in water demand volumes and wastewater discharge loads due to phasing requirements.

11 *Please indicate the type of connection required by ticking the appropriate box below:

Water ☐ Please go to Section D

Wastewater ☐ Please go to Section E

Both ☒ Please complete both Sections D and E

Section D | Water connection and demand details

12 ***Is there an existing connection to public water mains at the site?** Yes [ ] No [X]

12.1 If yes, is this enquiry for an additional connection to one already installed? Yes [ ] No [ ]

12.2 If yes, is this enquiry to increase the size of an existing connection? Yes [ ] No [ ]

13 **Approximate date water connection is required:** [0][1] / [0][6] / [2][0][2][2]

14 ***What diameter of water connection is required to service the development?** [2][0][0] mm

15 ***Is more than one connection required to the public infrastructure to service this development?** Yes [ ] No [X]

If 'Yes', how many? [ ][ ]

16 **Please indicate the business water demand (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak hour water demand	29	**l/s**
Post-development average hour water demand	5.8	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

17 **Please indicate the industrial water demand (industry-specific water requirements):**

Post-development peak hour water demand	N/A	**l/s**
Post-development average hour water demand	N/A	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

18 **What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?**

[9][.][7][0][ ] m

19 **What is the highest finished floor level of the proposed development above Malin Head Ordnance Datum?**

[5][5][ ][ ][ ] m

20 **Is on-site water storage being provided?** Yes [X] No [ ]

Please include calculations on the attached sheet provided.

21 **Are there fire flow requirements?** Yes [X] No [ ]

Additional fire flow requirements over and above those identified in Q16-17	TBC with Fire Officer	**l/s**

Please include calculations on the attached sheet provided, and include confirmation of requirements from the Fire Authority.

22 **Do you propose to supplement your potable water supply from other sources?** Yes [ ] No [X]

If 'Yes', please indicate how you propose to supplement your potable water supply from other sources (see **Guide to completing the application form** on page 12 of this document for further details):

Section E | Wastewater connection and discharge details

23 ***Is there an existing connection to a public sewer at the site?** Yes [ ] No [X]

23.1 If yes, is this enquiry for an additional connection to the one already installed? Yes [ ] No [ ]

23.2 If yes, is this enquiry to increase the size of an existing connection? Yes [ ] No [ ]

24 ***Approximate date that wastewater connection is required:** 0 1 / 0 6 / 2 0 2 2

25 ***What diameter of wastewater connection is required to service the development?** 3 0 0 mm

26 ***Is more than one connection required to the public infrastructure to service this development?** Yes [X] No [ ]

If 'Yes', how many? 3

27 **Please indicate the commercial wastewater hydraulic load (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak discharge	38.4	**l/s**
Post-development average discharge	6.4	**l/s**

Please include calculations on the attached sheet provided.

28 **Please indicate the industrial wastewater hydraulic load (industry-specific discharge requirements):**

Post-development peak discharge		**l/s**
Post-development average discharge		**l/s**

Please include calculations on the attached sheet provided.

29 Wastewater organic load:

Characteristic	Max concentration (mg/l)	Average concentration (mg/l)	Maximum daily load (kg/day)
Biochemical oxygen demand (BOD)			
Chemical oxygen demand (COD)			
Suspended solids (SS)			
Total nitrogen (N)			
Total phosphorus (P)			
Other			

N/A

Temperature range	
pH range	

30 *Storm water run-off will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer. In the case of such brownfield sites, please indicate if the development intends discharging surface water to the combined wastewater collection system:

Yes [ ] No [X]

If 'Yes', please give reason for discharge and comment on adequacy of SUDS/attenuation measures proposed.

31 *Do you propose to pump the wastewater? Yes [X] No [ ]

If 'Yes', please include justification for your pumped solution with this application.

32 What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?

9.70 m

33 What is the lowest finished floor level on site above Malin Head Ordnance Datum? 6.50 m

34 What is the proposed invert level of the pipe exiting the property to the public road?

6.90 m

Section F | Supporting documentation

Please provide the following additional information (all mandatory):

> Site location map: A site location map to a scale of 1:1000, which clearly identifies the land or structure to which the enquiry relates. The map shall include the following details: [X]

i. The scale shall be clearly indicated on the map.

ii. The boundaries shall be delineated in red.

iii. The site co-ordinates shall be marked on the site location map.

> Details of planning and development exemptions (if applicable). [ ]

> Calculations (calculation sheets provided below). [X]

> Site layout map to a scale of 1:500 showing layout of proposed development, water network and wastewater network layouts, additional water/wastewater infrastructure if proposed, connection points to Irish Water infrastructure. [X]

> Conceptual design of the connection asset from the proposed development to the existing Irish Water infrastructure, including service conflicts, gradients, pipe sizes and invert levels. [ ]

> Any other information that might help Irish Water assess this pre-connection enquiry. [ ]

Section G | Declaration

I/We hereby make this application to Irish Water for a water and/or wastewater connection as detailed on this form.

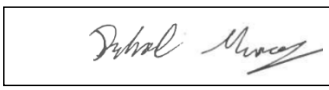
I/We understand that any alterations made to this application must be declared to Irish Water.

The details that I/we have given with this application are accurate.

I/We have enclosed all the necessary supporting documentation.

Any personal data you provide will be stored and processed by Irish Water and may be transferred to third parties for the purposes of the water and/or wastewater connection process. I hereby give consent to Irish Water to store and process my personal data and to transfer my personal data to third parties, if required, for the purposes of the connection process.

If you wish to revoke consent at any time or wish to see Irish Water's full Data Protection Notice, please see **https://www.water.ie/privacy-notice/**

Signature: 

Date: 1 0 / 1 2 / 2 0 2 0

Your full name (in BLOCK CAPITALS):

R I C H A R D M U R P H Y

Irish Water will carry out a formal assessment based on the information provided on this form.
Any future connection offer made by Irish Water will be based on the information that has been provided here.

Please submit the completed form to **newconnections@water.ie** or alternatively, post to:

Irish Water
PO Box 860
South City Delivery Office
Cork City

Please note that if you are sending us your application form and any associated documentation by email, the maximum file size that we can receive in any one email is 35MB.

Please note, if mandatory fields are not completed the application will be returned.

Irish Water is subject to the provisions of the Freedom of Information Act 2014 ("FOIA") and the codes of practice issued under FOIA as may be amended, updated or replaced from time to time. The FOIA enables members of the public to obtain access to records held by public bodies subject to certain exemptions such as where the requested records may not be released, for example to protect another individual's privacy rights or to protect commercially sensitive information. Please clearly label any document or part thereof which contains commercially sensitive information. Irish Water accepts no responsibility for any loss or damage arising as a result of its processing of freedom of information requests.

Calculations

Water demand

Assumptions
Assumed residential water demand rate of 150 litres/head/day (as per Irish Water CoP)
Assumed residential occupancy of 2.7 people/unit (as per Irish Water CoP)
Assumed non-residential water demand of 300 litres/100m2/day (based on industry guidance)
Assumed operational hours: 16 hours for residential and 10 hours for non-residential
Peak factor of 5 taken for all demands (as per Irish Water CoP)

Residential water demand
Proposed Units - 810. i.e. Population = 810 x 2.7 = 2187 people

- Residential daily demand = (2187 x 150) /1000 = 328 m3/day
- Residential average water demand = (328 x 1000) / (16 x 3600) = 5.7 l/s
- Residential peak water demand = 5.7 x 5 = 28.5 l/s

Non-residential water demand
Proposed area = 1,500 m2

- Non-resi daily demand = (1500 x (300/100)) /1000 = 4.5 m3/day
- Non-resi average water demand= (45 x 1000) / (10 x 3600) = 0.125l/s
- Commercial peak water demand = 0.125 x 5 = 0.625 l/s

Total average water demand = 5.7+ 0.125 = 5.8 l/s
Total Phase 1 peak Water demand = 28.5 + 0.625 = 29 l/s

On-site storage

TBC

Fire flow requirements

TBC with fire officer

Assumptions
Average wastewater flow taken as average potable water consumption plus 10% as per Irish Water wastewater CoP. i.e a multiplication factor of 1.1 is applied.
Peak factor of 6 is taken. (Note, Irish Water CoP indicates a peaking factor of 3 for populations over 1,001. However, 6 is taken to be conservative at this stage)

Residential wastewater discharge
- Average residential wastewater discharge = 5.7 x 1.1 = 6.27 l/s
- Peak residential wastewater discharge = 6.27 x 6 = 37.62 l/s

Non-residential water demand
- Average non-resi wastewater discharge = 0.125 x 1.1 = 0.1375 l/s
- Peak non-resi wastewater discharge = 0.1375 x 6 = 0.825 l/s

Total average wastewater discharge = 6.27 + 0.1375 = 6.4 l/s
Total peak wastewater discharge = 37.62 + 0.825 = 38.4 l/s

Flow balancing and pumping

N/A

Guide to completing the pre-connection enquiry form

This form should be completed by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure.

The Irish Water Codes of Practice are available at **www.water.ie** for reference.

Section A | Applicant Details

Question 1: This question requires the applicant or company enquiring about the feasibility of a connection to identify themselves, their postal address, and to provide their contact details.

Question 2: If the applicant has employed a consulting engineer or an agent to manage the enquiry on their behalf, the agent's address and contact details should be recorded here.

Question 3: Please indicate whether it is the applicant or the agent who should receive future correspondence in relation to the enquiry.

Section B | Site details

Question 4: This is the address of the site requiring the water/wastewater service connection and for which this enquiry is being made.

Question 5: Please provide the Irish Grid co-ordinates of the proposed site. Irish grid positions on maps are expressed in two dimensions as Eastings (E or X) and Northings (N or Y) relative to an origin. You will find these coordinates on your Ordnance Survey map which is required to be submitted with an application.

Question 6: Please identify the Local Authority that is or will be dealing with your planning application, for example Cork City Council.

Question 7: Please indicate if planning permission has been granted for this application, and if so, please provide the planning permission reference number.

Section C | Development details

Question 8: Please specify the number of different property/premises types by filling in the tables provided.

Question 9: Please indicate the approximate commencement date of works on the development.

Question 10: Please indicate if a phased building approach is to be adopted when developing the site. If so, please provide details of the phase master-plan and the proposed variation in water demand/wastewater discharge as a result of the phasing of the development.

Question 11: Please indicate the type of connection required by ticking the appropriate box and proceed to complete the appropriate section or sections.

Section D | Water connection and demand details

Question 12: Please indicate if a water connection already exists for this site.

Question 12.1: Please indicate if this enquiry concerns an additional connection to one already installed on the site.

Question 12.2: Please indicate if you are proposing to upgrade the water connection to facilitate an increase in water demand. Irish Water will determine what impact this will have on our infrastructure.

Question 13: Please indicate the approximate date that the proposed connection to the water infrastructure will be required.

Question 14: Please indicate what diameter of water connection is required to service this development.

Question 15: Please indicate if more than one connection is required to service this development. Please note that the connection size provided may be used to determine the connection charge.

Question 16: If this connection enquiry concerns a business premises, please provide calculations for the water demand and include your calculations on the calculation sheet provided. Business premises include shops, offices, hotels, schools, etc. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 17: If this connection enquiry is for an industrial premises, please calculate the water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak demand for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 18: Please specify the ground level at the location where connection to the public water mains will be made. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 19: Please specify the highest finished floor level on site. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 20: If storage is required, water storage capacity of 24-hour water demand must usually be provided at the proposed site. In some cases, 24-hour storage capacity may not be required, for example 24-hour storage for a domestic house would be provided in an attic storage tank. Please calculate the 24-hour water storage requirements and include your calculations on the attached sheet provided. Please also confirm that on-site storage is being provided by ticking the appropriate box.

Question 21: The water supply system shall be designed and constructed to reliably convey the water flows that are required of the development including fire flow requirements by the Fire Authority. The Fire Authority will provide the requirement for fire flow rates that the water supply system will have to carry. Please note that while flows in excess of your required demand may be achieved in the Irish Water network and could be utilised in the event of a fire, Irish Water cannot guarantee a flow rate to meet your fire flow requirement. To guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development. Please include your calculations on the attached sheet provided, and further provide confirmation of the Fire Authority requirements.

Question 22: Please identify proposed additional water supply sources, that is, do you intend to connect to the public water mains or the public mains and supplement from other sources? If supplementing public water supply with a supply from another source, please provide details as to how the potable water supply is to be protected from cross contamination at the premises.

Section E | Wastewater connection and discharge details

Question 23: Please indicate if a wastewater connection to a public sewer already exists for this site.

Question 23.1: Please indicate if this enquiry relates to an additional wastewater connection to one already installed.

Question 23.2: Please indicate if you are proposing to upgrade the wastewater connection to facilitate an increased discharge. Irish Water will determine what impact this will have on our infrastructure.

Question 24: Please specify the approximate date that the proposed connection to the wastewater infrastructure will be required.

Question 25: Please indicate what diameter of wastewater connection is required to service this development.

Question 26: Please indicate if more than one connection is required to service this development. Please indicate number required.

Question 27: If this enquiry relates to a business premises, please provide calculations for the wastewater discharge and include your calculations on the attached sheet provided. Business premises include shops, offices, hotels, schools, etc. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 28: If this enquiry relates to an industrial premises, please provide calculations for the wastewater discharge and include your calculations on the calculation sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak discharge for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 29: Please specify the maximum and average concentrations and the maximum daily load of each of the wastewater characteristics listed in the wastewater organic load table (if not domestic effluent), and also specify if any other significant concentrations are expected in the effluent. Please complete the table and provide additional supporting documentation if relevant. Note that the concentration shall be in mg/l and the load shall be in kg/day. Note that for business premises (shops, offices, schools, hotels, etc.) for which only domestic effluent will be discharged (excluding discharge from canteens/ restaurants which would require a Trade Effluent Discharge licence), there is no need to complete this question.

Question 30: In exceptional circumstances, such as brownfield sites, where the only practical outlet for storm/ surface water is to a combined sewer, Irish Water will consider permitting a restricted attenuated flow to the combined sewer. Storm/surface water will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer and the applicant must demonstrate how the storm/surface water flow from the proposed site is minimised using sustainable urban drainage system (SUDS). This type of connection will only be considered on a case by case basis. Please advise if the proposed development intends discharging surface water to the combined wastewater collection system.

Question 31: Please specify if the development needs to pump its wastewater discharge to gain access to Irish Water infrastructure.

Question 32: Please specify the ground level at the location where connection to the public sewer will be made. This is required to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 33: Please specify the lowest floor level of the proposed development. This is required in order to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 34: Please specify the proposed invert level of the pipe exiting the property to the public road.

Section F | Supporting documentation

Please provide additional information as listed.

Section G | Declaration

Please review the declaration, sign, and return the completed application form to Irish Water by email or by post using the contact details provided in Section G.

Notes

Notes

Richard Murphy

One Albert Quay
Cork City
Co. Cork
T128XN

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

25 January 2021

Re: CDS20008019 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 811 unit(s) at Kinslae Road, Cork, Co. Cork

Dear Sir/Madam,

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

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	Connection can be made to the watermain on the Kinsale Road
Wastewater Connection	Please note that according to our records there is an existing sewer running through this site (see drawing attached). It will not be permitted to build over any Irish water infrastructure. The layout of the development must ensure that this pipe is protected and adequate separation distances are provided between Irish Water infrastructure and any structures on site. Alternatively you may enter into a diversion agreement with Irish Water and divert the pipe to accommodate your development. If you wish to proceed with this option please contact with Irish Water at Diversions@water.ie and submit detailed design drawings before submitting your planning application. It will be necessary to provide a wayleave over this pipe to the benefit of Irish Water and ensure that it is accessible for maintenance. The foul sewer connection point shall be the existing or diverted sewer. It is noted that a portion of this site will have to be pumped to reach this

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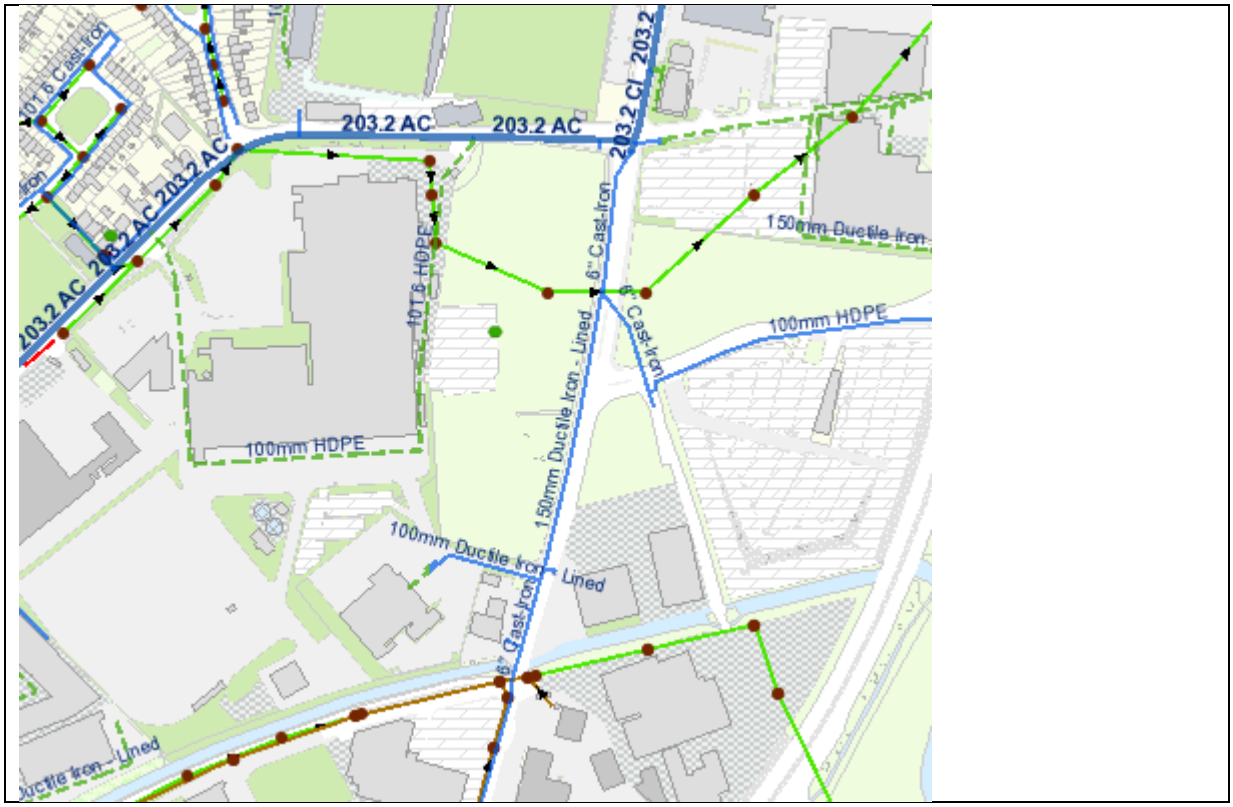
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363
IW-HP-BUS
REV012

	connection point. The pumping station shall be constructed such that it can serve the area to the south of the development. The design of the pumping station shal be agreed with Irish Water.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation 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 to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

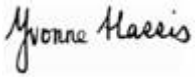
1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a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

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, 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. Please submit your design to CDSDesignQA@water.ie

If you have any further questions, please contact Brian O'Mahony from the design team on 022 52205 or email bomahony@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Watfore Limited c/o

AURP
One Albert Quay
Cork City,
T128XN

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

7 February 2022

Re: Design Submission for Kinslae Road, Cork, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS20008019

Dear Richard Murphy,

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.

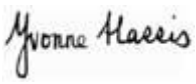
A resubmission of the water and wastewater network proposal is to be submitted to Irish Water for review at Connection Application stage to finalise the design including the wastewater pump station. This letter does not cover the proposal to divert the sewer running through the proposed site

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

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

If you have any further questions, please contact your Irish Water representative:
Name: PJ Murphy
Phone: 022 52267
Email: pjmurphy@water.ie

Yours sincerely,



Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- 252666-ARUP-ZZ-XX-DR-C-1000 P02
- 252666-ARUP-ZZ-XX-DR-C-2000 P06
- 252666-ARUP-ZZ-XX-DR-C-2100 P04
- 252666-ARUP-ZZ-XX-DR-C-3000 P04

*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.

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Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1 D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

A1

Notes:

1. All levels relate to OD Malin Head and are in meters.
2. Do not scale from this drawing. If in doubt, ask.
3. This drawing should be read in conjunction with all relevant and available documentation.
4. All pipework shall be Polypipe Ridgidrain pipework and fittings or similar approved.
5. Proposed linear drainage channels to be ACO MultiDrain channels with D400 Brickslot covers to suit the architects proposed finished surface.
6. Proposed road gullies shall be Polypipe Ridgigully with D400 Buffalo 100 ductile iron grating.
7. All runoff from car parking areas to be treated by a Class 1 Hydrocarbon separator.
8. All pipes to have a minimum cover of 900mm in non-trafficable areas and 1.2m in trafficable areas.
9. All gully and linear drainage sump outlets to be 150mm diameter.
10. All carrier pipes to be 225mm dia unless noted otherwise.
11. All chamber covers to be rated D400 where located in trafficable areas and C250 elsewhere.
12. Refer to drawings 252666-ARUP-ZZ-XX-DR-C-6000 and 6001 for drainage details.
13. Attenuation tank volumes are indicative.

LEGEND:

- Proposed Planning Boundary Line
- Proposed Proposed Building
- Proposed Outline of the Basement
- Existing Surface Water Drain & Manhole
- Proposed Surface Water Drain & Manhole
- Proposed Geocellular Surface Water Attenuation
- Proposed Road Gully (RG)
- Proposed Linear Drainage Channel & Sump
- Proposed Bypass Separator U.N.O.
- Proposed permeable paving

Rev	Date	By	Chkd	Appd
P02	20/12/21	WC	RM	J.MacC
	Issued for Information			
P01	06/08/21	ROD	RM	J.MacC
	Issued for Information			

ARUP

One Albert Quay
Cork, Ireland
Tel +353 (0)21 427 7670 Fax +353 (0)21 427 2345
www.arup.com

Client

CREAMFIELDS

Project Title

Creamfields Residential Development

Drawing Title

Proposed Surface Water Drainage Layout

Scale at A1: 1:500

Role: Site Infrastructure

Suitability: S2 - Suitable for Information

Arup Job No: 252666-00

Rev: P02

Name: 252666-ARUP-ZZ-XX-DR-C-1000

Do not scale

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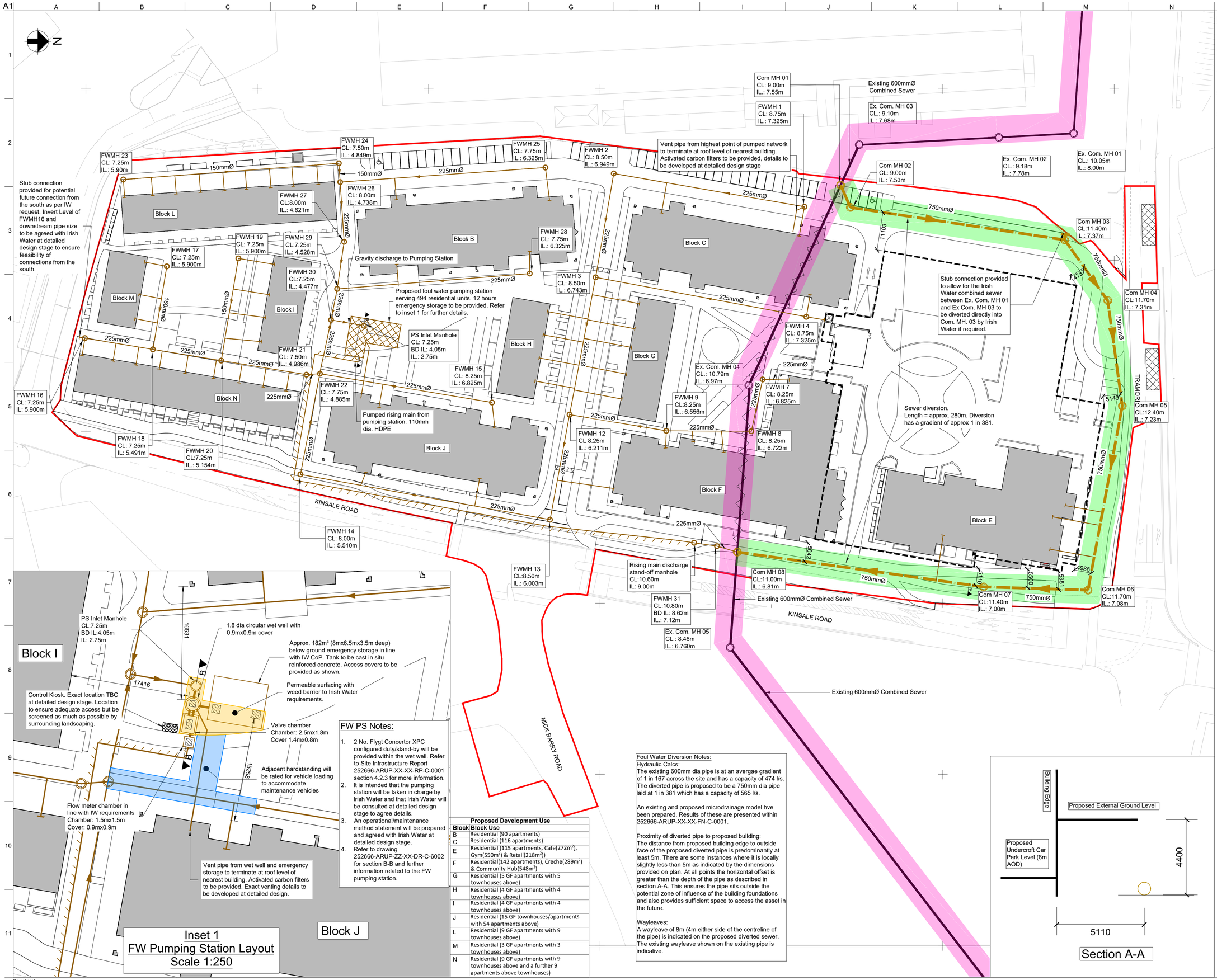

Proposed Development Use	
Block	Block Use
B	Residential (90 apartments)
C	Residential (116 apartments)
E	Residential (115 apartments, Cafe(272m²), Gym(550m²) & Retail(218m²))
F	Residential(142 apartments), Creche(289m²) & Community Hub(548m²)
G	Residential (5 GF apartments with 5 townhouses above)
H	Residential (4 GF apartments with 4 townhouses above)
I	Residential (4 GF apartments with 4 townhouses above)
J	Residential (15 GF townhouses/apartments with 54 apartments above)
L	Residential (9 GF apartments with 9 townhouses above)
M	Residential (3 GF apartments with 3 townhouses above)
N	Residential (9 GF apartments with 9 townhouses above and a further 9 apartments above townhouses)

Notes:

1. All levels relate to OD Malin Head and are in meters.
2. Do not scale from this drawing. If in doubt, ask.
3. This drawing should be read in conjunction with all relevant and available documentation.
4. Ordnance Survey Ireland License No. EN0002821 © Ordnance Survey Ireland/Government of Ireland.
5. Existing foul water infrastructure based on record drawings received from Irish Water & Cork City Council.
6. All foul water drainage to be designed and constructed in accordance with Irish Water Code of Practice and Standard Details.
7. All pipework shall be Polypipe Polysewer and fittings, or similar approved and to have a minimum cover of 900mm in non-trafficable areas and 1.2m in trafficable areas.
8. Outlet pipes from buildings to be min 150mm dia. Outlets from buildings to discharge to an inspection chamber (IC) prior to discharge to the main carrier sewer. IC's not shown for clarity.
9. Runoff from undercroft basement to be collected by channel drains and discharged to the FW network.
10. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-6000 and 6001 for drainage details.

LEGEND:

- Proposed Planning Boundary Line
- Proposed Proposed Building
- Proposed Outline of the Basement
- Existing Utility to be Diverted
- Existing Combined Water Sewer & Manhole
- Proposed Combined Water Sewer & Manhole Diversion
- Proposed Foul Water Sewer & Manhole
- Proposed Foul Water Building Connection
- Existing Combined Sewer Wayleave
- Proposed Combined Sewer Wayleave

Rev	Date	By	Chkd	Appd
P06	18/01/22	RM	RM	J.MacC
Issued for Information				
P05	20/12/21	WC	RM	J.MacC
Issued for Information				
P04	01/12/21	RM	RM	J.MacC
Issued for Information				
P03	18/11/21	BH	RM	J.MacC
Issued for Information				
P02	04/11/21	ROD	RM	J.MacC
Issued for Information				
P01	06/08/21	ROD	RM	J.MacC
Issued for Information				

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www.arup.com

Client

CREAMFIELDS

Project Title

Creamfields Residential Development

Drawing Title

Proposed Foul Water Layout

Scale at A1 1:500

Role Site Infrastructure

Suitability S2 - Suitable for Information

Arup Job No **252666-00**

Rev **P06**

Name **252666-ARUP-ZZ-XX-DR-C-2000**

Do not scale
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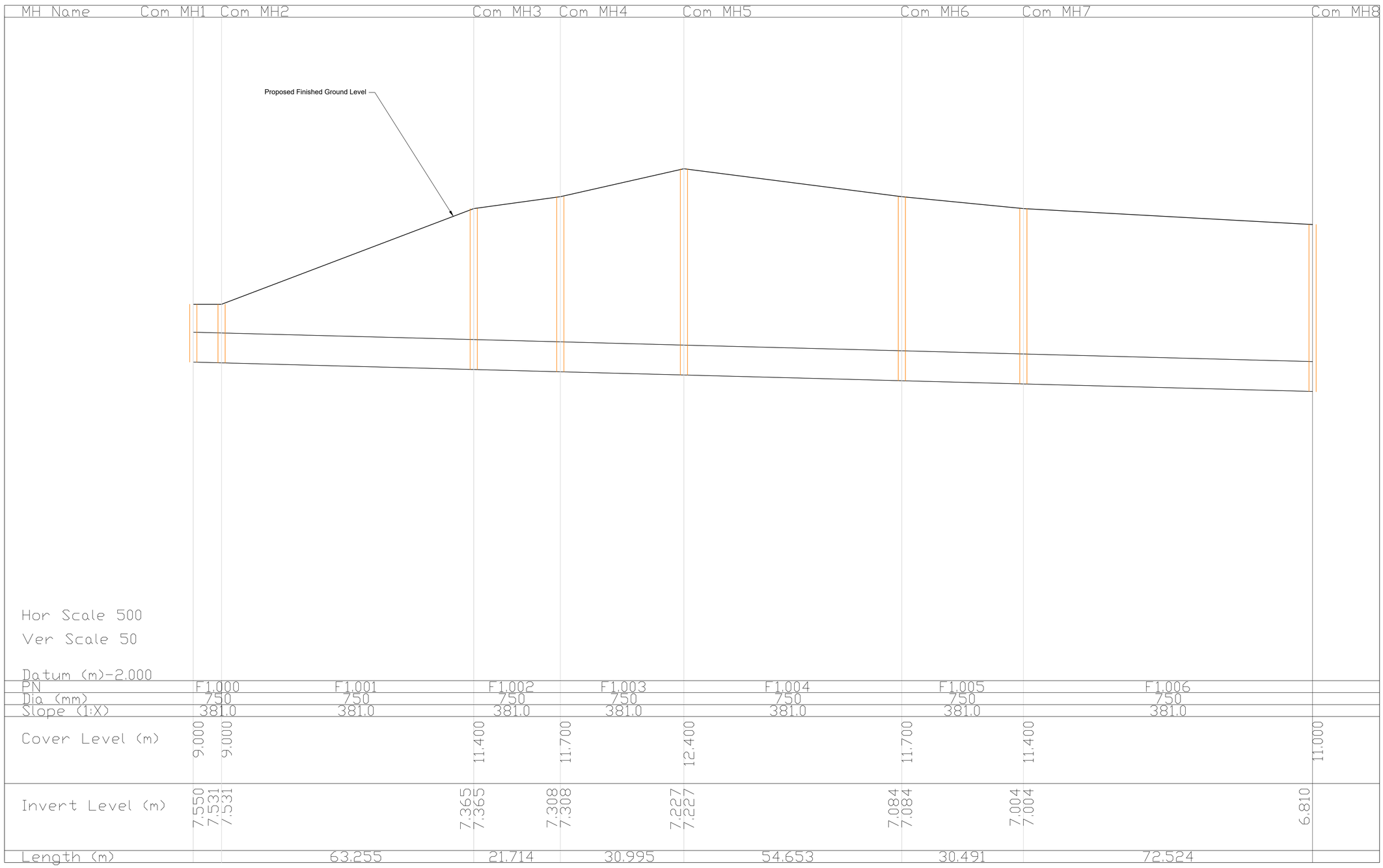

Notes:

1. All levels relate to OD Malin Head and are in meters.
2. Do not scale from this drawing. If in doubt, ask.
3. This drawing should be read in conjunction with all relevant and available documentation.
4. All foul water drainage to be designed and constructed in accordance with Irish Water Code of Practice and Standard Details.
5. All pipework shall be Polypipe Polysewer and fittings, or similar approved.
6. All pipes to have a minimum cover of 900mm in non-trafficable areas and 1.2m in trafficable areas.
7. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-2000 for Proposed Foul Water Layout.
8. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-6000 and 6001 for drainage details.

Rev	Date	By	Chkd	Appd
P04	18/01/22	RM	RM	J.MacC
	Issued for Information			
P03	20/12/21	WC	RM	J.MacC
	Issued for Information			
P02	18/11/21	RM	RM	J.MacC
	Issued for Information			
P01	04/11/21	ROD	RM	J.MacC
	Issued for Information			

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www.arup.com

Client

CREAMFIELDS

Project Title

Creamfields Residential Development

Drawing Title

Proposed Combined Sewer Longsections

Scale at A1: As Shown

Role: Site Infrastructure

Suitability: S2 - Suitable for Information

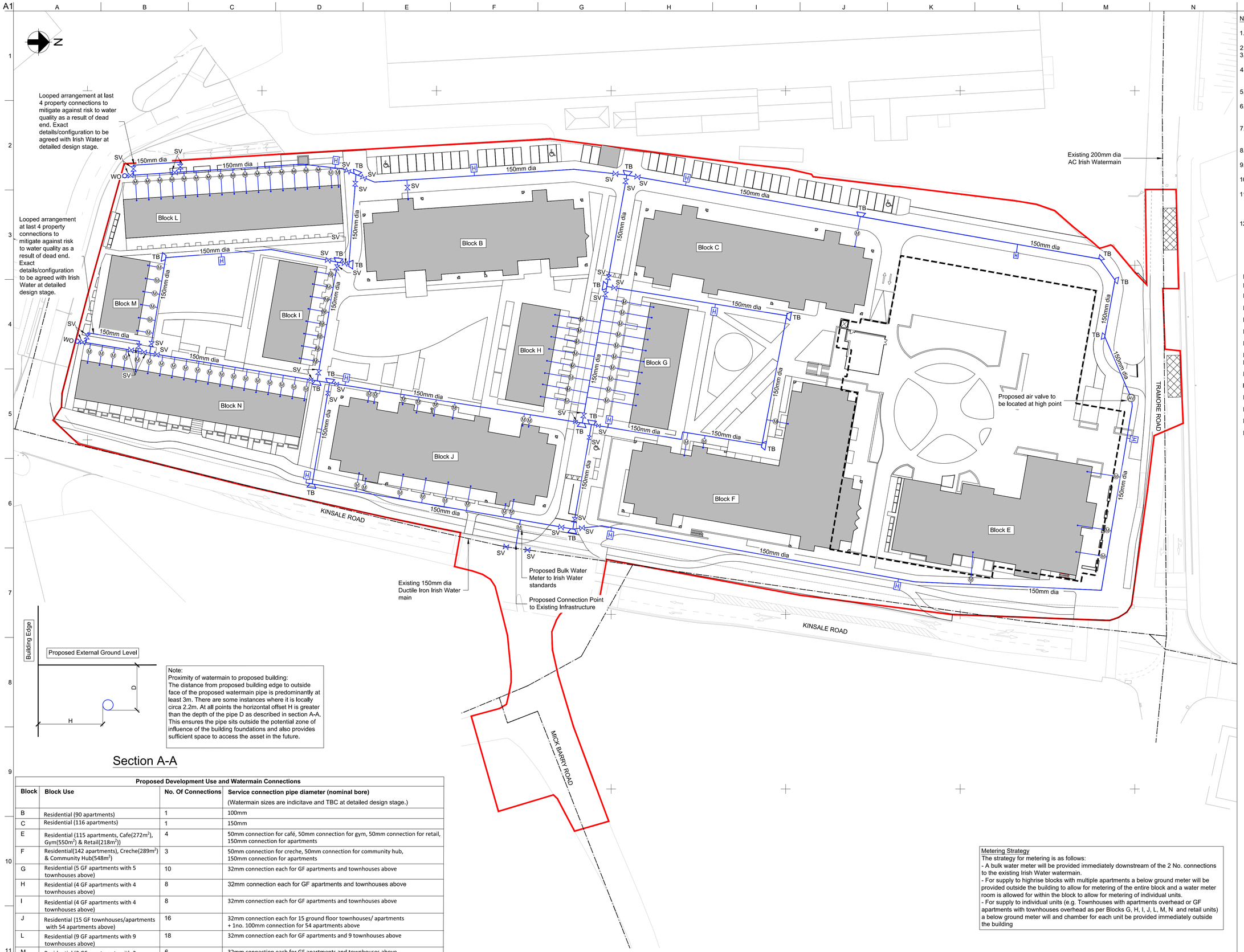
Arup Job No: **252666-00**

Rev: **P04**

Name: **252666-ARUP-ZZ-XX-DR-C-2100**

Do not scale

© Arup



Note:
Proximity of watermain to proposed building:
The distance from proposed building edge to outside face of the proposed watermain pipe is predominantly at least 3m. There are some instances where it is locally circa 2.2m. At all points the horizontal offset H is greater than the depth of the pipe D as described in section A-A. This ensures the pipe sits outside the potential zone of influence of the building foundations and also provides sufficient space to access the asset in the future.

Section A-A

Proposed Development Use and Watermain Connections

Block	Block Use	No. Of Connections	Service connection pipe diameter (nominal bore) (Watermain sizes are indicitave and TBC at detailed design stage.)
B	Residential (90 apartments)	1	100mm
C	Residential (116 apartments)	1	150mm
E	Residential (115 apartments, Cafe(272m^2), Gym(550m^2) & Retail(218m^2))	4	50mm connection for café, 50mm connection for gym, 50mm connection for retail, 150mm connection for apartments
F	Residential(142 apartments), Creche(289m^2) & Community Hub(548m^2)	3	50mm connection for creche, 50mm connection for community hub, 150mm connection for apartments
G	Residential (5 GF apartments with 5 townhouses above)	10	32mm connection each for GF apartments and townhouses above
H	Residential (4 GF apartments with 4 townhouses above)	8	32mm connection each for GF apartments and townhouses above
I	Residential (4 GF apartments with 4 townhouses above)	8	32mm connection each for GF apartments and townhouses above
J	Residential (15 GF townhouses/apartments with 54 apartments above)	16	32mm connection each for 15 ground floor townhouses/ apartments + 1no. 100mm connection for 54 apartments above
L	Residential (9 GF apartments with 9 townhouses above)	18	32mm connection each for GF apartments and 9 townhouses above
M	Residential (3 GF apartments with 3 townhouses above)	6	32mm connection each for GF apartments and townhouses above
N	Residential (9 GF apartments with 9 townhouses above and a further 9 apartments above townhouses)	19	32mm connection each for GF apartments and townhouses above + 1no. 80mm connection for apartments above townhouses

Notes:

1. All levels relate to OD Malin Head and are in meters.
2. Do not scale from this drawing. If in doubt, ask.
3. This drawing should be read in conjunction with all relevant and available documentation.
4. Ordnance Survey Ireland License No. EN0002821© Ordnance Survey Ireland/Government of Ireland.
5. Existing watermain infrastructure based on record drawings received from Cork City Council.
6. All potable watermains to be designed and constructed in accordance with Irish Water Code of Practice and Standard Details
7. All potable water pipework material shall be polyethylene PE100 SDR 11, subject to confirmation by Irish Water.
8. All potable water pipework to have a minimum cover of 900mm, unless notified otherwise.
9. A new bulk water meter shall be installed at the connection point to the site as shown.
10. Proposed water main sizes are indicative only and TBC at detailed design stage.
11. No. of hydrants and their locations are shown indicatively and will be located/spaced in accordance with the relevant standards at detailed design stage.
12. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-6000 and 6001 for typical watermain details.

LEGEND:

- Proposed Planning Boundary Line
- Proposed Proposed Building
- Proposed Outline of the Basement
- Existing Watermain
- Proposed Watermain
- Proposed Water Meter
- Proposed Watermain Building Connection
- Proposed Sluice Valve (SV)
- Proposed Thrust Block (TB)
- Proposed Air Valve (AV)
- Proposed Scour Valve (ScV)
- Proposed Fire Hydrant (H)
- Proposed Wash Out Valve (WO)

Metering Strategy
The strategy for metering is as follows:
- A bulk water meter will be provided immediately downstream of the 2 No. connections to the existing Irish Water watermain.
- For supply to highrise blocks with multiple apartments a below ground meter will be provided outside the building to allow for metering of the entire block and a water meter room is allowed for within the block to allow for metering of individual units.
- For supply to individual units (e.g. Townhouses with apartments overhead or GF apartments with townhouses overhead as per Blocks G, H, I, J, L, M, N and retail units) a below ground meter will and chamber for each unit be provided immediately outside the building

Rev	Date	By	Chkd	Appd
P04	18/01/22	RM	RM	J.MacC
	Issued for Information			
P03	22/12/21	WC	RM	J.MacC
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P02	01/12/21	BH	RM	J.MacC
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P01	06/08/21	ROD	RM	J.MacC
	Issued for Information			

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Client
CREAMFIELDS

Project Title
Creamfields Residential Development

Drawing Title
Proposed Potable Water Layout

Scale at A1: 1:500
Role: Site Infrastructure
Suitability: S2 - Suitable for Information
Arup Job No: 252666-00
Rev: P04
Name: 252666-ARUP-ZZ-XX-DR-C-3000

Do not scale
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Appendix D

Combined Sewer Diversion File Note

File Note

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Project title	Creamfields Residential Development	Job number	252666
cc		File reference	252666-ARUP-XX-XX-FN-C-0001
Prepared by		Date	16 February 2022
Subject	Irish Water Combined Sewer Diversion		

1 Introduction

This note supports the diversion application submitted to Irish Water as part of the proposed Creamfields Residential Development. This note should be read in conjunction with the following drawings:

Drawing No.	**Drawing Title**
252666-ARUP-ZZ-XX-DR-C-2000	Proposed Foul Water Layout
252666-ARUP-ZZ-XX-DR-C-2100	Proposed Combined Sewer Longsection
252666-ARUP-ZZ-XX-DR-C-2101	Existing Combined Sewer Longsection
252666-ARUP-ZZ-XX-DR-C-6000	Proposed Drainage and Water Details Sheet 1 of 2
252666-ARUP-ZZ-XX-DR-C-6001	Proposed Drainage and Water Details Sheet 2 of 2

Supplementary information is provided within the Appendices of this note as follows:

Appendix A – Existing combined sewer Microdrainage model results

Appendix B – Diverted combined sewer Microdrainage model results

Appendix C – Brochure & Data Sheet for indicative proposed diverted sewer product

File Note

252666 16 February 2022

Appendix A

FOUL SEWERAGE DESIGN

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	21.858	0.220	99.4	0.000	0	0.0	0.012	o	450	Pipe/Conduit	
F1.001	40.780	0.100	407.8	0.000	0	0.0	0.012	o	450	Pipe/Conduit	
F1.002	77.255	0.710	108.8	0.000	0	0.0	0.012	o	600	Pipe/Conduit	
F1.003	76.690	0.210	365.2	0.000	0	0.0	0.012	o	600	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)
F1.000	8.000	0.000	0.0	0	0.0	0	0.00	1.95	309.9	0.0
F1.001	7.780	0.000	0.0	0	0.0	0	0.00	0.96	152.9	0.0
F1.002	7.680	0.000	0.0	0	0.0	0	0.00	2.26	637.7	0.0
F1.003	6.970	0.000	0.0	0	0.0	0	0.00	1.23	348.1	0.0

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File Note

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Appendix B

FOUL SEWERAGE DESIGN

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
F1.000	6.992	0.018	378.0	0.000	0	0.0	1.500	o	750	Pipe/Conduit
F1.001	67.589	0.179	378.0	0.000	0	0.0	1.500	o	750	Pipe/Conduit
F1.002	18.922	0.050	378.0	0.000	0	0.0	1.500	o	750	Pipe/Conduit
F1.003	31.695	0.084	378.0	0.000	0	0.0	1.500	o	750	Pipe/Conduit
F1.004	51.856	0.137	378.0	0.000	0	0.0	1.500	o	750	Pipe/Conduit
F1.005	30.145	0.080	378.0	0.000	0	0.0	1.500	o	750	Pipe/Conduit
F1.006	72.595	0.192	378.0	0.000	0	0.0	1.500	o	750	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)
F1.000	7.550	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0
F1.001	7.532	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0
F1.002	7.353	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0
F1.003	7.303	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0
F1.004	7.219	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0
F1.005	7.082	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0
F1.006	7.002	0.000	0.0	0	0.0	0	0.00	1.28	567.2	0.0

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File Note

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Appendix C

Condron Concrete Works

CONDRON CONCRETE WORKS IS A TRADENAME FOR CONDRON CONCRETE LTD.

ARDEN ROAD, TULLAMORE, CO. OFFALY, IRELAND.

CONCRETE PIPES

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INTRODUCTION

Condron Concrete Works is a 100% Irish owned Private Company founded in 1969 by John Condron. It is located just outside Tullamore, Co. Offaly, Ireland. The Company manufactures Concrete Pipes, Manholes and Gulley Traps as well as Concrete Roof Tiles and Accessories.

Production can be divided into four main categories:

- OGEE pipes which are used mainly for Surface Water Drainage, Land Drainage etc. Diameters range from 150mm to 1200mm with perforated pipes available up to 600mm.
- Spigot and Socket (S&S) pipes used for Foul and Surface Water Sewers and Culverts and are produced in diameter sizes from 150mm to 2100mm.
- Manhole bases, rings and covers. Gullies, Bends, Saddles and Junctions, as well a wide range of sealing methods.
- Concrete Roof Tiles are produced in seven different profiles – Concrete Pantiles, Concrete Slate Tiles, Concrete Bullnose Slate Tiles, 3 in 1 Tile / Cladding Tiles Concrete Plain Tiles / Cladding Tiles, M Profile and Condron Slate. Colours ranging through Black, Grey, Brown, Red, Marigold, Terracotta, and a range of Streaky colours are available. Details are in our Concrete Tile Brochure which is available by contacting our office or on our website.

Specials of all products can be manufactured and supplied "to order".

Ogee pipes are manufactured a metre long. S&S vary from 1.25 metres for 150mm and 225mm diameter, to 2 metres for 300mm diameter, and 2.5 metres for all other sizes.

All our pipes are manufactured and certified to relevant European (EN) and Irish (IS) Standards Specifications and are regularly inspected by officials from National Standards Authority of Ireland (NSAI). Daily routine Quality Control is also carried out by our own team of engineers to ensure that highest standards are maintained at all times.

Certificates of Compliance to the relevant Standard on which the products comply are available on request.

Information on all our piping products is given in the following pages and further information is available, if required, from our office at Arden Road.

The information contained within this brochure is available on our web site.

Condron Concrete Works
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Condron Concrete Works
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ARDEN ROAD, TULLAMORE, CO. OFFALY, IRELAND.

PRODUCTION OF CONCRETE PIPES

Materials

All our products are manufactured using highest quality aggregates, which come from our own quarries and sand pits. Our batching and mixing procedures are fully computerised producing low water to cement ratio, high strength, concrete.

Reinforcement

Reinforcement cages required for the Spigot & Socket pipes are produced from Cold Drawn High Tensile Steel on our automatic welding machines.

I.S.6: Concrete Sewer Pipe

This specification deals with the manufacture and properties of flexible jointed concrete pipes and fittings, either reinforced with steel or unreinforced, intended to be used for the conveyance of sewage, or sewage and surface water at atmospheric pressure. These test requirements may be found in I.S. 6: 2004 and are to be used in conjunction with ISEN 1916: 2004. These new Standards are also be available from NSAI.

Material Comparison

To assist in choosing between rigid and flexible pipes, consider the following:

Table 1

Attribute	Concrete	Plastic
Proven Durability	YES	NO
Non-Flammable	YES	NO
High Impact Strength	YES	NO
Structural Strength Principally in pipe rather than surround	YES	NO
Rigid Under Load	YES	NO
Copes with poor quality installation	YES	NO
Copes with high pressure water jetting	YES	NO
Contains Rats in sewers	YES	NO
Self weight inhibits floatation	YES	NO
Diameters from DN 225 To DN 2100	YES	NO
Availability of complete pipeline system	YES	NO

Reinforcement Cage for 1500ø I.S. 6 Pipe

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QUALITY CONTROL AND TESTING

Quality Control and Testing

The requirements of I.S.6 2004 and ISEN 1916 are such that the pipes are tested at the place of manufacture to ensure that they are adequate for the purpose intended.
The following tests are carried out in compliance with the Standard on a daily basis by our Quality Control Team and are audited regularly by N.S.A.I. to ensure full compliance with the current Standard.

Table 2

Test	Purpose
Crush Test (proof)	To ensure reinforced pipes stand up to 80% of the minimum Crush Load before developing cracks.
Crush Test (min.)	To ensure all pipes are capable of withstanding the specified minimum Crush Load without collapse.
Hydrostatic Test	To assess the permeability of the pipe walls.
Water Absorption	To assess the quality and density of the concrete.
Joint Deflection	To ensure the flexibility of the pipe joints to the minimum angular deflection specified.
Joint Straight Draw	This enables us to guarantee joints will remain watertight with a 20mm gap between pipes.
Joint Shear	To prove that a joint will remain watertight when a load is applied.
Cover to Reinforcement	To monitor that all the reinforcement is protected by minimum of 15mm cover.

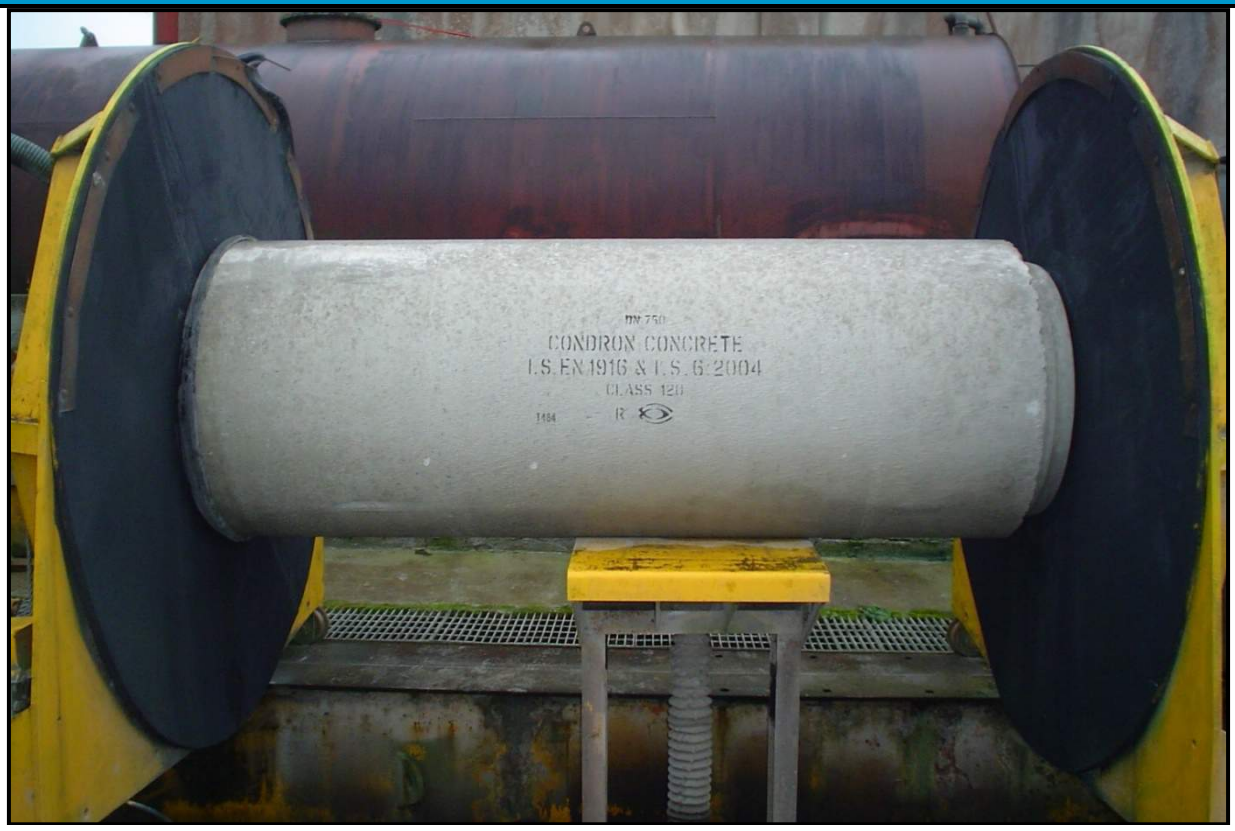
Gauging of 1050mm Ø Pipe

In-house Material Testing

Quality Control Inspection

Production Quality Control

QUALITY CONTROL AND TESTING



750mm ø I.S. 6 Pipe undergoing Hydrostatic Test

1200mm ø I.S. 6 Pipe undergoing Crush Test

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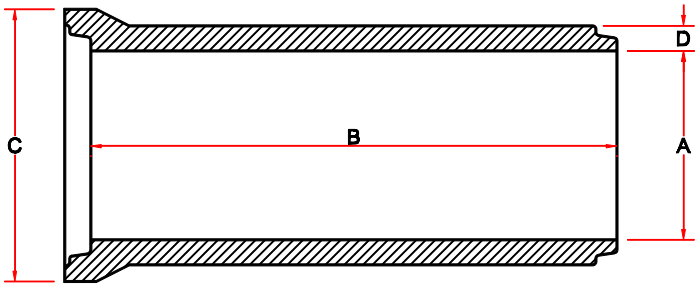
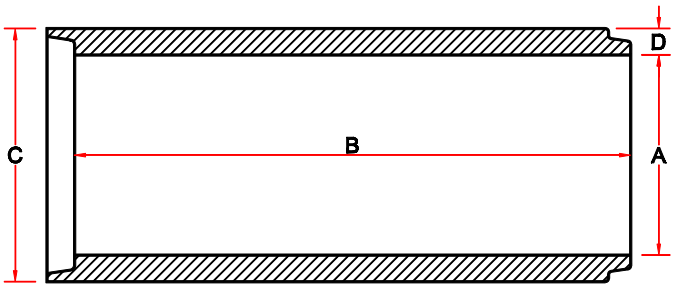
TECHNICAL SPECIFICATIONS

FLEXIBLE JOINTED PIPES



Spigot and Socket Type Pipe (S & S)



Rebated Type Pipe

Table 3

A Pipe ¬	B Length (m)	C Approx. Outside ¬ (mm) O/D	D Approx. Wall Thickness (mm)	Approx. Weight in kgs	Pipe Type
150mm	1.25	290	33	80	S & S
225mm	1.25	392	38	122	S & S
300mm	2.0	505	60	358	S & S
375mm	2.5	606	65	565	S & S
450mm	2.5	707	69	730	S & S
525mm	2.5	808	77	980	S & S
600mm	2.5	909	91	1240	S & S
675mm	2.5	1008	97	1520	S & S
750mm	2.5	1016	111	1840	S & S
900mm	2.5	1183	122	2380	S & S
1050mm	2.5	1420	128	3040	S & S
1200mm	2.5	1605	138	3880	S & S
1350mm	2.5	1805	152	4640	S & S
1500mm	2.5	2012	150	5800	S & S
1650mm	2.5	2155	178	6900	S & S
1800mm	2.5	2310	203	8240	S & S
2100mm	2.5	2525	211	9560	Rebated
2400mm	2.5	2866	230	11600	Rebated

I.S. 6: 2004 is to be used in conjunction with ISEN 1916: These pipes can also be manufactured to customers' own specification if so required.
Rockers and Butt pipes are also available in 1-metre length in all sizes.

OGEE PIPES

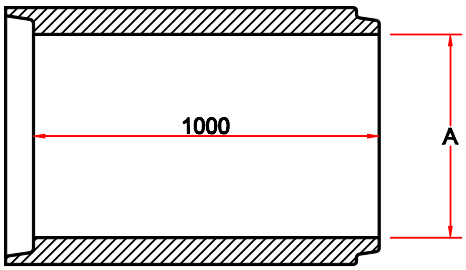


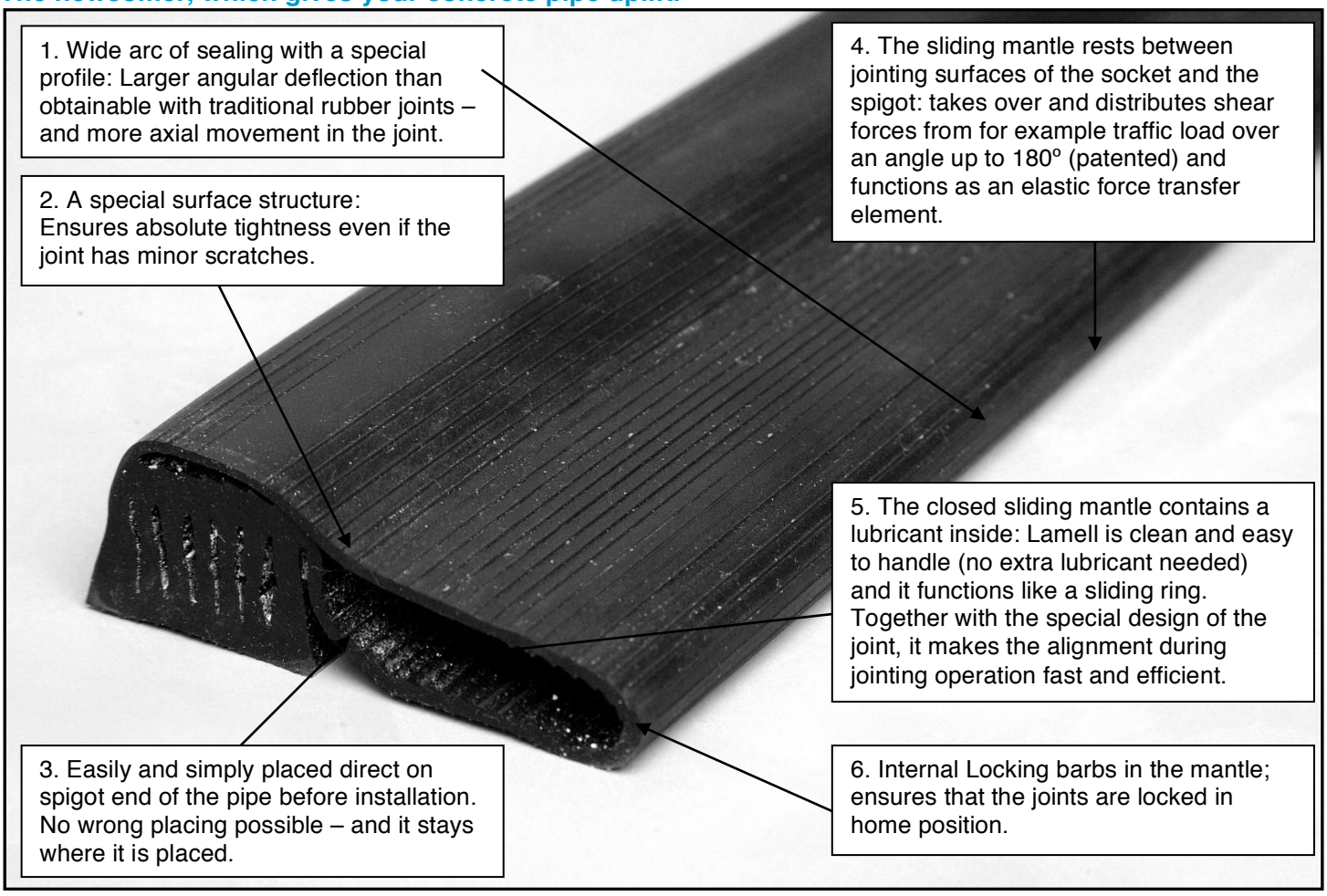
Table 4

"A" Internal Diameter	B Length	Approx. Wall Thickness (mm)	Approx. Weight in kgs
225mm	1 Metre	35	65
300mm	1 Metre	37	86
375mm	1 Metre	38	124
450mm	1 Metre	46	167
525mm	1 Metre	47	210
600mm	1 Metre	54	278
750mm	1 Metre	75	470
900mm	1 Metre	95	710
1050mm	1 Metre	100	870
1200mm	1 Metre	110	1110

Ogee pipes are manufactured to I.S. 166: 1972 specification

LAMELL RUBBER GASKET

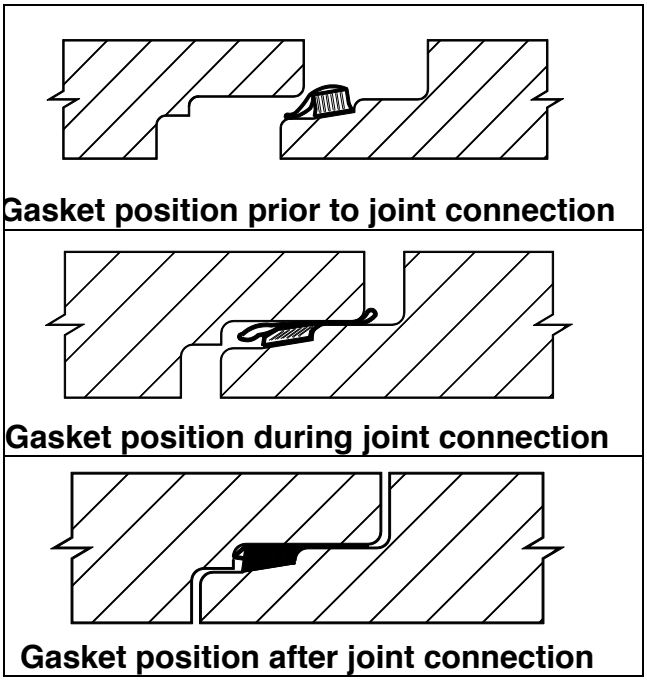
The newcomer, which gives your concrete pipe uplift.



Today, it is normal to use either roll-in type or sliding ring joints on concrete pipes. Both of them have well-known advantages as well as disadvantages. But the demands for tightness and strength of pipe systems have been increased, however. The inventor of the brilliant Lamell system has considered this. The Lamell joint has been developed in cooperation with contractors, concrete pipe manufacturers, and pipe machine producers. This ensures that the Lamell joint combines the advantages of all known types of joint without having their disadvantages.

Because of the design of the Lamell joint and the elasticity and the configuration of the Lamell gasket, the compression of the Lamell gasket will always be within the needed limits, as well as the tightening area will not change within the tolerance limits. This ensures an absolutely tight pipeline.

The Lamell joint can be used in connection with all known dimensions and shapes of pipes for sewer and low head pressure systems as well as for manhole systems.



Correct Gasket Fitting

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LAMELL RUBBER GASKET

Ensure Spigot is clean. Position gasket as outlined on supplied illustration to suit Spigot Type A or B

Check that gasket is equally tensioned around pipe

Ensure gasket is NOT protruding onto higher lip.

The Lamell gasket is patented.

Because of the combined strength and elasticity of the Lamell gasket, and because the limited annular space between the concrete surfaces formed by the socket and spigot is occupied by the sliding mantle, the intrusion of root webs from plants and trees is prevented automatically.

Furthermore the joint is designed for automatic and mechanical installation of pipes in order to reduce the manual handling in the trench.

The Lamell gasket meets for example the specifications of: D.S.421.2 - SS 367611 - B.S.I.2494 (2) - ASTM 443 - ASTN 505 - ISO/DIS 4633 - ASTM-361.

The Lamell gaskets are normally delivered in a SBR-rubber compound and are resistant to all substance normally found in ordinary drainage and sewer systems and are resistant to microbiological attacks from anaerobes.

Lamell gaskets can be delivered in an oil resistant Neoprene quality as well as in an EPDM-quality.

Please ask for more technical details if necessary.

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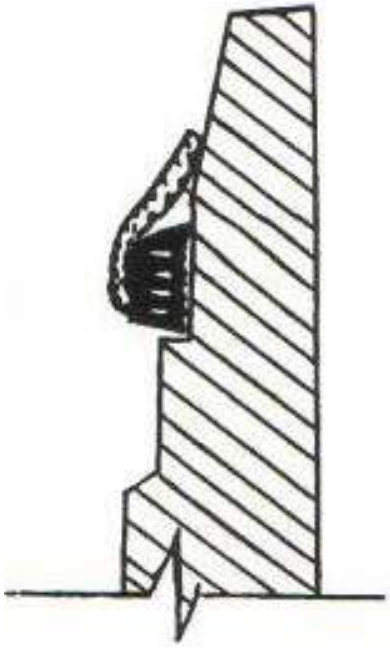
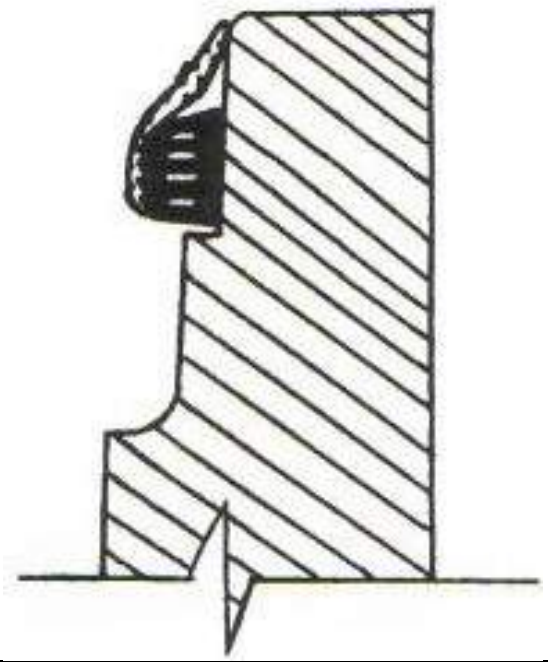
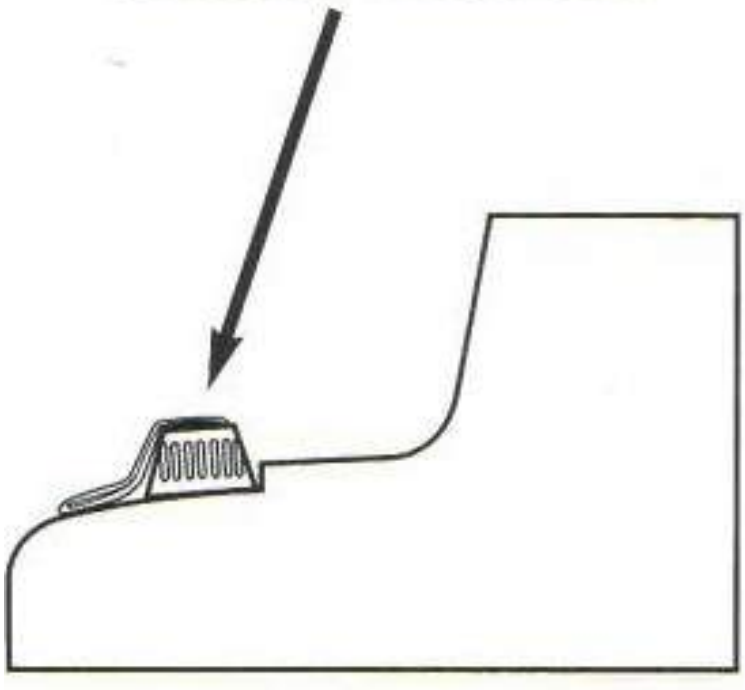
POSITIONING OF RUBBER GASKET

Illustration shows the correct position of the Rubber Gasket

Spigot Type A (225, 300, 375, 450, 525, 750,900mm)	Spigot Type B (600, 675, 1050, 1200, 1350, 1500, 1800, 2100mm)
	
	**Application of gasket.** 1. Clean the Spigot and the Socket of the previous pipe with a damp cloth ensuring no debris will interfere with the joint. 2. Apply the gasket as illustrated for spigot type A or type B. No lubricant required. 3. Check that the gasket is evenly tensioned all the way round. 4. Finally check to ensure that the gasket has not protruded onto the higher lip of the Spigot. **5.** When jointing check for proper horizontal and vertical alignment of the two pipes so the gasket rolls correctly and neatly into position giving a watertight joint. **6.** Prior to the pipe being fitted into its final position all gaskets should be checked to ensure twisting has not occurred, particularly if the alignment of the pipe has been altered.
Spigot	**Correct Gasket Fitting**

INCORRECT POSITIONING OF RUBBER GASKET

Spigot end of I.S. 6 Pipe

INCORRECT POSITIONING OF GASKET

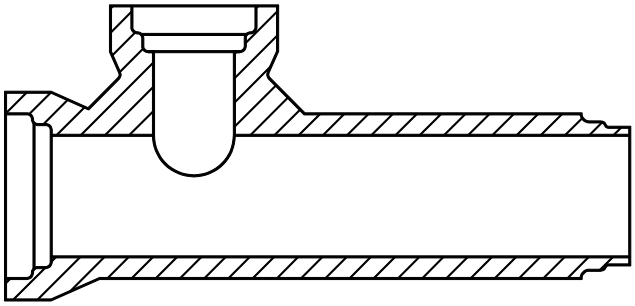
JUNCTIONS

Branches from 100mm upwards, can be fitted for either Ogee, Spigot and Socketed or Rebated Pipes

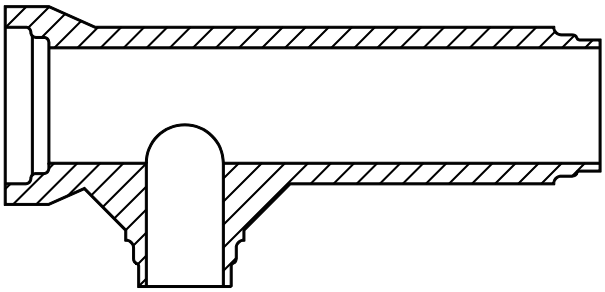
Junctions are normally produced in 150/225/300mm range with branches from 100mm to 300mm. Junctions in larger diameters can be produced to customers' requirements.

Junctions are only fitted to full-length pipes.

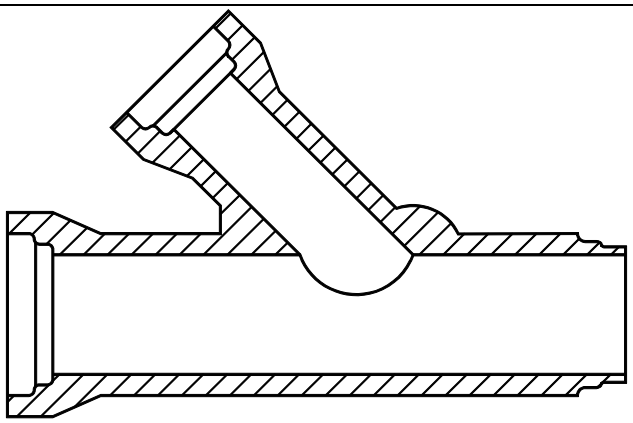
We also supply saddles in 100/150/225mm diameters, which can be adopted to fit all pipe sizes.



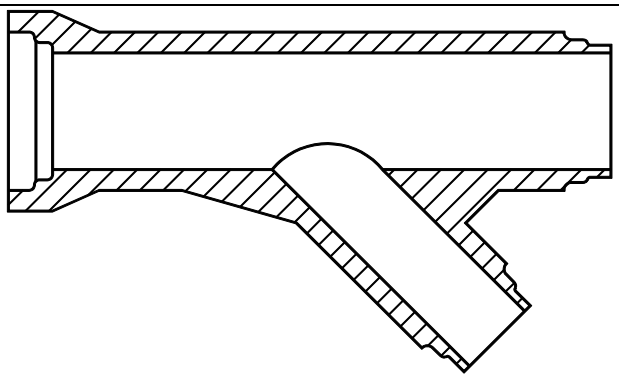
T Junction – Socketed



T Junction – Spigot



Y Junction – Socketed



Y Junction - Spigot

Y Junction - T Junction Socketed – T Junction PVC Socketed

Junction

BENDS AND BACKDROPS

Permissible angles under I.S.6: as follows:

Table 6

Nominal Size mm	Permissible Angle
150	90°, 45°, 22½°
225	90°, 45°
300/600	45°,

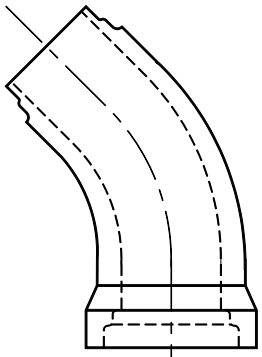
Bends are produced in any angle at request.
Larger diameter bends can be made

Bends are manufactured for both Ogee and S&S joints and are so designed as to include 100mm straight section on both spigot and socket ends, so as to improve the hydraulic characteristics of the bend.

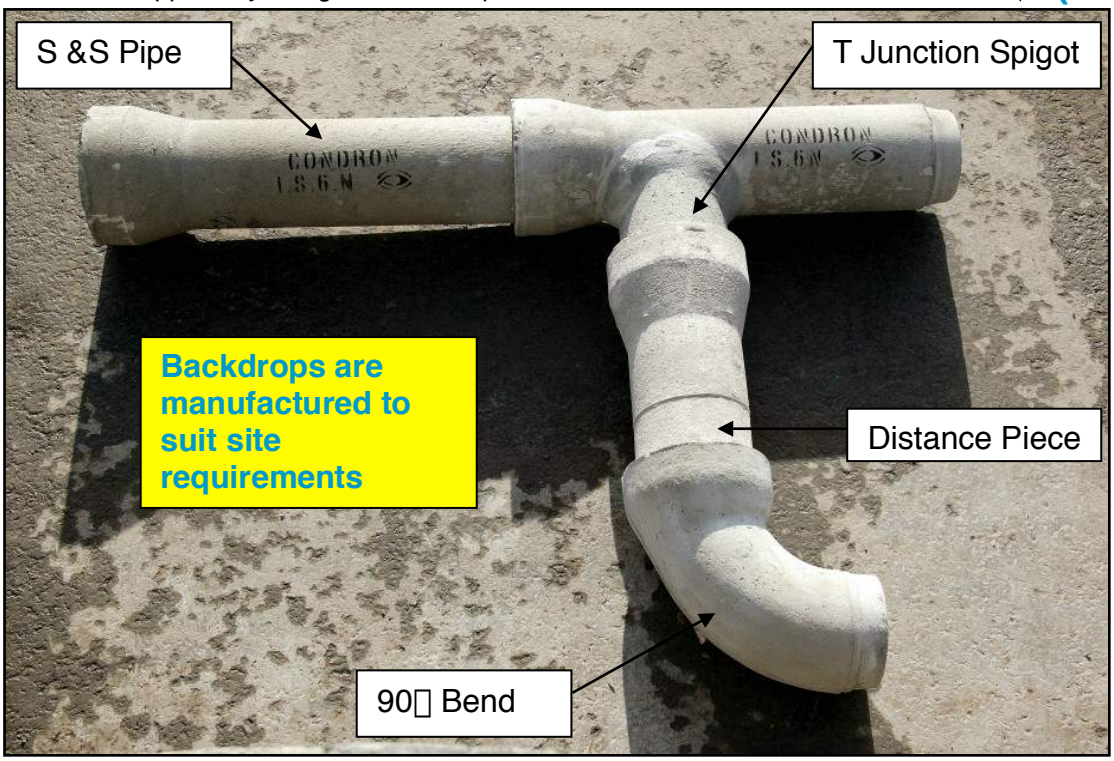
Table 7
Minimum Invert-to-Invert Backdrops.

Pipe Diameter mm	Drop Size	T +2 x 45º Bends (min)
225mm Ø	225mm	725mm
300 to 450mm Ø	300mm	800mm
300 to 450mm Ø	375mm	1180mm
525 to 675mm Ø	450mm	1180mm
525 to 675mm Ø	525mm	1380mm
750 to 900mm Ø	600mm	1500mm

Shallower inverts can be supplied by using a Y backdrop and a 45º bend.



S & S Bend (45□)

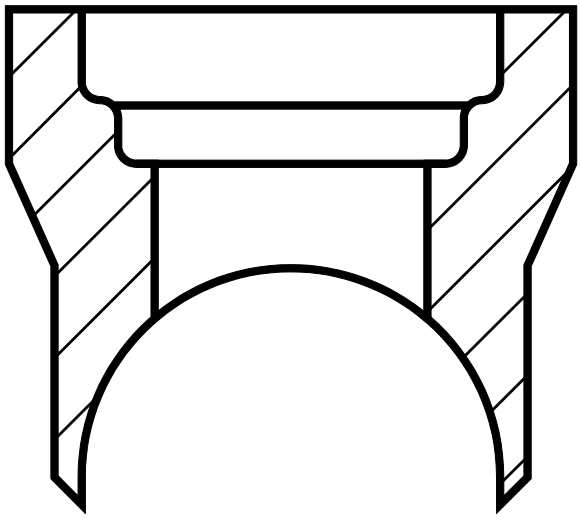


Backdrop Junction

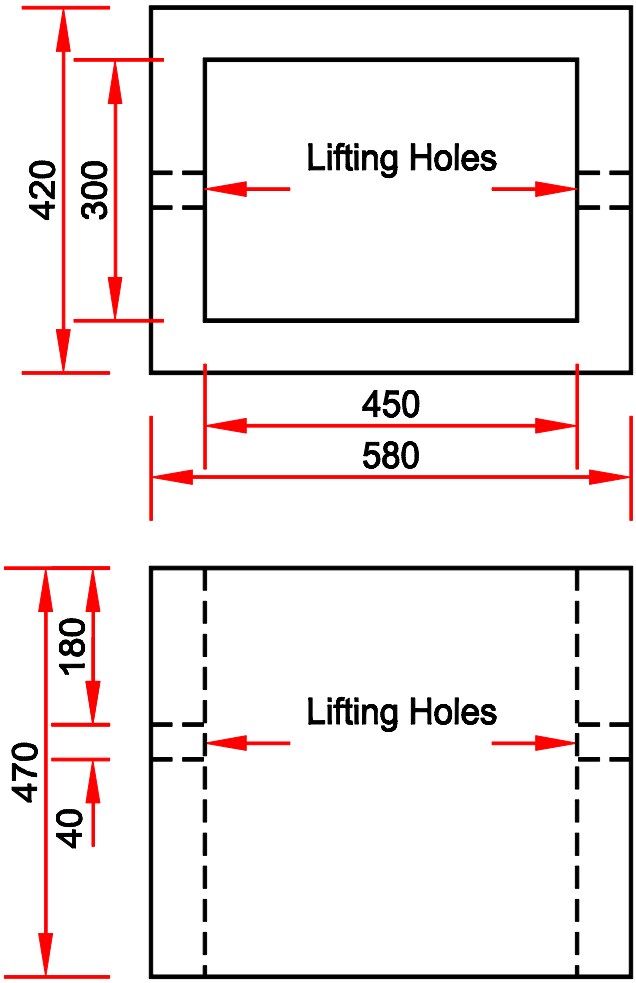
Junctions and Bends are manufactured in accordance with I.S.6. They have the same wall thickness and internal diameters as the pipes with which they are to be used. Junctions are manufactured from components produced by the vertically cast process, but the whole of the branch, the main incorporating the branch, and bends, should be encased in a concrete surround designed to withstand external loads.

DATA SHEET – SADDLE AND HYDRANT BOX

Saddle



Hydrant Box



Bends – Saddles Double Spigot – Gulley Cover Slab

Hydrant Box

SULPHATE RESISTANT / BITUMEN COATED PIPES

SULPHATE RESISTANT (S.R.) PIPES

In the rare conditions where sulphuric acid is present in the ground water or where internal acid attack is thought likely, Sulphate Resistant concrete pipes should be used. These are made to order and to comply with sulphate class 4b of I.S. 6: 2004 Table 2 and give a high-class resistance to attack. High Sulphate Resistant Hydraulic Cement is used in concrete exposed to severe sulphate action, principally where soils or ground waters have high sulphate content. It gains strength more slowly than General Use hydraulic cement. Use of a low water-to-cementing-materials ratio and low permeability are critical to the performance of any concrete exposed to severe sulphate attacks. Like other Portland cements, it is not resistant to acids and other highly corrosive substances.

Ground Granulated Blastfurnace Slag (GGBS) is added to concrete by addition at the concrete mixer, along with ordinary cement, aggregates and water. The normal ratios and proportions of aggregates and water to cementitious material in the mix remain unchanged. Mixing times are the same as for ordinary cement. Both wet mixing and dry mixing processes can be used for making concrete with GGBS.

GGBS is used as a direct replacement for ordinary cement, and replaces ordinary cement on a one-to-one basis by weight. Replacement rates for GGBS vary from 30% to up to 85%. Typically 50% is used in most instances. Higher replacement rates up to 85% are used in specialist applications such as in aggressive environments and to reduce heat of hydration.

Sulphate Class	Cement Group	Minimum Cementitious Content (kg/m³)	
2		Reinforced Units	Unreinforced Units
	1	360	330
	2	360	300
	3	360	300
3	1	380	380
	2	360	340
	3	360	320
4a	2	360	360
	3	360	360
4b	2	360	360
	3	360	360
5	Seek the Advice from the Manufacturer		

Extract from Table 2 Cementitious Content I.S. 6:2004

Cement Group	Factory Produced or Combination (FP or COM)	Composition/ Specification
1	FP	Portland cement conforming to CEM 1 as specified in I.S. EN 197-1
		Portland blastfurnace cement conforming to BS 146
		Portland pfa cement conforming to CEM II/B-V as specified in I.S. EN 197-1
	COM	Combination of Portland cement conforming to CEM 1 as specified in I.S. EN 197-1 and ggbs conforming to BS 6600 containing no less than 36% and not more than 65% ggbs by mass of ggbs plus cement
		Combination of Portland cement conforming to CEM 1 as specified in I.S. EN 197-1 and pfa conforming to BS 3892-1 containing no less than 21% and not more than 35% pfa by mass of pfa plus cement
2	FP	Portland pfa cement conforming to CEM II/B-V as specified in I.S. EN 197-1 containing not less than 26% PFA by mass of nucleus
	COM	Combination of Portland cement conforming to CEM 1 as specified in I.S. EN 197-1 and ggbs conforming to BS 6699 containing no less than 70% and not more than 85% ggbs by mass of ggbs plus cement
		Combination of Portland cement conforming to CEM 1 as specified in I.S. EN 197-1 and pfa conforming to BS 3892-1 containing no less than 25% and not more than 40% pfa by mass of nucleus
3	FP	Sulphate resisting Portland cement conforming to BS 4027

PRECAST CONCRETE MANHOLES TO I.S.420

Condron Concrete Works produce a complete range of manhole components, all of which are certified to I.S. 420: 1989 and I.S. 420: 2004 in conjunction with ISEN 1917 and supersedes I.S. 420: 1989 in October 2004.

Advantages of Precast Manholes:

The main advantages of precast concrete manhole units over insitu concrete construction are:

1. Units are factory produced to I.S. 420: 1989, I.S. 420: 2004 and I.S. EN 1917.
2. They are manufactured in wide range of sizes and depths.
3. They are simple to assemble requiring relatively unskilled labour on site.
4. Units are capable of being constructed as flexible watertight structures.
5. They are supplied fitted with non slip steps to EN 13101: 2002 Class C.
6. The structure is durable with its own inherent strength.

Base Units:

The diameter of our Manhole Base is 1200mm and as can be seen from Table 11, an extensive range of channel sizes and floor plans are available which would cater for the vast majority of site requirements. The all socketed units are designed so that a seal can be provided on all connections, with double spigoted sections available for connecting the outlet to the socket of the first downstream pipe.

The 150mm, 225mm and 300mm channel sizes are also available with sockets and gaskets suitable for use with plastic pipes.

Heights and Weights of Manhole Bases are as shown on Tables 9 and 10.

Chamber/ Inspection Units:

All chamber sections are fitted during manufacture with 350mm wide plastic coated aluminium rung steps, which are spaced 250mm apart, thereby providing a uniform step interval in all units. The black polyethylene covering on the steps is resistant to nearly all media and also prevents sparking when walked on with iron-mounted boots. The steps comply to EN 13101: 2002 Class C Chamber Rings can be supplied reinforced if required. All sections are jointed using our CS 202 Butyl Sealant giving an immediate and flexible watertight joint.

Heights of chamber sections are as shown on Table 6.

NOTE: All chamber sections are to be stored vertically on site to prevent rolling.

Cover Slabs:

The cover slabs, which are all reinforced, have a different thickness for different diameters. All are provided with a 600mm diameter opes and a socketed base which allows a butyl sealant joint to the top chamber section.

Table 8

Cover Slab Dia.	Overall Approx. Thickness	Effective Approx. Thickness	Approx. Weight (kg)
900mm	230mm	170mm	340
1050mm	230mm	160mm	480
1200mm	230mm	150 mm	580
1350mm	300mm	200mm	1020
1500mm	300mm	200mm	1260
1800mm	300mm	200mm	1780
2100mm	350mm	230mm	3200
2400mm	380mm	250mm	4140

Quality Control and Testing

I.S. 420: 1989, I.S. 420: 2004 and ISEN 1917 incorporates routine water absorption tests, works proof load tests, maximum load tests, cube crushing tests, cover to reinforcement, complete manhole hydrostatic test and installed step tests. Our Quality Control Team carries these tests out daily to ensure compliance to the relevant standards.

Condron Concrete Works
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PRECAST CONCRETE MANHOLES TO I.S.420: 1989

Precast concrete cover slab showing the approx. location of the access ope in the cover slab over the access steps to EN 13101: 2002 Class C.

Manhole Cover Slab Showing Access Ope

Precast concrete cover slabs should always be stored horizontally on site.

Precast concrete manhole ring on base with access steps. to EN 13101: 2002 Class C.

1200mm ø, 1 Meter high Manhole Ring positioned on Base

Precast concrete manholes and bases should always be stored vertically on site.

Heights and weights of Chamber Rings

Table 9

Internal Diameter of Chamber Rings	Wall Thickness (Approx.)	Height (Approx Weight in kgs)			
		1.00m	0.75m	0.50m	0.25m
900mm	95mm	630	-	325	205-
1050mm	100mm	820	-	420	215
1200mm	110mm	1120	-	570	290
1350mm	140mm	1660	1250	850	-
1500mm	155mm	2080	1565	1050	-
1800mm	160mm	2420	-	1120	-
2100mm	155mm	3000	-	1520	-
2400mm	230mm	4700	-	2380	-

Heights and weights of Manhole Bases

Table 10

Channel Size	Overall height (Approx.)	Effective Height (Invert to top of Base)	Approx Weight in kgs for Base Types			
			Type 1	Type 2	Type 3	Type 4
150mm	750mm	600mm	1960	-	-	1800
225mm	750mm	600mm	2120	-	-	1850
300mm	750mm	600mm	2120	2000	2050	-
375mm	750mm	600mm	2120	2000	2050	-

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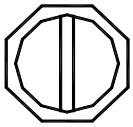
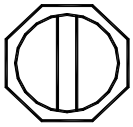
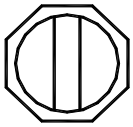
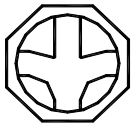
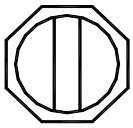
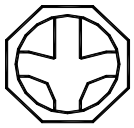
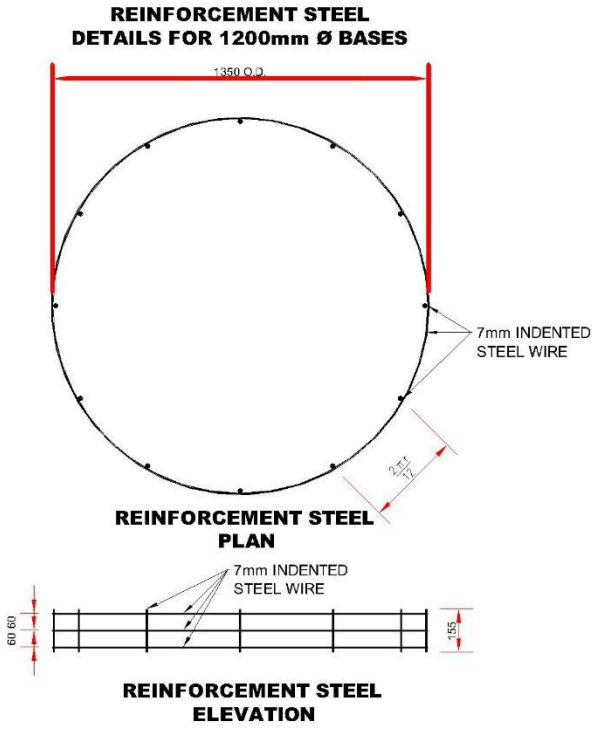
AVAILABLE MANHOLE BASE PLANS IN 1200MM Ø BASES

Table 11

Plan Type	1	2	3	4
150mm Diameter Channel				
225mm Diameter Channel				
300mm Diameter Channel				
375mm Diameter Channel				

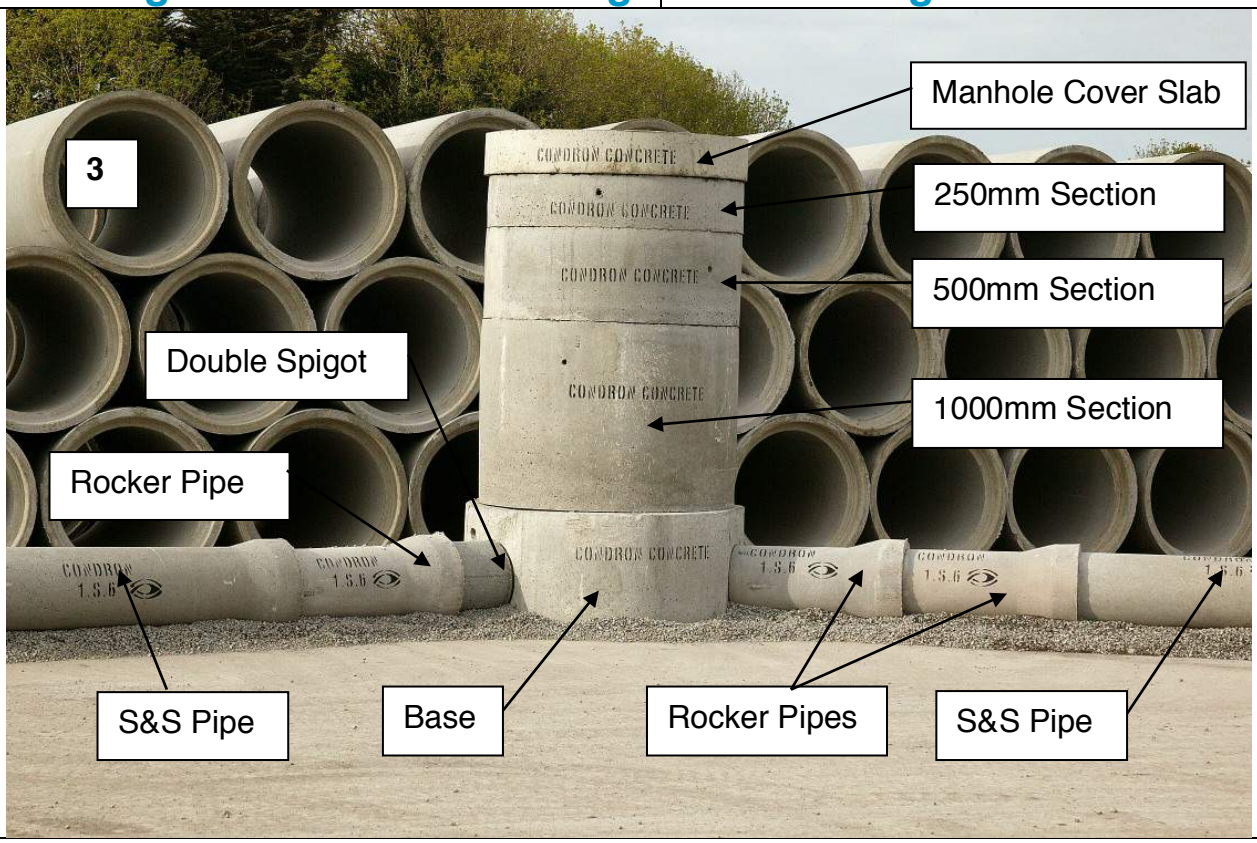


Manhole Base with 300mm ø channel (Type 1) showing correct position of Butyl Sealant

MANHOLES

Positioning of 0.5M Chamber Ring

Positioning of Manhole Cover



Typical Manhole Construction

Condron Concrete Works
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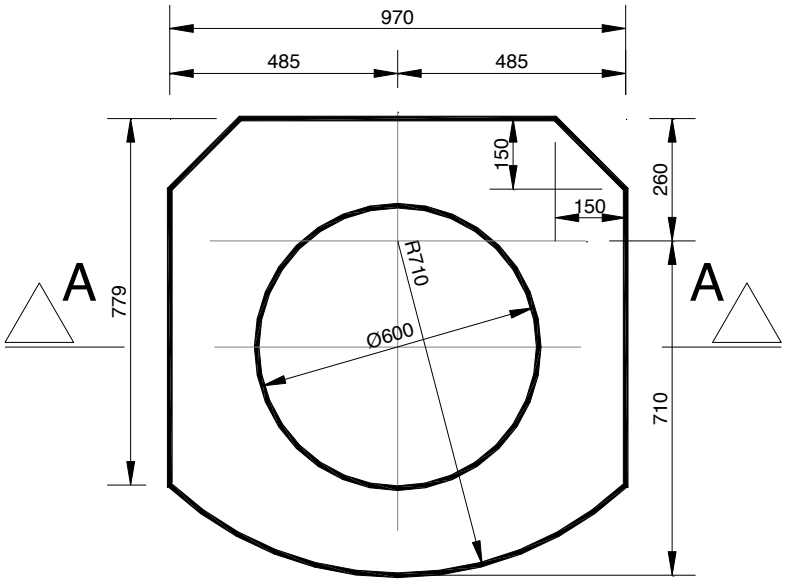
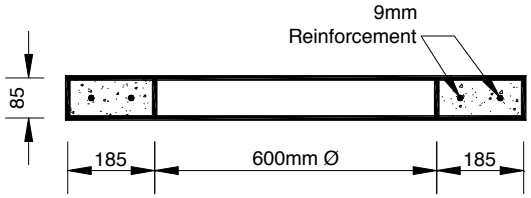
CONDRON CORBEL SLABS/ADJUSTING UNITS

Seating Ring Depth (mm)	Manhole Diameter (mm)	Weight (Approx.) (kg)
85	600	100

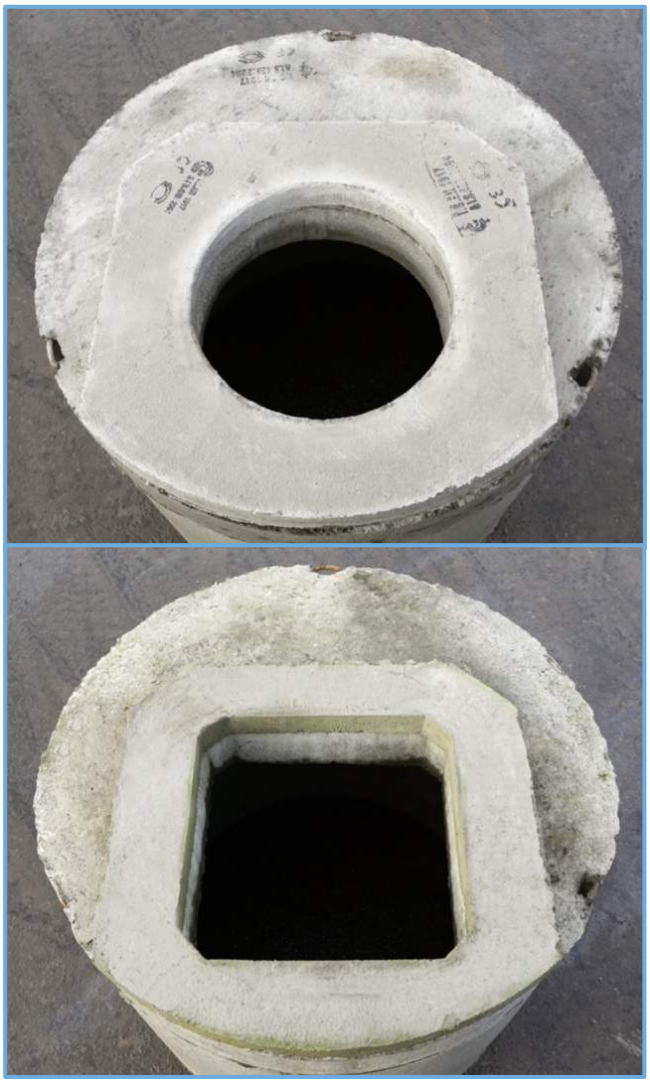
- National Roads Authority (NRA) approved.
- Condron Cover Frame Corbel Slabs/ Adjusting Unit are manufactured using 85mm thick reinforced concrete to suit Condron Concrete manhole covers with 600mm access aperture.
- They are quick and simple to install.
- They can be used as risers in place of engineering bricks to achieve the required level for the manhole cover and frame.
- All Corbel Slabs/ Adjusting Units manufactured by Condron Concrete Works are tested in accordance with I.S. 420 and I.S. EN 1917:2004 Specifications.



PLAN

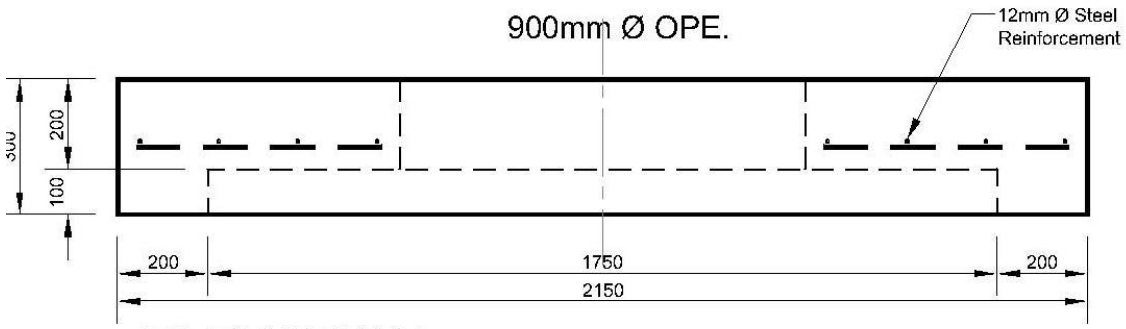


SECTION A-A

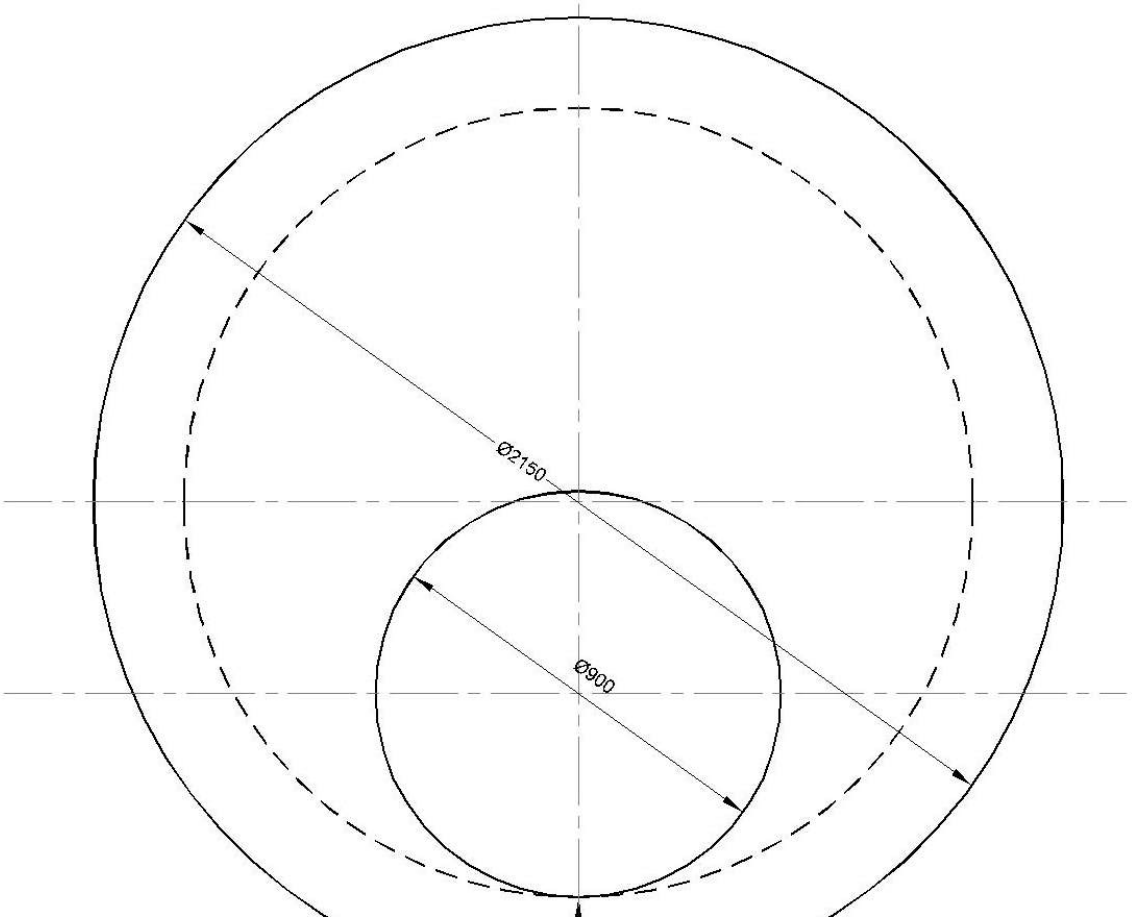


CONDRON MANHOLE COVER

CONDRON CONCRETE 1800mm Ø H.D.C. to I.S.EN 1917 and I.S. 420:2004



ELEVATION

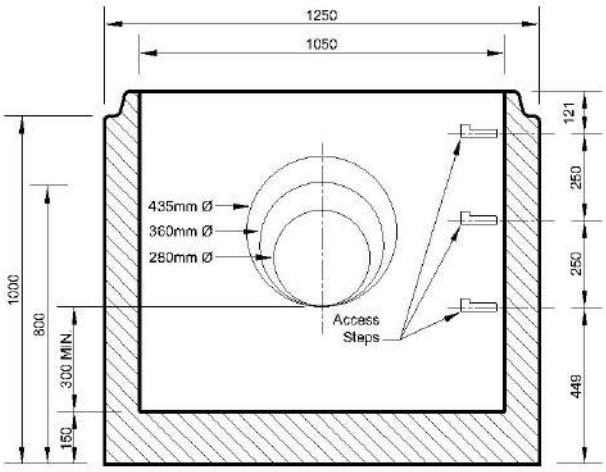


CATCH PITS

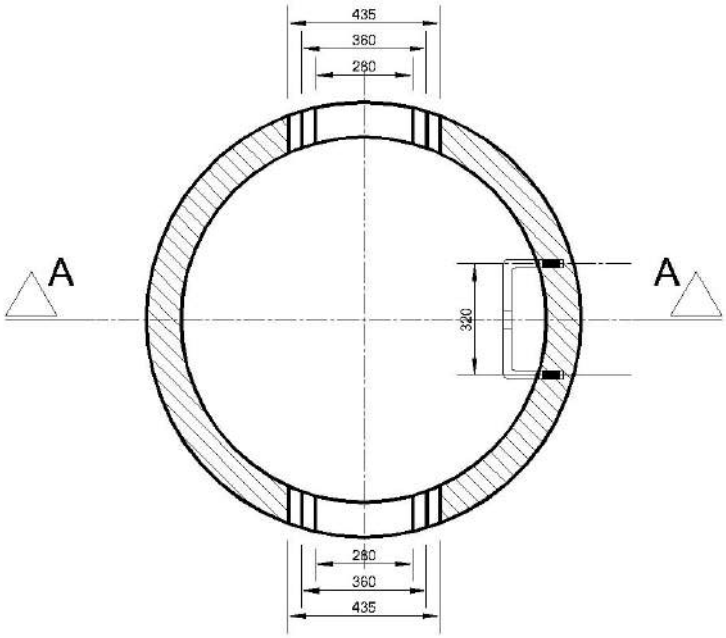
Available Configurations

Inlet / outlet size	225mm Ø	300mm Ø	375mm Ø
90° base	✔	✔	✔
180° base	✔	✔	✔
270° base	✔	✔	✔

- Inlet/outlet opes can vary to suit 225mm, 300mm and 375mm Condron Concrete S&S Pipes, Ogee Pipes or (proprietary) Twin Wall and P.V.C pipes.
- Base Configurations can incorporate a third inlet/outlet ope and are available left or right handed.
- Reinforced concrete base.
- Extendable depths and standard manhole covers available.
- Chamber Catch-pits can be supplied in 900mm or 1200mm Ø upon request.
- Quick installation.
- Catch-pit sections are manufactured and tested in accordance with I.S. 420 and I.S. EN 1917:2004.
- Steps available if required.
- National Roads Authority (NRA) approved.
- Catch Pits must be lifted using a specialist grab and never lifted using slings through pipe opes or step rings.

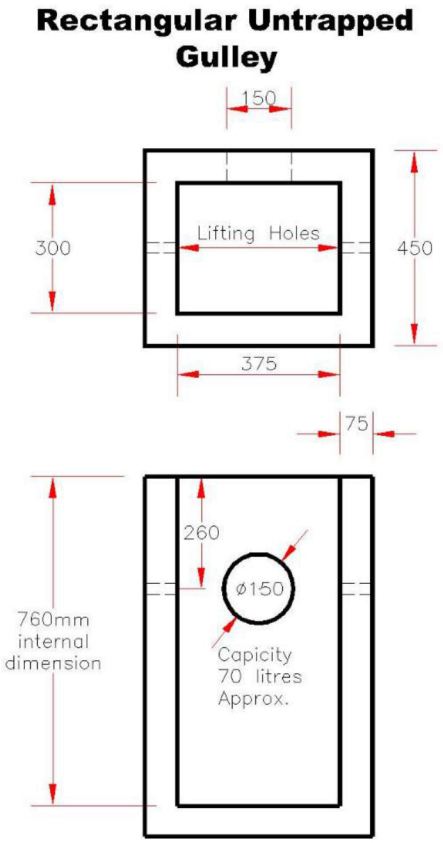


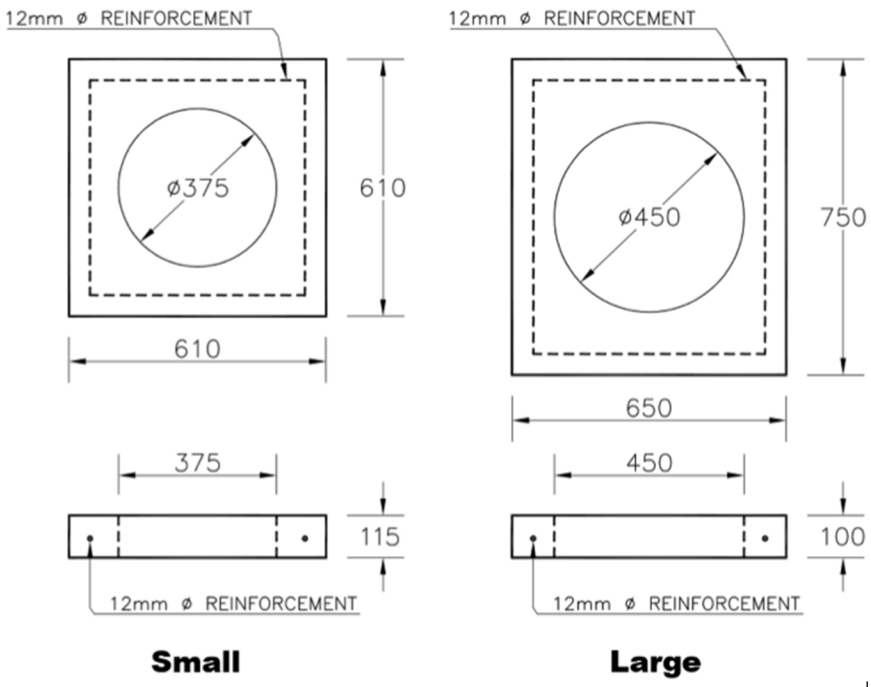
SECTION A-A



PLAN

RECTANGULAR GULLIES TO BS 5911 – 6:2004





National Roads Authority (NRA) approved.

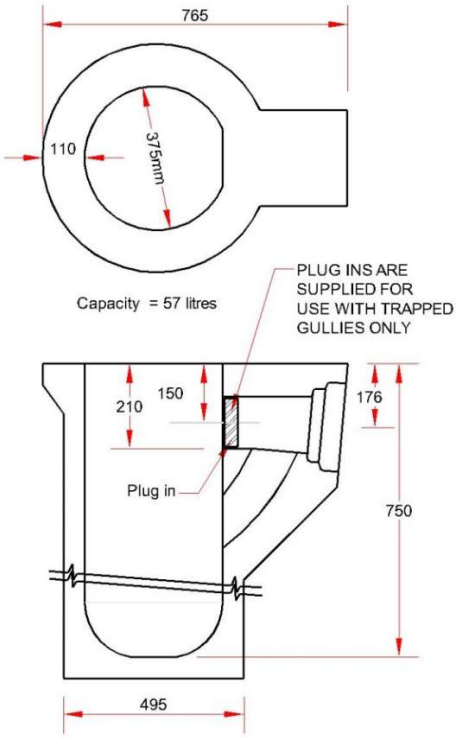
Rubber insert to be installed into gulley traps for use with PVC pipes.

PVC pipe with rubber insert in Circular Gulley with Concrete Cover Slab.
Cover Slabs are universally designed to receive most types of Gulley Grids.

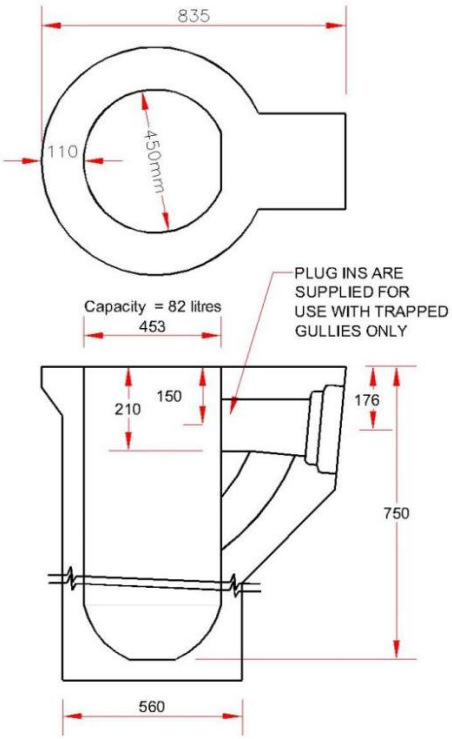
CIRCULAR GULLIES TO BS 5911 – 6: 2004

Circular Gullies are available with 375mm Ø, 450mm Ø trapped or un-trapped. Gulley Cover Slabs available on request 610x610x115mm, 375mm ope.

Circular Trapped Gulley 375



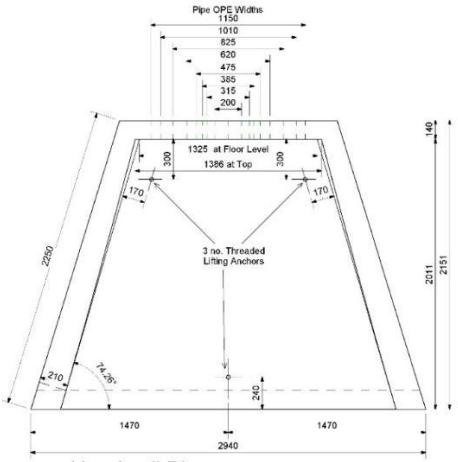
Circular Untrapped Gulley (450mm to NRA Specification)



The above Diagrams Shows Approximate Capacity only

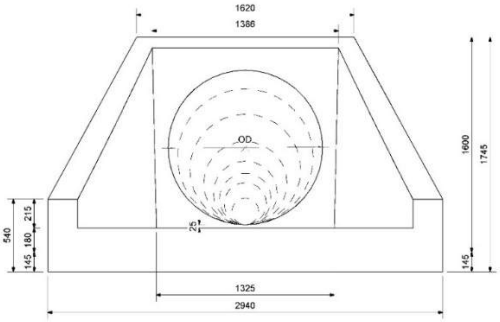
Rectangular and Circular Gullies

CONDRON HEADWALL

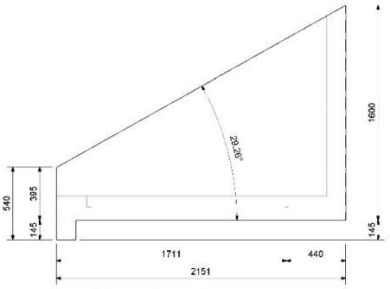


1 Headwall Plan
1 : 20

4 Isometric

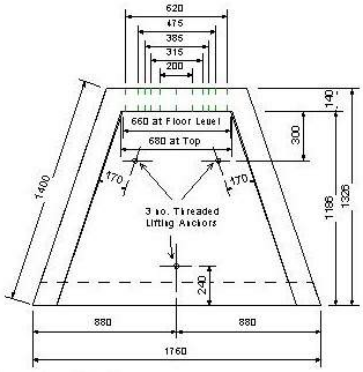


3 Front Elevation
1 : 20

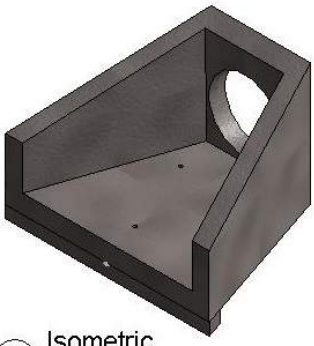


2 Side Elevation
1 : 20

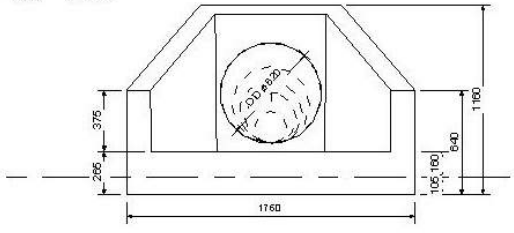
Large Condron Headwall



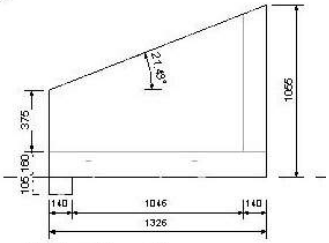
1 Headwall Plan
1 : 20



4 Isometric



3 Front Elevation
1 : 20



2 Side Elevation
1 : 20

Medium Condron Headwall

CONDRON HEADWALL

Condron Headwalls are available in the following sizes:

Ope Diameter (OD) mm	Medium headwall opes: 1185x1760x1055 high	Large headwall opes: 2151x2940x1600 high
200	✓	✓
315	✓	✓
385	✓	✓
475	✓	✓
620	✓	✓
825		✓
1010		✓
1150		✓

Headwall with Concrete Pipe

Headwall with optional Rubber Gasket

HANDLING / PIPE JOINTING

All pipes and fittings should be carefully inspected on delivery and before being used. No broken or defective pipe should be used (Ref to Pipe testing page 27). Cleanliness is essential to ensure a watertight joint. The spigot and the socket of all joints must be cleaned. The rubber gasket should be placed in the correct position (see pages 8 & 9). **Under no circumstances should a lubricant be used with Lamell rings. A check must be made that the rubbers are evenly tensioned and not twisted. The vertical and horizontal alignment of the pipe must be correct before the joint is made. Piping should start at the downstream end, the pipes being normally laid with the sockets upstream. The spigot must be first entered into the socket of the preceding pipe; a suitable jointing harness should then be attached to the two pipes, which are drawn together until the pipe locks home. Prior to the pipe being fitted into its final position all gaskets should be checked to ensure twisting has not occurred. If the alignment of the pipe has been altered the pipes may need to be pushed together again.**

HANDLING

Adherence to the basic principles of pipe handling will do much to ensure a sound and efficient pipeline.
For the larger size pipes (1050mm Ø and over), the contractor must provide all off-loading equipment.

RECOMMENDATIONS FOR HANDLING CONCRETE PIPES

1. Avoid damage when handling, especially to the ends of concrete pipes, and **NEVER** drag or roll pipes over rough ground.
2. Use correct craneage for offloading utilising properly constructed 'C' hooks with spreader bar or canvass/fabric slings with central lift.
3. Stack pipes on even ground on timbers to protect sockets and spigots, making sure the bottom row is securely chocked.
4. Never exceed recommended heights for stacking pipes on site, as shown in Table 8.
5. Joint rings **MUST** be stored away from sunlight, heat or possible contact with any oils.
6. Under NO circumstances should pipes be lifted by passing ropes or chains through the bores.
7. Ensure compliance with the Health & Safety at Work Act 1989, subsequent amendments and the Health & Safety Product Data Sheet issued by Condron Concrete Works in compliance with of the above act.
8. See Product Data Sheet at back of brochure.

Table 12

PIPE STACKING LAYERS	
Pipe Ø (DN)	**Number Of Layers**
150 – 225	6
300 – 375	4
450 – 600	3
600 – 900	2
1050 and above	1

Note: Chamber Rings and manhole Rings should never be stored on their side ("on the roll") but should always be stored Vertically. This is particularly important with shallow depth sections, which are easily toppled even if stacked on firm, level ground.

Further Information

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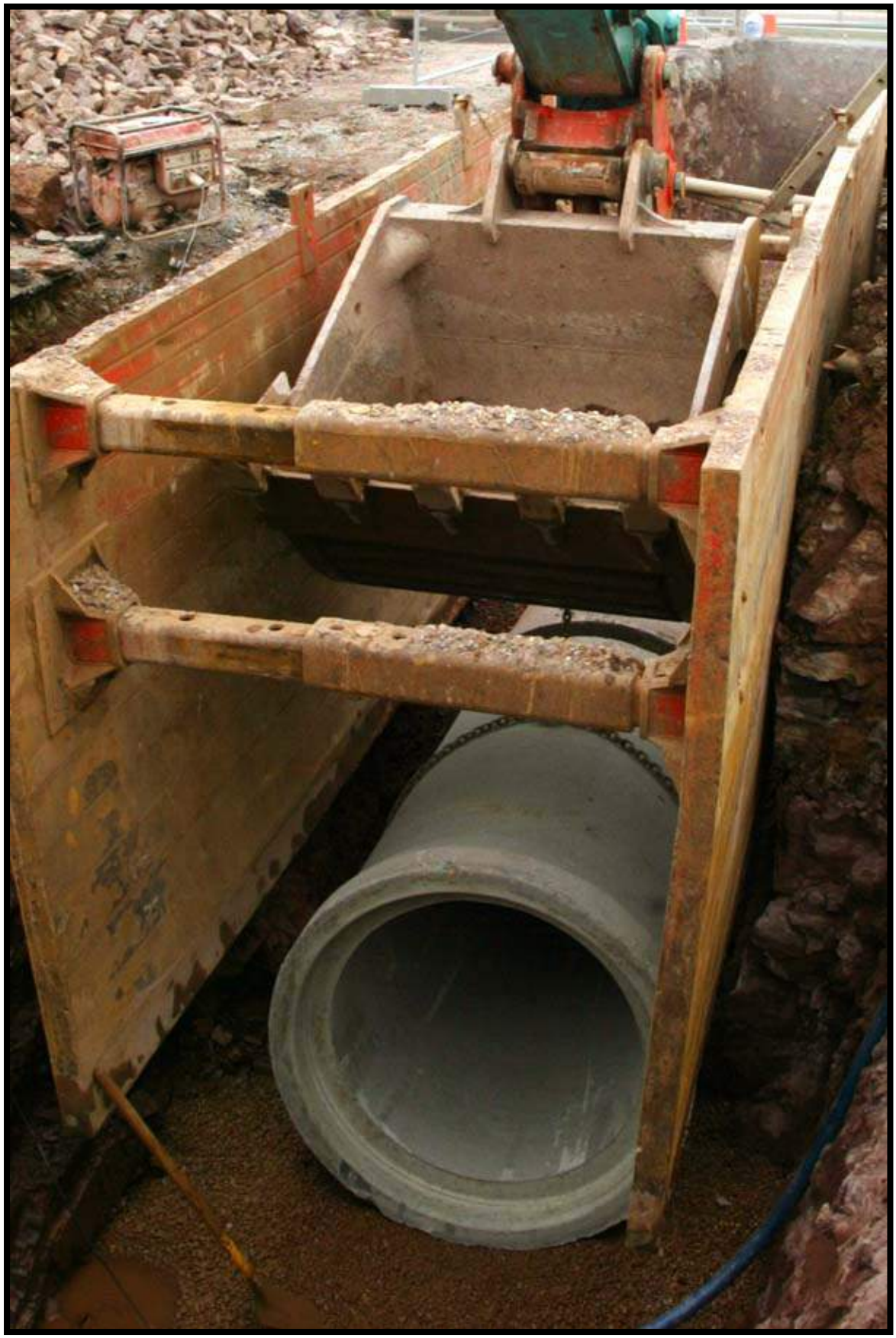
Web: www.condronconcrete.com
THIS DATA SHEET IS IN COMPLIANCE WITH THE HEALTH AND SAFETY AT WORK ACT 1989

LAYING PIPES

LAYING PIPES

LAYING PIPES



LAYING PIPES

SITE TESTING AND INSPECTION OF PIPELINE

All pipelines must be tested **before** and **after** backfilling. (Ref to table 13 page 28)

AIR TEST

This test is not covered by, I.S. 6: 2004 and ISEN 1916, but a pipe which complies with the Standard will usually comply with the air test provided it is laid correctly and the test equipment is in good condition. Failure to pass the air test should not preclude the acceptance of the pipeline if a successful water test can be achieved.

Air testing, whilst being convenient for the contractor, is subject to many variants and special care must be taken to ensure that any indicated failure is not due to the test equipment as opposed to the pipeline. It is always more satisfactory to test a string of pipes correctly jointed rather than single pipes, because this will minimise the effect of any shortcomings in the equipment and will give an average for the line rather than an individual result, which may vary.

A typical specification states that air should be pumped into the pipeline by a suitable means until a stable pressure of 100mm head of water is indicated on the U-tube and if, after allowing a suitable period for the pressure to stabilise, the air pressure has not fallen below 75mm during a period of 5 minutes, without further pumping, the pipeline should be accepted.

Test Procedure and Acceptance Criteria

The following test procedure is consistent with that described in BS 8301 / the Water Authorities Association publication “Sewers for Adoption”.

(a) Seal the ends of the pipeline by means of expanding or inflatable drain stoppers. We recommend the use of Mill test or A.T.O. type inflatable stoppers, which are light and reliable.
(b) Connect a ‘U’ gauge (manometer) to the test nipple of the drain stopper by means of rubber tubing.
(c) Raise the internal pressure of the system until the ‘U’ gauge indicates slightly more than 100mm of water (50mm where gullies are connected). Purpose made drain testing equipment is so calibrated that the scale indicates the actual pressure in mm water gauge.
(d) Allow about 5 minutes for stabilisation of the air temperature (a 1° change in temperature is reflected in a change in pressure of about 38mm on the gauge).
(e) Adjust the pressure to 100mm (or 50mm if appropriate) by either introducing further air or by bleeding off any excess pressure.
(f) Observe the fall in indicated pressure over a 5-minute test period. The residual pressure should not be less than 75mm (or 38mm for a 50mm test).

Comment

(a) If a test fails, identify the cause. Leaks may readily be detected by applying a soap solution to **all** parts of the system while the air test is in progress.
(b) Stoppers, which are not well seated, can allow air to escape. Reseating or retightening the stopper may be necessary. Mill Test or A.T.O. type inflatable stoppers are recommended for pipes > 375mm ø.
(c) Temperature change can lead to an apparent failure of the air test (particularly if a cold wind is blowing across the pipes). If this is the case a longer stabilisation period may be necessary.
(d) Check gaskets are positioned correctly (see pipe jointing).

Water Test

I.S. 6: 2004 and ISEN 1916 specifies that each batch of pipes is sampled and tested hydrostatically to 50KPa (5 metre head) for 15 minutes. Tests are also carried out at this pressure on joints whilst under shear load and during angular deflection. This provides a rapid indication of the impermeability of the pipes and joints and how they will perform when laid on site. It is normal for a site test to be of much longer duration and at a lower pressure. The following test is typically specified: The pipe shall be filled with water and provided with a

standpipe so that the head is not less than 1.2m above the crown of the pipe at the highest point and no more than 6.0 metres at the lowest point. It may be necessary to test pipelines laid at a steep gradient in sections to remain within these limits.

It is normal to allow the filled pipeline to stand full of water for a period of not less than 2 hours to allow for absorption prior to commencement of the test.

If the loss of water over a 30 minute period, when topped up every 10 minutes, is less than 0.5 litres per metre diameter per linear metre of pipe run the test is considered acceptable.

Close Circuit Television (CCTV)

The use of CCTV is now quite widely used for the inspection of mature sewers to assess their serviceability, and also for newly laid sewers to identify any major defects at the end of the maintenance period prior to adoption by the appropriate authority.

Close circuit television (CCTV) is used by many authorities for pipeline inspections.

This is a visual check only and requires personnel who are not only experienced in the operation of the equipment but also in interpreting the results.

General

The air and water tests summarised above are consistent with those specified in the following publications: - B.S. 8301 and I.S. E.N.1610: 1998

Table 13

Pipe ¬	Pipe Length (m)	Maximum No. of pipes to be laid prior to testing
150mm	1.25	3/4
225mm	1.25	3/4
300mm	2.0	3/4
375mm	2.5	3/4
450mm	2.5	3/4
525mm	2.5	3/4
600mm	2.5	3/4
675mm	2.5	3/4
750mm	2.5	3/4
900mm	2.5	3/4
1050mm	2.5	3/4
1200mm	2.5	3/4
1350mm	2.5	3/4
1500mm	2.5	3/4
1650mm	2.5	3/4
1800mm	2.5	3/4
2100mm	2.5	3/4
2400mm	2.5	2/3

Table 13 Shows the maximum number of pipe lengths to be tested before and after backfilling under normal site conditions.

NOTE:

We strongly recommend that testing be carried out periodically during the pipe laying process for every three to four pipes as set out in B.S. 8010 Section 2.7 ie. British Standard Code of Practice for Precast Concrete Pipelines. Where backfilling is required as work progresses three to four pipes must be tested before and after backfilling. This practice is recommended to facilitate rectification of defects prior to backfilling. All concrete pipe work should be laid in accordance with the Manufacturer's Instructions and the Supervising Engineers Specifications.

STRUCTURAL DESIGN

The forces acting on a cross section of pipeline arise from four main sources.

1. Weight of overlying fill.
2. Soil pressures transmitted to the pipe from surface loads i.e. traffic and other transient loads.
3. Supporting reaction below the pipe.
4. Water within the pipe (only significant for larger diameter pipes).

The four main conditions in which pipes are installed are:

1. In a 'narrow' trench.
2. In a 'wide' trench.
3. On the surface of ground over which an embankment is built.
4. In a narrow trench over which an embankment is built.

Design tables for condition 1 are supplied in the bedding Class / depth of cover tables. For conditions as stated in 2, 3 & 4 special design considerations apply and consultation may be required.
It is structurally critical if trench width on site exceeds the designed trench width. Trench width should be inspected and recorded regularly. A trench adjacent to a manhole may need to be wider but this should be taken into account at design stage.

TESTING

The Irish Standard Specification for Concrete Sewer Pipes, I.S.6: 2004 gives minimum crushing test loads for each diameter of pipe. Loads are applied in a three edge-bearing test described in the standard. Hydraulic tests are also carried out, by applying an internal hydraulic pressure of 0.5 bar to test for porosity. We also employ a 100% gauging system of our Spigots and Sockets to ensure watertight joints to 10m head of water.
(See Quality Control Page 5 and 6 and Testing and Inspection Page 27 and 28).

BEDDING FACTORS AND MATERIAL

In the three edge-bearing test, the vertical loading and supporting reactions are line loads. The strength of the pipes determined in the crushing test is multiplied by a bedding factor (Fm), which represents the amount by which the stresses in the pipe are reduced because of the spreading properties of the bedding for load and reaction.

The value of bedding factor (Fm) for a particular method of construction is not a precise figure but is affected by the quality of workmanship. The figures given are assuring a good standard of workmanship. Pipe settlement will be kept to a minimum by the proper selection and compaction of the bedding material. The bedding should be compacted to a density not less than that of the natural soil in the sides and bottom of the trench. The bedding material should be of a similar particle size to that in the trench sides. Where the ground is clay or silt, bedding material must consist of all-in gravels to prevent the trench from becoming a drainage channel and thus carrying away fines from the trench walls and bedding and causing settlement of the pipes. Rounded single size material is not recommended. The bedding directly beneath or above the pipeline must not be over compacted; otherwise line loading of the pipes will result.

Research and long experience has shown the following rule of thumb to be acceptable with a maximum of 40mm and limit on fine sands.

Table 14

↓ (mm) Pipe	Bedding Material Size
225 – 600	5 – 14mm
675 – 1500	15 – 20mm
1650 – 2400	25 – 40mm

COMPACTION

The degree of compaction shall be as specified in the structural design of the pipeline. Specified degrees of compaction shall be controlled by a method specification related to the particular equipment used (compaction means) or, where required, verified by testing.

The initial backfill directly above the pipe should be compacted by hand where required. Mechanical compaction of the main backfill directly above the pipe should not be commenced until there is a total depth of cover of least 300mm above the top of the pipe. The total depth of the cover directly above the pipe before mechanical compaction is commenced depends on the type of compaction device. The choice of compaction equipment, the number of passes and the thickness of layer to be compacted shall take account of the material to be compacted and the pipe to be installed.

Compaction by saturating the backfill or side fill is permissible only in exceptional cases and then only in suitable, non-cohesive soils.

MINIMUM DEPTH OF COVER

It is advisable that pipes laid under roads should have cover over the pipe of not less than 1.2m. Pipes laid with less than 1.2m cover require special consideration.
For pipes laid in fields a minimum cover of 0.6m should be provided. At shallower depths there is a risk of damage from agricultural operations.

DESIGN CALCULATIONS

The required crushing strength of a concrete pipe can be calculated using the following equation.
$Wt > (We \times Fs) / Fm$

Where: Wt = required I.S.6 crushing load (kn/m), (Fn=Wt)
We = Total applied load on the pipe (kn/m)
Fs = Factor of safety (1.25 MINIMUM)
Fm = the bedding factor
Crushing load (Wt) as stated in I.S. 6: 2004 Table 5

NOTE:
The minimum crushing load (Wt) is the load which the pipe will sustain without collapse. The proof load (Wp) is the load which reinforced pipes sustain without developing a crack exceeding 0.3mm in width over a length of 300mm.. The Design Loads used in Tables 16, 17 and 18 are calculated from the Marston's Formula to collapse. (Fn=Wt)

STRUCTURAL DESIGN

Minimum Crush Test Loads I.S. 6: 2004 and ISEN 1916

Table 15

Nominal Pipe ¬ (DN)	Minimum Crushing Load Fn kN/m (Fn=Wt)
225mm	27
300mm	36
375mm	45
450mm	54
525mm	63
600mm	72
675mm	81
750mm	90
900mm	108
1050mm	126
1200mm	144
1350mm	162
1500mm	180
1650mm	198
1800mm	216
2100mm	252
2400mm	288

Note 1, Sizes DN 225 to DN675 inclusive are manufactured unreinforced.
Note 2, Sizes DN 750 and above are manufactured reinforced.
Note 3, When using Condron Concrete I.S. 6: 2004 reinforced pipes the proof load is 80% of the minimum crushing load and the normal factor of safety of 1.25 is sufficient.

1200mm ø I.S. 6 Pipe undergoing Crush Test

STRUCTURAL DESIGN

DEPTH OF COVER TABLES

Depth of cover tables are provided for I.S. 6: 2004 Minimum Crush Strength and give a simple guide to maximum depth of cover for different bedding classes for single pipelines laid in a narrow trench. The density of fill is taken as 19.6kn/m³. This value is suitable for general design purposes and is unlikely to be exceeded in normal practice.

GENERAL

The general requirements of I.S. EN 1295 – 1: 1998 `Structural Design of Buried Pipelines' must be followed. Under no circumstances should blocks or bricks be placed beneath pipes and special care should be taken with material immediately surrounding the pipeline to minimise the possibility of large size lumps of rock, hardcore etc. coming into direct contact with the pipe and thus causing point loading. With a Socketed pipe care must be taken to ensure that adequate clearance is given beneath the Socket. Uniform support along the pipeline is essential. Where pipes are installed in soft ground the thickness of the lower bedding may need to be increased to prevent excessive settlement of the pipeline.

In assessing the loading category, regard should be paid to the possible future upgrading of a road. Pipes under verges should normally be treated as though under the road, and should take account of any planned road improvements.

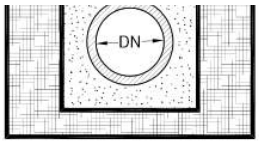
The water table must be kept below all trenches while pipe laying is in progress. Trench width should be kept as narrow as possible and within its designed dimensions. See recommended trench width, on Bedding Class depth of Cover tables. **Acceptance tests (water or air) must be applied prior to commencement of backfilling and should comply with BS8301: 1985 or ISEN 1610. Adequate trench support** should be used where necessary to ensure stability and safety.

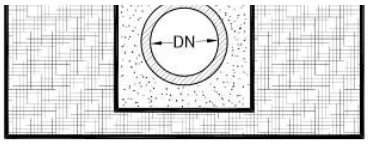
FACTOR OF SAFETY

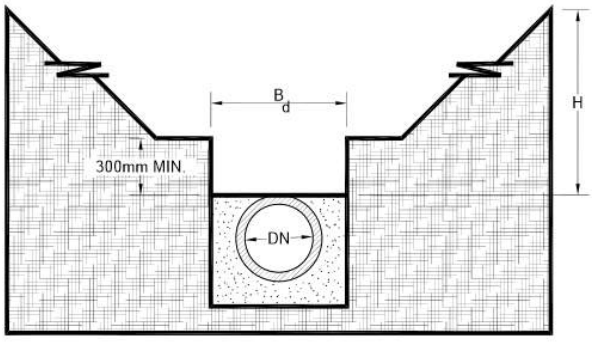
To allow for unexpected site conditions a minimum factor of safety of 1.25 should be allowed on the calculated external loads.

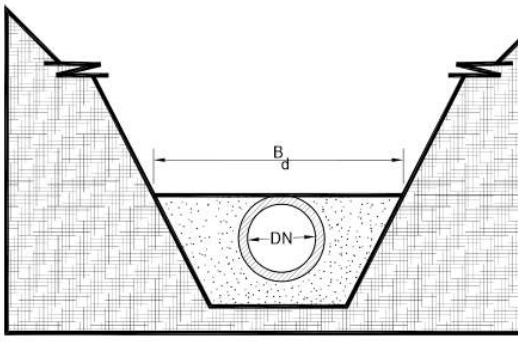
TRENCH WIDTHS

Narrow trench conditions – the assumed widths are given in the depth of cover charts.
The effective trench width (B_d)





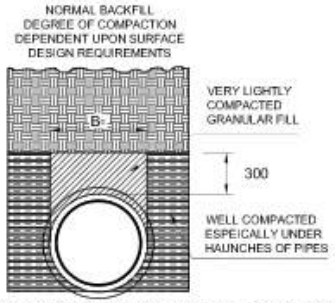




Strength Classes Required For Depth of Cover

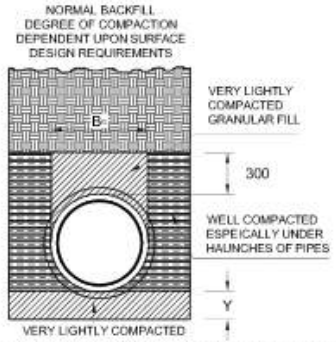
STRUCTURAL DESIGN / BEDDING CLASSES

CLASS D
Hand Trimmed Flat Bottom.
BEDDING FACTOR = 1.1



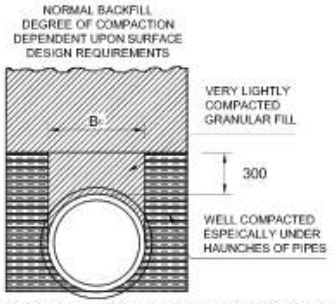
Suitable in fine grained soils and relatively dry conditions. Hand trim formation filling in any hollows. Form socket hollows as required with 50mm minnimum clearance of suffient length to permit jointing. Pipes are laid directly onto excavated trench base.

CLASS N
Flat Granular Type
BEDDING FACTOR = 1.1



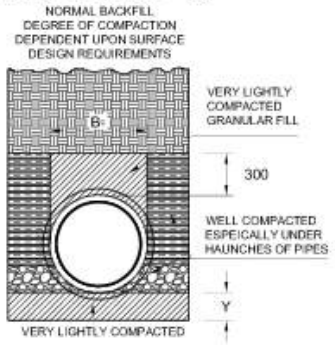
Lay pipes in a flat layer of selected material. Form socket hollows as required with 50mm minnimum clearance of suffient length to permit jointing.

CLASS C
Hand Shaped Bottom.
BEDDING FACTOR = 1.5



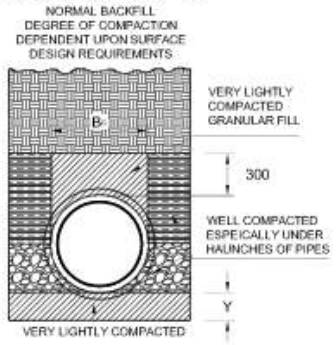
Suitable in uniform soils and relatively dry conditions. The bottom of the trench / formation shall be profiled to fit the pipes over a width of ½ **Bc** with socket hollows as required with 50mm minnimum clearance of suffient length to permit jointing. Scarifying the formation level of the trench is generally adaquate in practice.

CLASS F
Granular Bedding
BEDDING FACTOR = 1.5



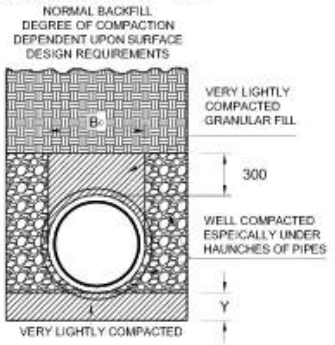
Lay pipes in a flat layer of granular bedding material on the formation level of the trench. Form socket hollows as required with 50mm minnimum clearance of suffient length to permit jointing. Pipes will settle slightly in to the bedding. Place side fill and compact well.

CLASS B
180° Granular Bedding
BEDDING FACTOR = 1.9



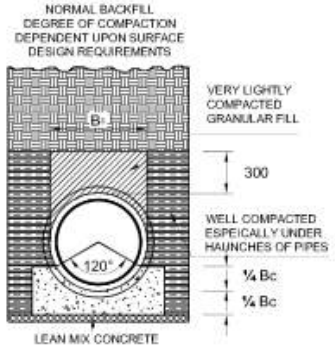
Lay pipes in a flat layer of granular bedding material on the formation level of the trench. Form socket hollows as required with 50mm minnimum clearance of suffient length to permit jointing. Compact the layers each side of the pipe up to the springing level taking care not to displace them.

CLASS S
360° Granular Bedding
BEDDING FACTOR = 2.2



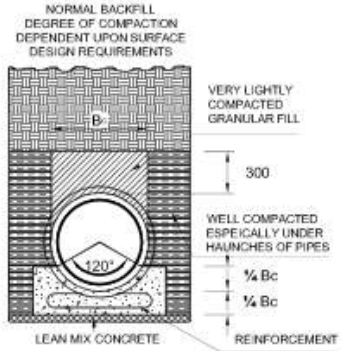
Lay, joint and bed pipes as per Class B then place and well compact layers of the same bedding material at each side up to the crown level taking care not ot displace the pipes. This is followed by a 300mm layer of the same granular bedding material but slightly compacted directly over the pipe, after which ordinary backfilling is commenced.

CLASS A
Plain Concrete Cradle
BEDDING FACTOR = 2.6



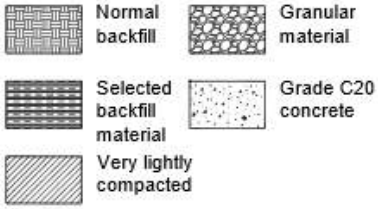
Class A concrete bedding, either plain or reinforced each with 120° cradle. Screed the formation level with lean mix concrete, place blocks on the screed to support pipes behind each socket. Lay pipes using packers on blocks to achieve the correct line and level.At pipe joints, form construction joints through the concrete bed to ensure flexibility of pipeline.

Reinforced Concrete Cradle
BEDDING FACTOR = 3.4



The minimum width of cradle is to be 1¼ Bc or Bc + 200mm. The minimum thickness is to be ¼ Bc. Pour the cradle carefully from one side to prevent voids in the concrete. Backfill when the concrete has cured to the required strength.

KEY



STRUCTURAL DESIGN

Table 16: FOR IS EN 1916 AND I.S. 6: 2004, CLASS 120 PIPES

Class B fm = 1.9 (green)
Class S fm = 2.2 (blue)
Class A fm = 2.6 (red)

MAIN ROADS																		
Nominal Diameter (mm)	Socket O.D. (mm)	Recommended Trench Width (m)	Load Included kN/m	Depth of Cover (m)														
				1		2		3		4		5		6		7		8
225	392	0.70	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
300	505	0.75	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
375	606	1.05	-	B	B	B	B	B	B	B	B	B	B	S	S	S	S	S
450	707	1.15	-	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
525	808	1.20	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
600	909	1.35	2.1	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
675	1008	1.45	2.6	B	B	B	B	B	B	B	B	B	B	B	B	B	S	S
750	976	1.50	3.3	B	B	B	B	B	B	B	B	B	B	B	B	B	B	S
900	1148	1.90	4.7	B	B	B	B	B	B	B	B	B	B	S	S	S	S	A
1050	1420	2.05	6.4	B	B	B	B	B	B	B	B	B	B	B	S	S	S	S
1200	1605	2.30	8.3	B	B	B	B	B	B	B	B	B	B	B	S	S	S	S
1350	1805	2.45	10.3	B	B	B	B	B	B	B	B	B	B	B	S	S	S	S
1500	2012	2.60	13.0	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
1650	2155	2.80	15.7	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
1800	2310	2.95	18.7	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
2100	2525	3.25	25.5	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
2400	2866	3.55	33.3	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S

Table 16

The above Table assumens recommended trench width and proper pipe laying procedures, with adaquate backfill material and compaction.

Minimum pipe crushing loads have been obtained from Table 5 of I.S. 6:2004.

The loadings have been calculated using the Minimum Crush Load (W=) with a factor of safety of 1.25 minimum.

The recommended minimum depth of cover for pipelines under roads is 1.2m.

NOTE: Refer to the Design Calculations in this document.

The above table is is to be used as a guide only.

STRUCTURAL DESIGN

Table 17: FOR ISEN 1916 AND I.S. 6: 2004, CLASS 120 PIPES

LIGHT ROADS														
Nominal Diameter (mm)	Socket O.D. (mm)	Recommended Trench Width (m)	Load Included kN/m	Depth of Cover (m) 1	2	3	4	5	6	7		8
225	392	0.70	-									
300	505	0.75	-									
375	606	1.05	-									
450	707	1.15	-									
525	808	1.20	-									
600	909	1.35	2.1									
675	1008	1.45	2.6									
750	976	1.50	3.3									
900	1148	1.90	4.7									
1050	1420	2.05	6.4									
1200	1605	2.30	8.3									
1350	1805	2.45	10.3									
1500	2012	2.60	13.0									
1650	2155	2.80	15.7									
1800	2310	2.95	18.7									
2100	2525	3.25	25.5									
2400	2866	3.55	33.3									

Table 17

The above Table assumens recommended trench width and proper pipe laying procedures, with adaquate backfill material and compaction.
Minimum pipe crushing loads have been obtained from Table 5 of I.S. 6:2004.
The loadings have been calculated using the Minimum Crush Load (W=) with a factor of safety of 1.25 minimum.
The recommended minimum depth of cover for pipelines under roads is 1.2m.
NOTE: Refer to the Design Calculations in this document.
The above table is to be used as a guide only.

STRUCTURAL DESIGN

Table 18: FOR ISEN 1916 AND I.S. 6: 2004, CLASS 120 PIPES

B = Class B, fm = 1.9
S = Class S, fm = 2.2

FIELDS																		
Nominal Diameter (mm)	Socket O.D. (mm)	Recommended Trench Width (m)	Load Included kN/m	Depth of Cover (m)														
				1		2		3		4		5		6		7		8
225	392	0.70	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
300	505	0.75	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
375	606	1.05	-	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
450	707	1.15	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	S
525	808	1.20	-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
600	909	1.35	2.1	B	B	B	B	B	B	B	B	B	B	B	B	B	B	S
675	1008	1.45	2.6	B	B	B	B	B	B	B	B	B	B	B	B	B	B	S
750	976	1.50	3.3	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
900	1148	1.90	4.7	B	B	B	B	B	B	B	B	B	B	B	S	S	S	S
1050	1420	2.05	6.4	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
1200	1605	2.30	8.3	B	B	B	B	B	B	B	B	B	B	B	B	S	S	S
1350	1805	2.45	10.3	B	B	B	B	B	B	B	B	B	B	B	B	B	S	S
1500	2012	2.60	13.0	B	B	B	B	B	B	B	B	B	B	B	B	B	S	S
1650	2155	2.80	15.7	B	B	B	B	B	B	B	B	B	B	B	B	B	S	S
1800	2310	2.95	18.7	B	B	B	B	B	B	B	B	B	B	B	B	B	S	S
2100	2525	3.25	25.5	B	B	B	B	B	B	B	B	B	B	B	B	B	S	S
2400	2866	3.55	33.3	B	B	B	B	B	B	B	B	B	B	B	B	B	B	S

Table 18

The above Table assumens recommended trench width and proper pipe laying procedures, with adaquate backfill material and compaction.

Minimum pipe crushing loads have been obtained from Table 5 of I.S. 6:2004.

The loadings have been calculated using the Minimum Crush Load (W=) with a factor of safety of 1.25 minimum.

The recommended minimum depth of cover for pipelines under roads is 1.2m.

NOTE: Refer to the Design Calculations in this document.

The above table is is to be used as a guide only.

HYDRAULIC DESIGN

Pipelines should be designed to accommodate expected discharge, while also ensuring self-cleansing is achieved. A velocity between 0.75m / sec and 4.0m / sec, is considered satisfactory for self-cleaning when flowing half full.

COLEBROOK – WHITE EQUATION

A number of formulas have been developed to assist in hydraulic calculations to determine flow rates in pipelines. The Colebrook – White equation is considered most accurate for commercial pipes as effective roughness is applied. The equation expressed in Engineering terms is as follow:

$$V = -2\sqrt{2g\,Di}\;\mathrm{Log}\left(\frac{ks}{3.7D} + \frac{2.51v}{D\sqrt{2g\,Di}}\right)$$

Where V = Velocity
G = Gravitational acceleration (9.81 m/s)
i = Hydraulic gradient (m/m)
D = Pipe internal diameter (m)
ks = Hydraulic

v = Kinematic viscosity of fluid (1.31 x 10⁻⁶ m²/s)

Now Q can be calculated using
Q = VR (m³/s)

Where Q = Discharge (m³/s)
V = Velocity (m/s)
R = Hydraulic Radius = $\frac{D\,(m)}{4}$
D = Internal Diameter of pipe

DESIGN CHARTS

BS 8005:Part 1 1987, contains hydraulic flow charts based on the Colebrook – White equation for calculating transitional flow.
Two such charts have been included to simplify calculations. Each has a different roughness factor (ks) and should be used as follows:-

Foul and combined sewers	ks = 1.5mm
Surface water sewers	ks = 0.6mm

The velocities and discharges given in the hydraulic flow charts are for circular concrete pipes flowing full. If the pipes are partially full the proportional discharge and velocity values, can be taken off the partial flow chart provided.

Example

Design of Surface Water Sewer

Pipeline length	=300m
Difference in level between inlet and outlet	=2m
Design discharge	=500L/S

To determine:

a) Adequate pipe size when flowing full
b) Discharge and Velocity when flowing 70% full
c) Determine if the velocity is satisfactory for self-cleansing

Solution

Hydraulic Gradient	1 in 150 (or 0.0066)
Ks for surface water sewer	0.6mm

a) Flowing Full

Refer to hydraulic flow chart ks = 0.6mm
The intersection of the horizontal discharge line of 500 L/S (0.5m³/sec) with the vertical hydraulic gradient line of 1 in 150 gives:

Pipe Diameter	600mm
Average Velocity	1.95 m/sec
Discharge	550 L/S

b) Discharge and Velocity when flowing 70% full

Refer to the graph showing Relative Velocity and flow in circular pipes for any depth of flow. The intersection of the horizontal proportional depth line of 0.7 with the proportional discharge and velocity curves gives:

Proportional Discharge	0.84
Proportional Velocity	1.12

Therefore:

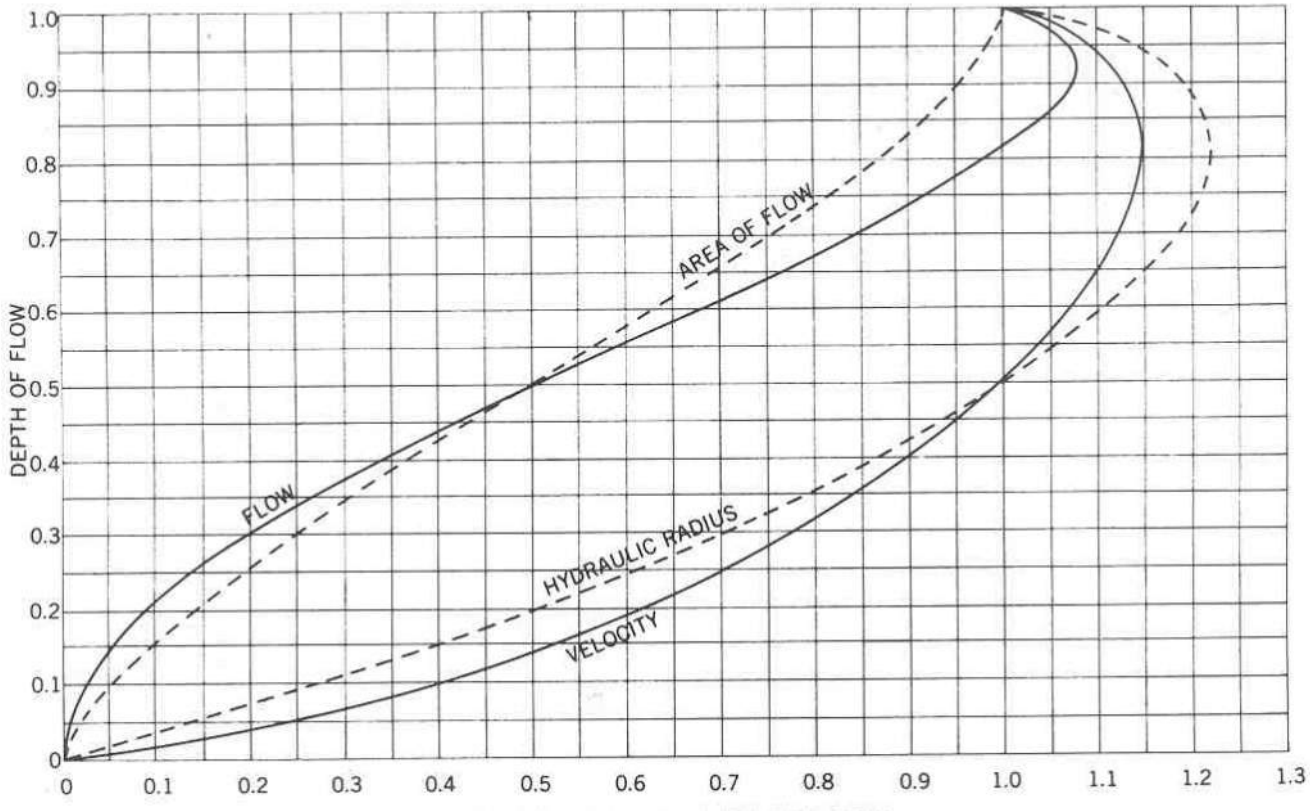
Actual Discharge	0.84 x 550 = 462 L/sec
Actual Velocity	1.12 x 1.95 = 2.18 m/sec

c) Check if self-cleansing is achieved when flowing half full

Refer again to Relative Velocity and flow chart. When the discharge is 0.5 the proportional velocity is 1.0,

=> 1.0 x 1.95 = 1.95m/sec, $0.75 < 1.95 < 4.0$
therefore satisfactory

Relative Velocity and Flow in Circular Pipe for any Depth of Flow

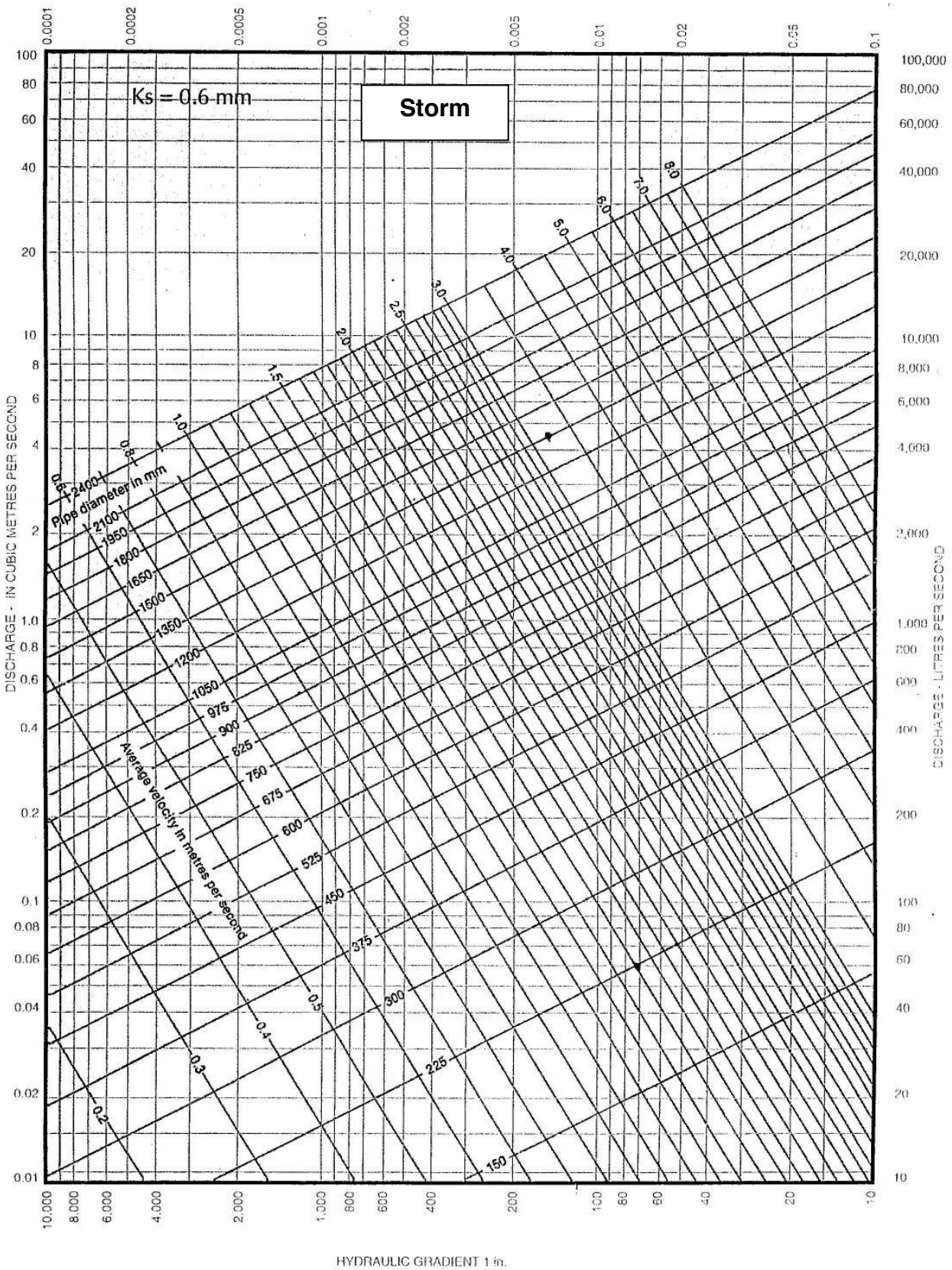


NOTE: This graph complies with B.S. 8005: part 1 1987 and will comply to **any new Irish, British or European Standards in the future.**

HYDRAULIC DESIGN

Colebrook – White) Water at 15°C

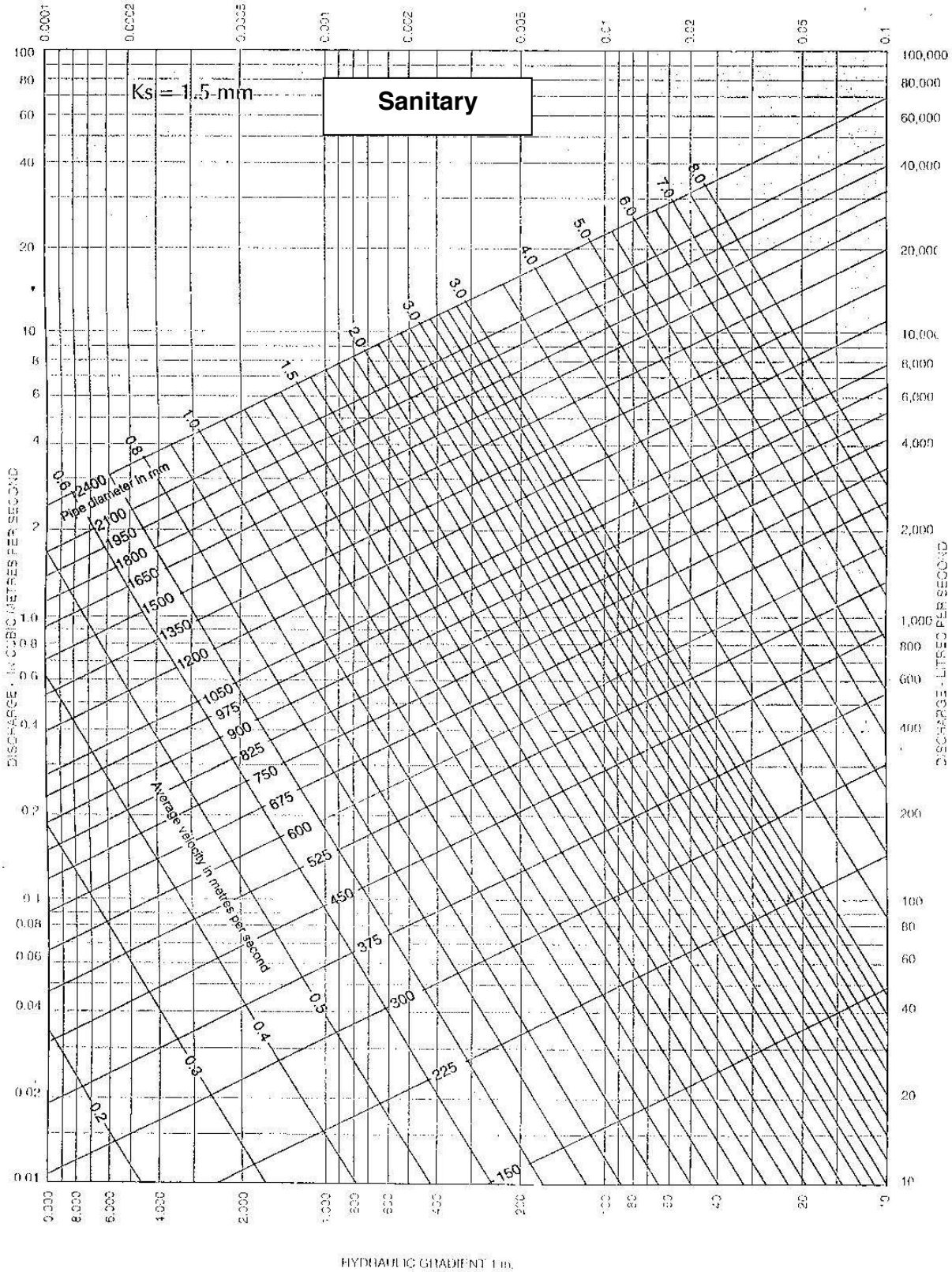
Flow Chart No.1



HYDRAULIC DESIGN

(Colebrook – White) Water at 15°C

Flow Chart No.2



PRODUCT DATA SHEET

CONCRETE PIPES, MANHOLE COMPONENTS AND ANCILLARY PRECAST PRODUCTS MANUFACTURED BY CONDRON CONCRETE WORKS

Composition

The products are composed of cementitious materials and aggregates and possibly admixtures. Certain products may be reinforced with steel.

Hazards

The finished products as supplied are of an inert nature and inherently non-hazardous to health. The individual items are generally heavy and many are so shaped that they can roll easily. Correct handling and stacking procedures as given below must be employed.

Handling/Use Precautions

The weight and surface nature of the products requires the use of protective gloves and footwear to avoid injuries.

- The manual handling of such loads may cause an injury should be avoided. Good slinging and lifting practices should always be used and the following points observed:
- Products must not be rolled off vehicles or around sites.
- Chamber Rings and manhole Rings should never be stored on their side ("on the roll") but should always be stored vertically. This is particularly important with shallow depth sections, which are easily toppled even if stacked on firm, level ground.
- Chamber rings, Bases and Catch Pits must not be lifted by slinging through the step/rung irons and pipe junctions must not be lifted by slinging around the branch.
- Use correct craneage for offloading vehicles. Properly constructed 'C' hooks with spreader bar or canvas/fabric slings with a central lift are recommended.
- Where lifting points are provided, all the lifting points must be used.
- Where lifting points are not provided, then suitable slings (canvas/fabric) should be used around the product and never through it. Correct craneage must always be utilised.
- Care should be taken when breaking down product stacks either on the delivery vehicle or on site.
- Pipe jointing tackle is only to be used for the purpose for which it is supplied.
- When cutting or surface treating products by hand or machine, dust and flying fragments may be created. The dust created may be of respireable size and may contain quartz. Extended periods of exposure to high concentrations of such dust, particularly in enclosed spaces, can constitute a health hazard. In such circumstances, respiratory protective equipment should be worn. Suitable eye protection should be worn to protect against dust and/or flying fragments.
- Provide Trench Supports where necessary.
- Ensure compliance which the Health Safety and Welfare at Work Act 2005. See Safety Page 47

Ogee Pipe Loading per 12 Metre Vehicle

Table 23

Pipe ¬	Approx. Number of Ogee pipes per 12 Metre Vehicle
150mm	450
225mm	330
300mm	220
375mm	160
450mm	120
600mm	86
750mm	40
900mm	35
1050mm	18
1200mm	16

S & S Pipe Loading per 12 Metre Vehicle

Table 24

Pipe ¬	Approx. Number of S & S pipes per 12 Metre Vehicle
150mm	400
225mm	200
300mm	60
375mm	45
450mm	30
525mm	24
600mm	18
675mm	16
750mm	12
900mm	10
1050mm	8
1200mm	7
1350mm	5
1500mm	4
1650mm	4
1800mm	3
2100mm	3
2400mm	3

SAFETY

Attention is drawn to Regulations 76 and 77 of the Safety, Health and Welfare at Work (Construction) Regulations 1995. These notes are a brief summary of safety precautions based on the 1995 Regulations made under the Safety, Health and Welfare at Work Act 1989. It is the responsibility of employers, employees, and the self-employed, to ensure that legal requirements are complied with. Particular attention is drawn to the Safety, Health and Welfare at Work (Construction) Regulations 1995 and other legislation setting out the duties of owners, employers and employees in relation to the construction and maintenance of buildings.

Above notes are given for general information guidance only, and are not to be taken as comprehensive. All Condron Concrete Works Drivers have Hard Hats, Steel - Toe Boots, Safety Jackets and current FAS Safety Passes.

Identification Of Product - Concrete Pipes

Application:

Use of concrete pipes should be in accordance with the relevant National and European Union Codes of Practice.

Composition of Ingredients:

Concrete pipes are a mixture of natural aggregates, cement, water and steel. Admixtures may be added to modify the properties of the finished product.

Hazard Identification:

Concrete pipes are abrasive and can weigh 50kg to over 8 tonnes depending on the dimensions and should be handled accordingly

Concrete pipes should be stored correctly to prevent rolling and overturning.

Cutting, drilling or hammering of concrete pipes can create dust. If inhaled in excessive quantities over extended periods, respirable dust can constitute a long term hazard

Cutting, drilling or hammering of concrete pipes, unless adequately controlled, can project particles at high velocity with consequent risk of impact damage and/or injury particularly to the exposed areas of the body and eyes.

When cutting, use equipment suitable for concrete and steel in accordance with manufacturer's instructions.

First Aid Measures and First Aid Treatment as follows:

Eye Contact: Immediately rinse under running water and seek medical advice

Cuts and Abrasions: Cuts / Abrasions from concrete pipes should be cleaned and treated using the normal first aid method. Wounds must receive prompt medical attention. In all cases of doubt or where symptoms persist, medical advice must be obtained.

Accidental Release Measures:

Avoid contact with skin.

Tidy up debris from broken pipes.

Handling and Storage:

Protect skin when handling concrete pipes.

Use suitable handling and transport equipment when using concrete pipes.

Before lifting always size up the load.

Always follow safe lifting and manual handling procedures.

Ensure adequate load bearing capacity of the ground when placing or storing concrete pipes.

Recommended stacking heights depending on diameter.

Pipes in storage should be chocked.

Do not roll / drag pipes.

Webbed fabric slings or `C' hooks should be used.

Trench preparation and pipe support should be in accordance with Health and Safety regulations.

Store / Stack well back from edge of any excavation.

Exposure Controls / Personal Protection:

Hand Protection: Wear suitable protective gloves.

Skin Protection: Avoid contact with skin.

Eye Protection: Wear goggles to prevent eye contact from flying particles when cutting, drilling or hammering concrete pipes.

Masks: Wear appropriate respiratory protection when cutting, drilling or hammering concrete pipes.

Footwear: Wear footwear with protective toecaps when working with concrete pipes.

Physical and Chemical Properties:

Concrete pipes are grey in colour.

The product is abrasive.

Stability and Reactivity:

Ensure the integrity and stability of pipes whilst stored on site.

Toxicological Information:

Not applicable.

Ecological Information:

Concrete pipes have no ecological effects.

Disposal Considerations:

Concrete pipes may be recycled or placed in approved landfill sites.

Transport Information:

Ensure security and safety of load at all times

Note:

The information given in this manual is, to the best of our knowledge, correct, but customers, including consultant engineers, site engineers, architects and specifiers, must satisfy themselves that any particular product is suitable for their specific requirements. Condron Concrete Works, or their employees, or agents, do not accept any liability whatsoever arising from anything contained in this manual.

Condron Concrete Works

CONDRON CONCRETE WORKS IS A TRADENAME FOR CONDRON CONCRETE LTD.

ARDEN ROAD, TULLAMORE, CO. OFFALY, IRELAND.

CONCRETE ROOF TILES

Concrete Pantiles, Concrete Slate Tiles, Concrete Bullnose Slate Tiles, 3 in 1 Tile /Cladding Tiles, Concrete Plain Tiles /Cladding Tiles, M Profile and Condron Slate. and Accessories including Ridge Tiles, Ornamental Ridge Tiles, Cloak Tiles, Baby Ridge Tiles are available from:

Condron Concrete Works
Arden Road, Tullamore,
Co. Offaly.
Telephone: +353 (057) 9349000-9
Fax: +353 (057) 9341565
Email: condronconcrete@eircom.net or
Web: www.condronconcrete.com

Appendix E

Irish Water Foul Water Diversion Confirmation of Feasibility

Note, drawings included within the confirmation of feasibility are superseded by the planning drawings as the red line boundary changed to incorporate the surface water discharge point to the south of the site.

Stephen Ginn
Arup
One Albert Quay,
Cork
T12 X8N6

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

8 February 2022

Dear Mr Ginn,

Re: DIV21300 – Kinsale Road, Cork – Diversion enquiry.

Irish Water has reviewed your enquiry in relation to the diversion of an existing 600mm sewer to facilitate a proposed development at Kinsale Road, Cork as indicated on drawings 252666-ARUP-22-XX-DR-C-2000 Proposed Foul Water Layout and 252666-ARUP-22-XX-DR-C-2001 Proposed Combined Sewer Long Sections

Based upon the details you have provided with your enquiry and as assessed by Irish Water, we wish to advise you that, the proposed sewer diversion is feasible, subject to the conditions set out below being in place.

1. The construction shall be constructed in strict accordance to drawings 252666-ARUP-22-XX-DR-C-2001 Proposed Combined Sewer Long Sections
2. A 750mm spur shall be left out of proposed manhole MH3 to allow for any future works on this sewer.
3. You are advised that this correspondence does not constitute an agreement in whole or in part to provide a diversion of Irish Water infrastructure and is provided subject to diversion agreement being executed at a later date. You are advised to make contact with the diversions team at diversions@water.ie once planning permission has been granted and prior to any works commencing on site in order to enter into a diversion agreement with Irish Water.

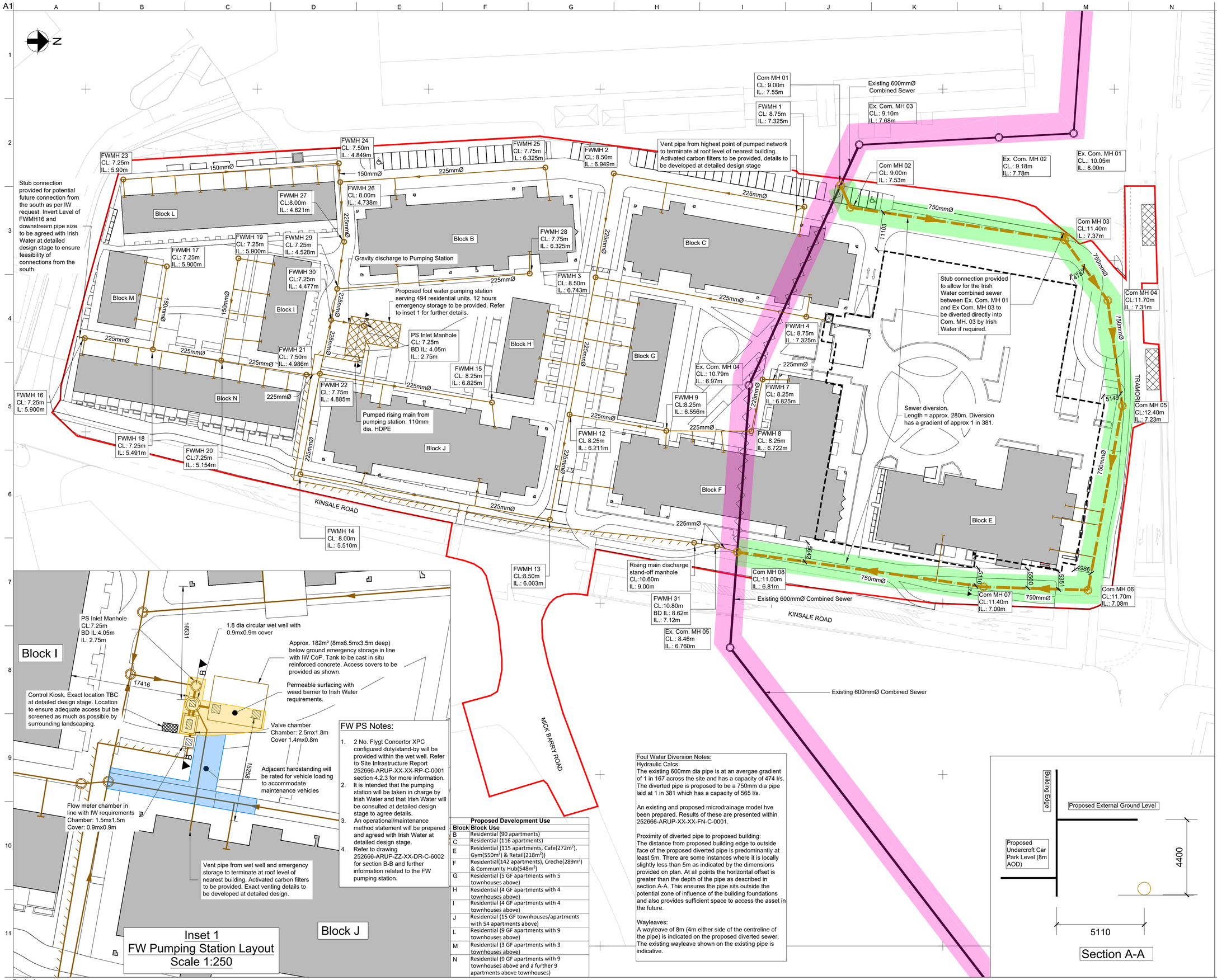
If you have any further questions, please contact Maurice Feehan from the diversions team on 087 9027174 or email maufeehan@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Dawn O'Driscoll, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1 D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363



Proposed Development Use	
Block	Block Use
B	Residential (90 apartments)
C	Residential (116 apartments)
E	Residential (115 apartments, Cafe(272m²), Gym(550m²) & Retail(218m²))
F	Residential(142 apartments), Creche(289m²) & Community Hub(548m²)
G	Residential (5 GF apartments with 5 townhouses above)
H	Residential (4 GF apartments with 4 townhouses above)
I	Residential (4 GF apartments with 4 townhouses above)
J	Residential (15 GF townhouses/apartments with 54 apartments above)
L	Residential (9 GF apartments with 9 townhouses above)
M	Residential (3 GF apartments with 3 townhouses above)
N	Residential (9 GF apartments with 9 townhouses above and a further 9 apartments above townhouses)

Notes:

1. All levels relate to OD Malin Head and are in meters.
2. Do not scale from this drawing. If in doubt, ask.
3. This drawing should be read in conjunction with all relevant and available documentation.
4. Ordnance Survey Ireland License No. EN0002821 © Ordnance Survey Ireland/Government of Ireland.
5. Existing foul water infrastructure based on record drawings received from Irish Water & Cork City Council.
6. All foul water drainage to be designed and constructed in accordance with Irish Water Code of Practice and Standard Details.
7. All pipework shall be Polypipe Polysewer and fittings, or similar approved and to have a minimum cover of 900mm in non-trafficable areas and 1.2m in trafficable areas.
8. Outlet pipes from buildings to be min 150mm dia. Outlets from buildings to discharge to an inspection chamber (IC) prior to discharge to the main carrier sewer. IC's not shown for clarity.
9. Runoff from undercroft basement to be collected by channel drains and discharged to the FW network.
10. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-6000 and 6001 for drainage details.

LEGEND:

- Proposed Planning Boundary Line
- Proposed Proposed Building
- Proposed Outline of the Basement
- Existing Utility to be Diverted
- Existing Combined Water Sewer & Manhole
- Proposed Combined Water Sewer & Manhole Diversion
- Proposed Foul Water Sewer & Manhole
- Proposed Foul Water Building Connection
- Existing Combined Sewer Wayleave
- Proposed Combined Sewer Wayleave

Rev	Date	By	Chkd	Appd
P06	18/01/22	RM	RM	J.MacC
Issued for Information				
P05	20/12/21	WC	RM	J.MacC
Issued for Information				
P04	01/12/21	RM	RM	J.MacC
Issued for Information				
P03	18/11/21	BH	RM	J.MacC
Issued for Information				
P02	04/11/21	ROD	RM	J.MacC
Issued for Information				
P01	06/08/21	ROD	RM	J.MacC
Issued for Information				

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www.arup.com

Client

CREAMFIELDS

Project Title

Creamfields Residential Development

Drawing Title

Proposed Foul Water Layout

Scale at A1 1:500

Role Site Infrastructure

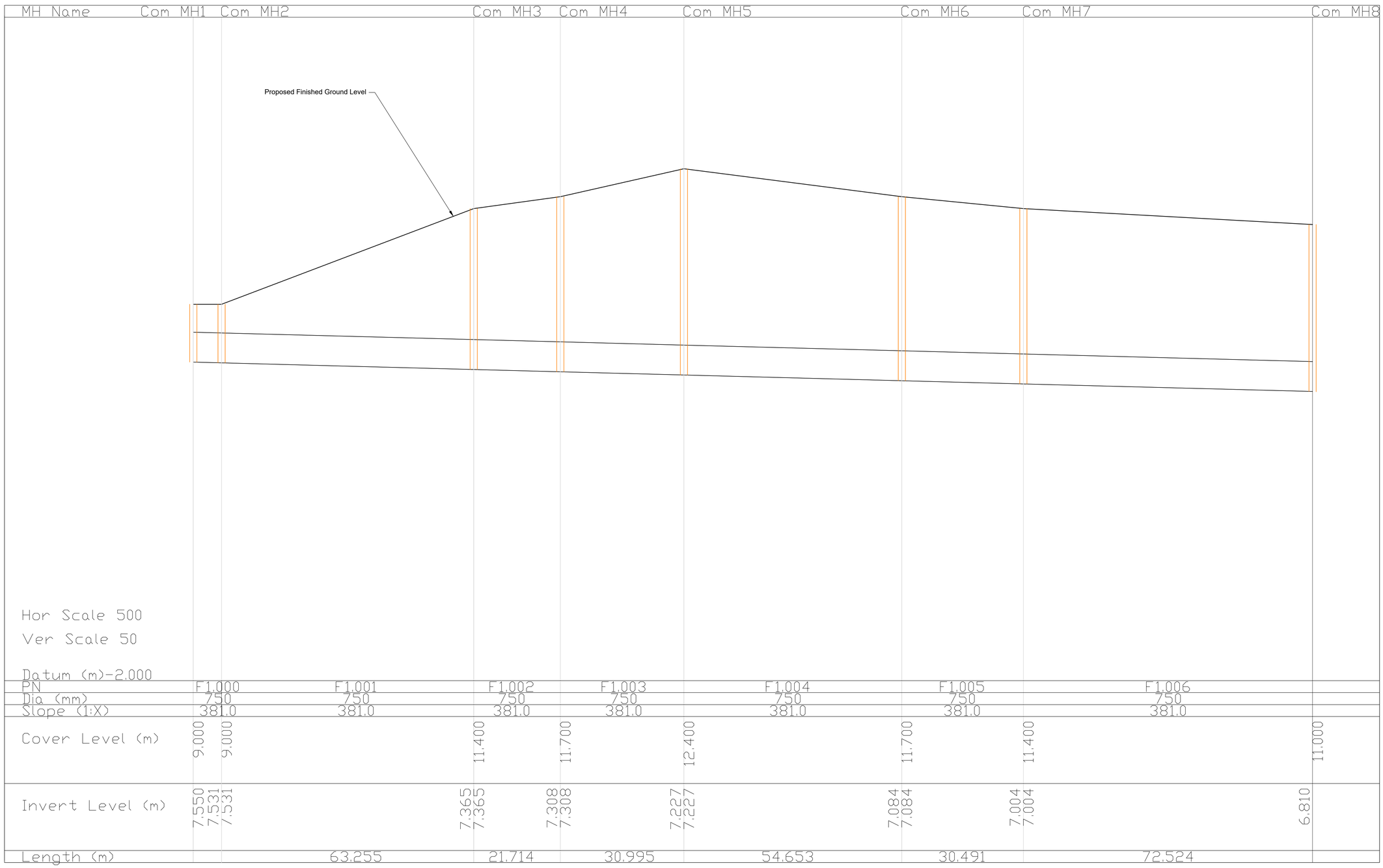
Suitability S2 - Suitable for Information

Arup Job No **252666-00**

Rev **P06**

Name **252666-ARUP-ZZ-XX-DR-C-2000**

Do not scale
© Arup



Notes:

1. All levels relate to OD Malin Head and are in meters.
2. Do not scale from this drawing. If in doubt, ask.
3. This drawing should be read in conjunction with all relevant and available documentation.
4. All foul water drainage to be designed and constructed in accordance with Irish Water Code of Practice and Standard Details.
5. All pipework shall be Polypipe Polysewer and fittings, or similar approved.
6. All pipes to have a minimum cover of 900mm in non-trafficable areas and 1.2m in trafficable areas.
7. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-2000 for Proposed Foul Water Layout.
8. Refer to drawing 252666-ARUP-ZZ-XX-DR-C-6000 and 6001 for drainage details.

Rev	Date	By	Chkd	Appd
P04	18/01/22	RM	RM	J.MacC
	Issued for Information			
P03	20/12/21	WC	RM	J.MacC
	Issued for Information			
P02	18/11/21	RM	RM	J.MacC
	Issued for Information			
P01	04/11/21	ROD	RM	J.MacC
	Issued for Information			

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www.arup.com

Client

CREAMFIELDS

Project Title

Creamfields Residential Development

Drawing Title

Proposed Combined Sewer Longsections

Scale at A1: As Shown

Role: Site Infrastructure

Suitability: S2 - Suitable for Information

Arup Job No: **252666-00**

Rev: **P04**

Name: **252666-ARUP-ZZ-XX-DR-C-2100**

Do not scale

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Appendix F

CCTV Drainage Survey Results

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Report

KINSALE ROAD
CORK

29/11/2021
Approved By: B.Gallahue
Job Number: Q309604-REV 1

Crowley Services (Cork) Ltd
T/A Dyno-Rod, Unit P1, Marina Commercial Park,
Centre Park Road, Cork
Tel: 021 4322 444 | Fax: 021 4322 433
info@crwly.com
www.dynorod.ie
Company Registration Number 52987

Project Information

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Client Details:

ARUP

Site Details:

KINSALE ROAD
CORK

Contractor Details:

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Office Contact Name: B.Gallahue
Office Contact Number: 00353 21500 4100

Purpose of Survey:

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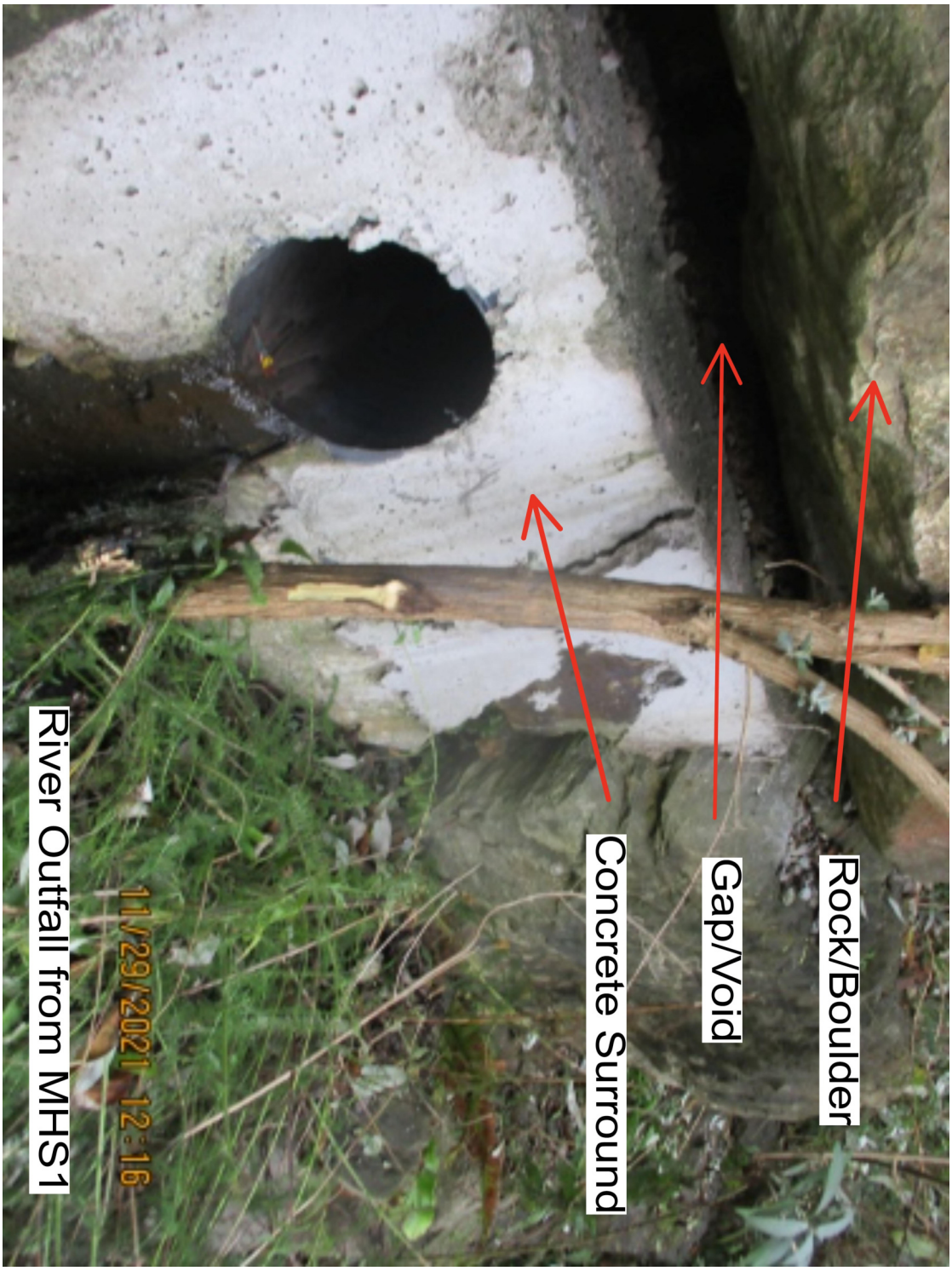
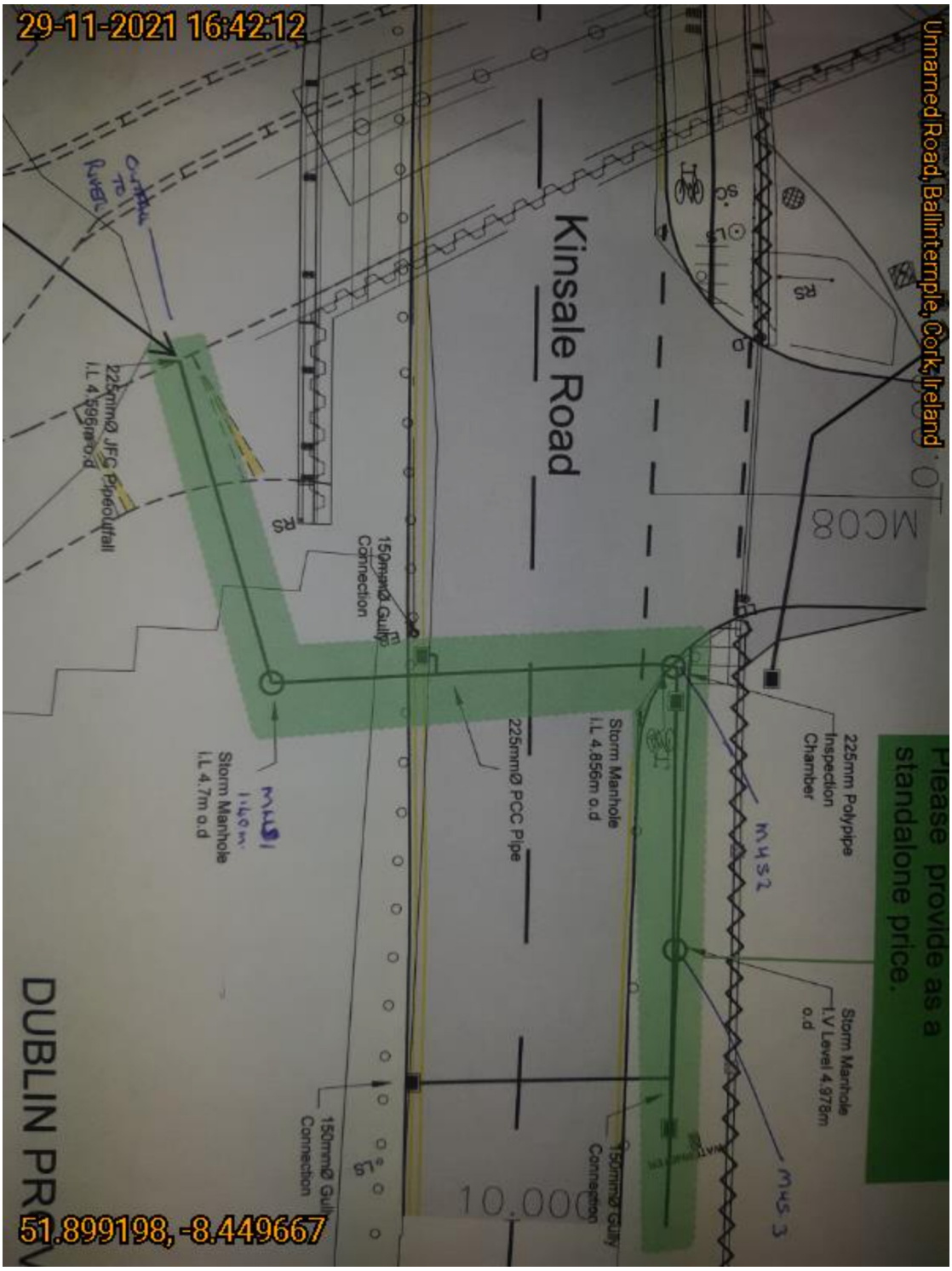
Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

This sketch is not to scale and does not represent the exact routing of the drainage system



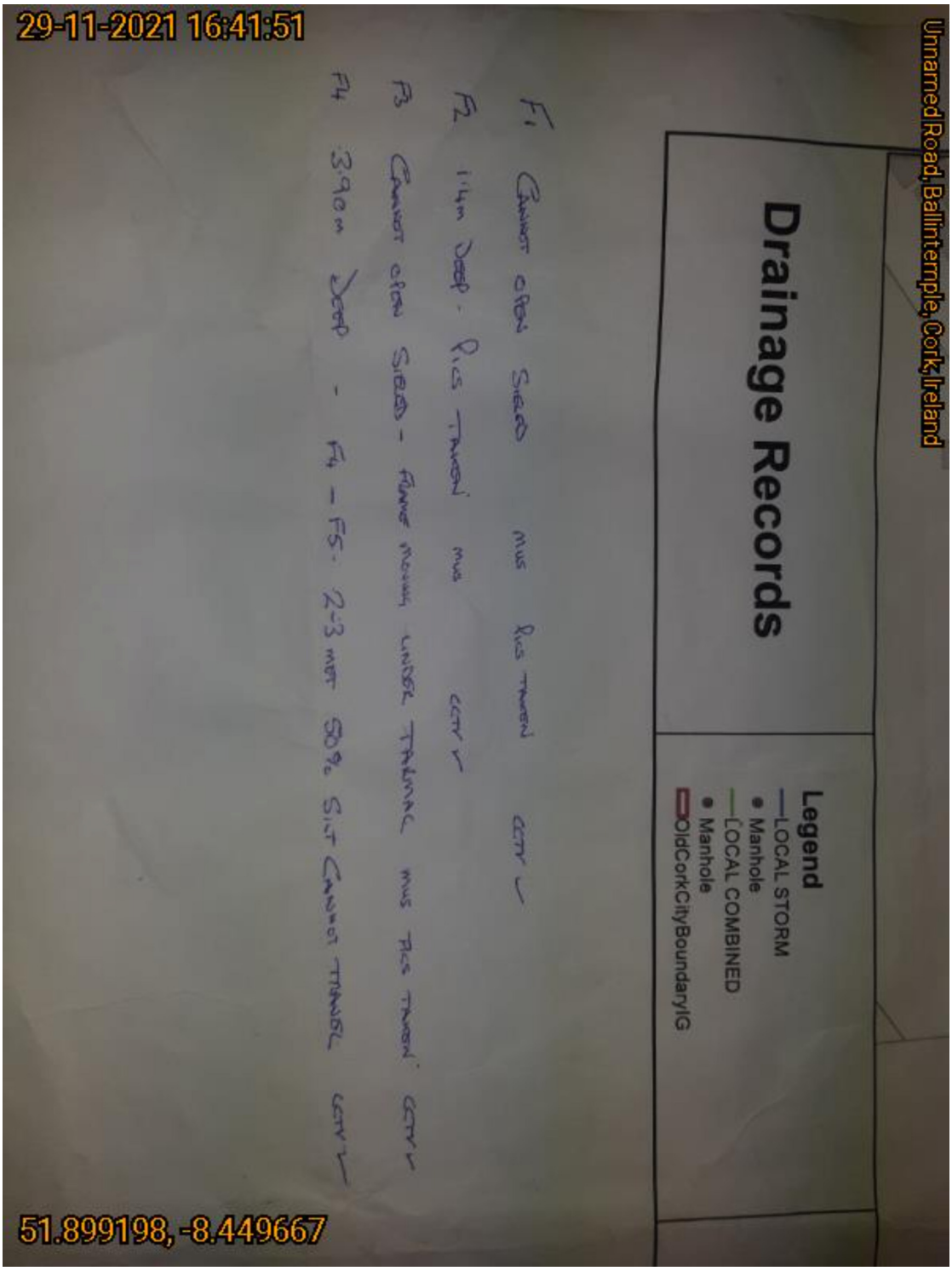
Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

This sketch is not to scale and does not represent the exact routing of the drainage system



Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

This sketch is not to scale and does not represent the exact routing of the drainage system

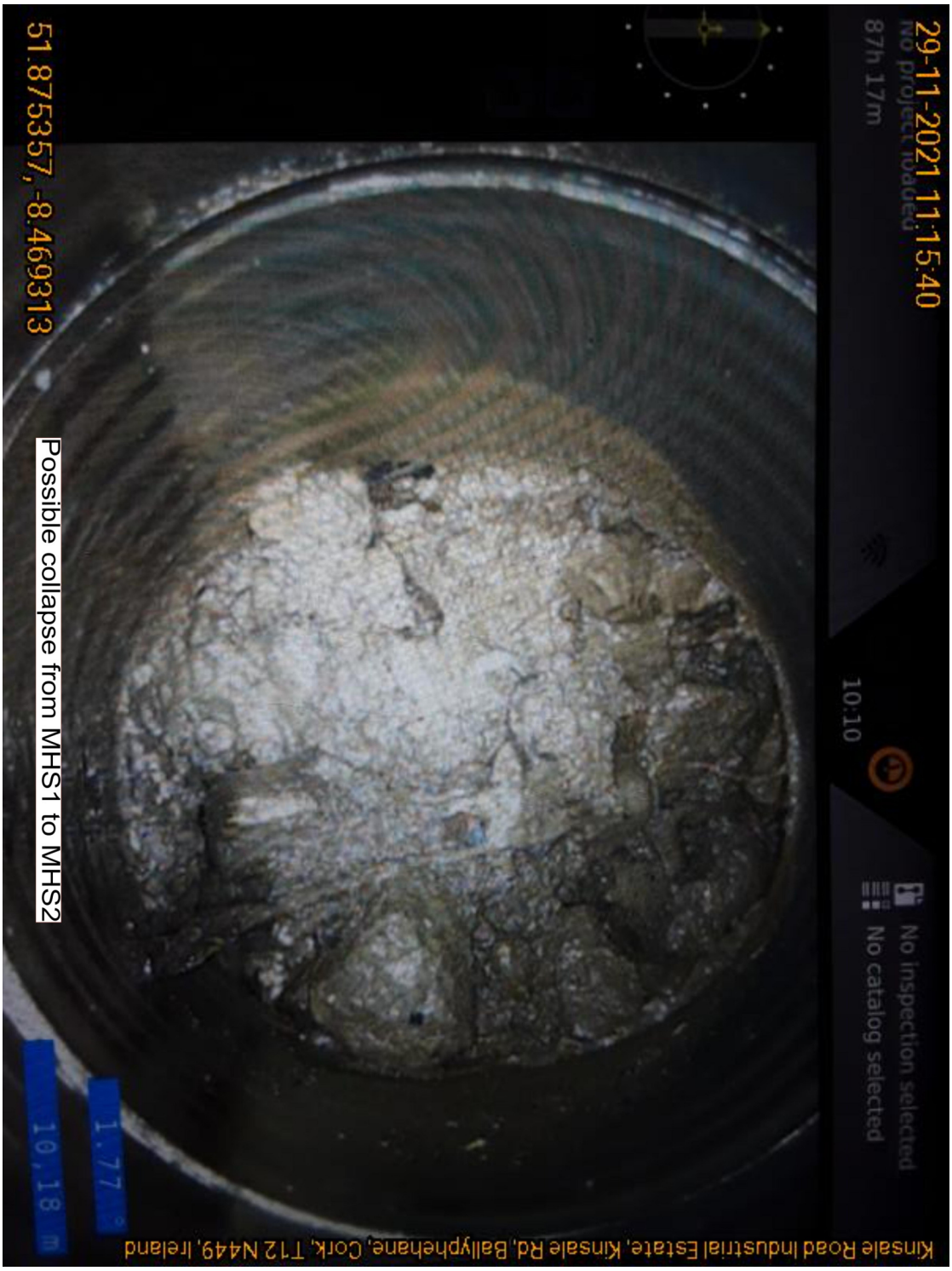


Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

This sketch is not to scale and does not represent the exact routing of the drainage system

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

This sketch is not to scale and does not represent the exact routing of the drainage system



Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Manhole / **Access Point:** MH.S1 Location - *In Dublin Providers Yard*

Manhole / **Access Point:** RIVER Location

Manhole / **Access Point:** RIVER Internal

Manhole / **Access Point:** MHF,1 Location

Manhole / **Access Point:** MHF,1 Internal - *Unable to open*

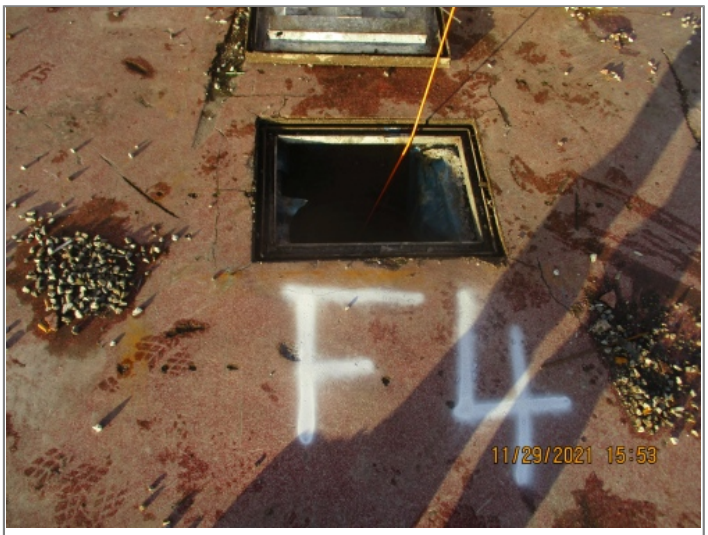
Manhole / **Access Point:** MH,F2 Location

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Manhole / **Access Point:** MH,F2 Internal

Manhole / **Access Point:** MHF,3 Location

Manhole / **Access Point:** MHF,3 Internal - *Unable to open, surface lifting with frame*



Manhole / **Access Point:** MHF,4 Location

Manhole / **Access Point:** MHF,4 Internal

Manhole / **Access Point:** MHF,4 Location

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MH,S2 X**	**29/11/2021**	**Flushed through to enable survey**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
1 - Dry		**0/0**	**45HB4JCDDY**	**1**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **STORM**
Catchment

Shape/Size **225mm**
Material **PVC**
Category

Start Node **MH.S1**
End Node **MH,S2**
Total length **10.7 metres**

Scale **1:0.52**
Direction **Upstream**

Start Node Ref:MH.S1 | I/L :mm | Depth: 1400mm

Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874781	Comment / 0
0.00	MH	Start node type, manhole, reference MH.S1	5874782	Comment / 0
0.00	WL	Water level 0% height/diameter	5874783	Comment / 0
10.70	REM	LINE LOOKS TO BE BLOCKED OFF	5874784	Comment / 0
10.70	FH	Finish survey length	5874785	Comment / 0
10.70	FH	Finish survey length	5874786	Comment / 0

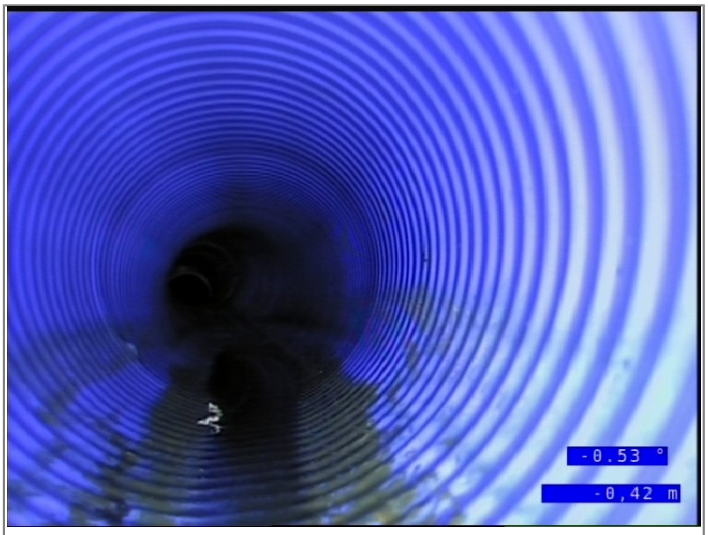
End Node Ref:MH,S2 | I/L :mm

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

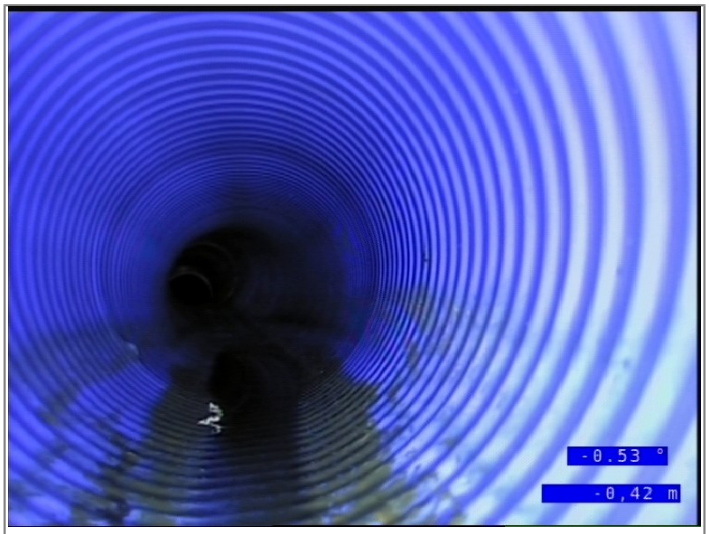
CCTV Inspection Photos

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

MH.S1 Location - In Dublin Providers Yard



Start of Survey Length



Start node type, manhole, reference MH.S1

Water level 0% height/diameter

LINE LOOKS TO BE BLOCKED OFF

Finish survey length

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Finish survey length

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MH.S1 X**	**29/11/2021**	**Flushed through to enable survey**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
1 - Dry		**0/0**	**45HB4JCDDY**	**2**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **STORM**
Catchment

Shape/Size **225mm**
Material **PVC**
Category

Start Node **MH.S1**
End Node **RIVER**
Total length **8.27 metres**

Scale **1:0.42**
Direction **Downstream**

Start Node Ref:MH.S1 | I/L :mm

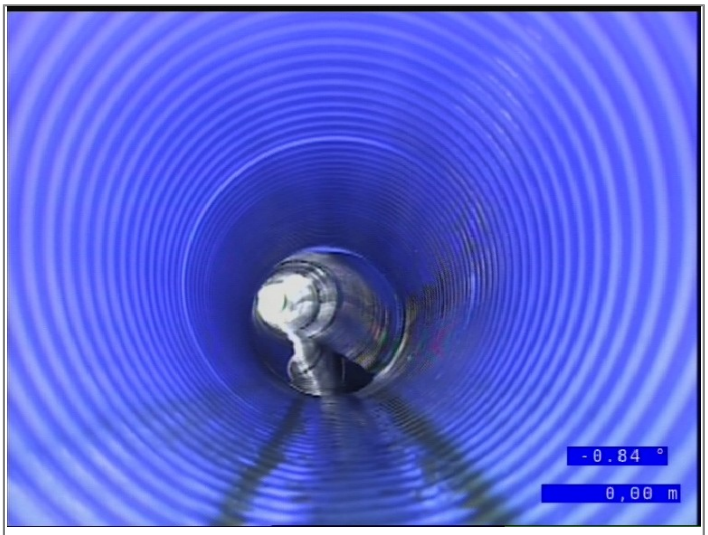
Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874787	Comment / 0
0.00	MH	Start node type, manhole, reference MH.S1	5874788	Comment / 0
0.00	WL	Water level 0% height/diameter	5874789	Comment / 0
0.27	FH	Finish survey length	5874791	Comment / 0

8.27	REM	OUT FALL TOO RIVER	5874790	Comment / 0

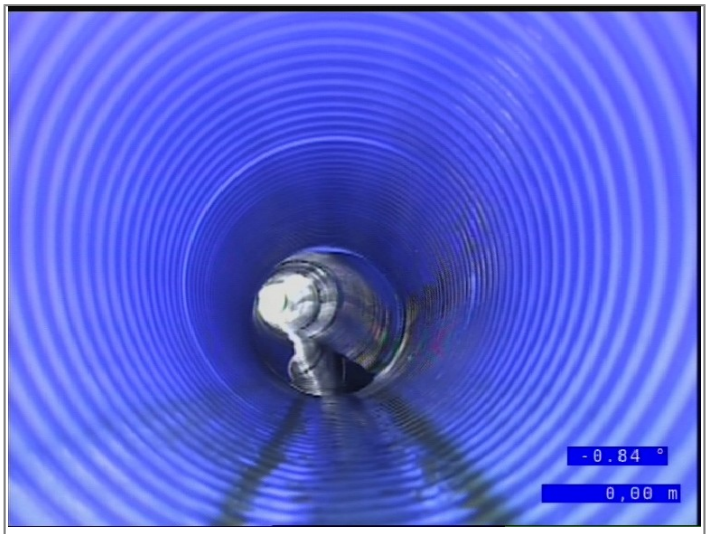
End Node Ref:RIVER | I/L :mm

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

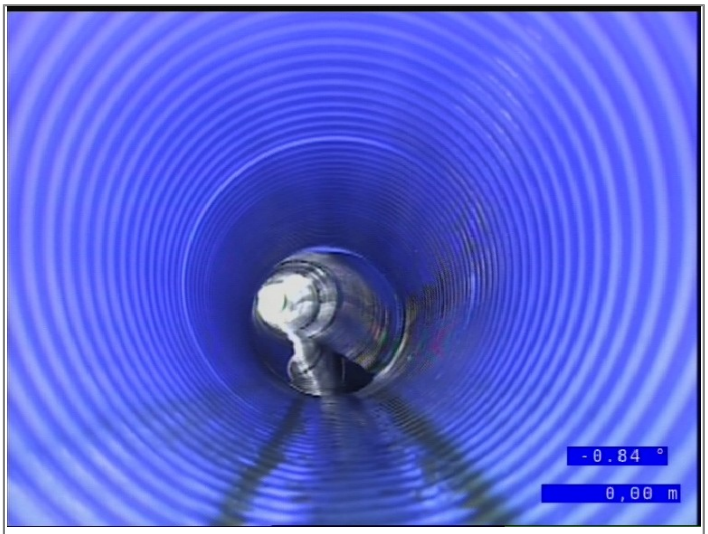
MH.S1 Location - In Dublin Providers Yard



Start of Survey Length



Start node type, manhole, reference MH.S1



Water level 0% height/diameter

Finish survey length

OUT FALL TOO RIVER

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

RIVER Internal

RIVER Location

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MHF,1 X**	**29/11/2021**	**Flushed through to enable survey**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
1 - Dry		**0/0**	**45HB4JCDDY**	**3**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **CON**
Category

Start Node **MH,F2**
End Node **MHF,1**
Total length **26.52 metres**

Scale **1:1.36**
Direction **Upstream**

Start Node Ref:MH,F2 | I/L :mm | Depth: 1400mm

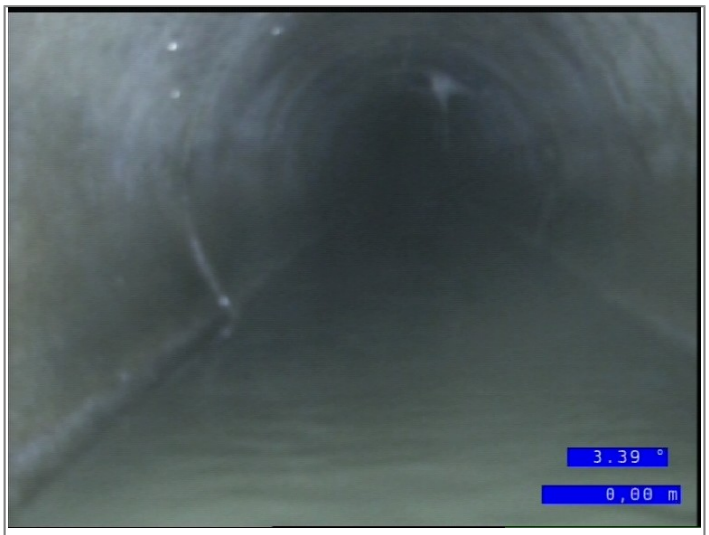
Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874792	Comment / 0
0.00	MH	Start node type, manhole, reference MH,F2	5874793	Comment / 0
0.00	WL	Water level 10% height/diameter	5874794	Comment / 0
26.52	REM	MHF,1	5874795	Comment / 0
26.52	FH	Finish survey length	5874796	Comment / 0

End Node Ref:MHF,1 | I/L :mm

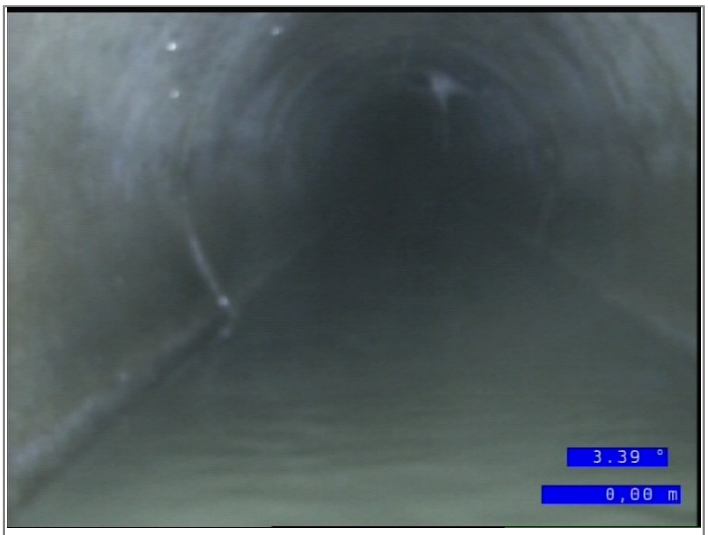
Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

MH,F2 Location

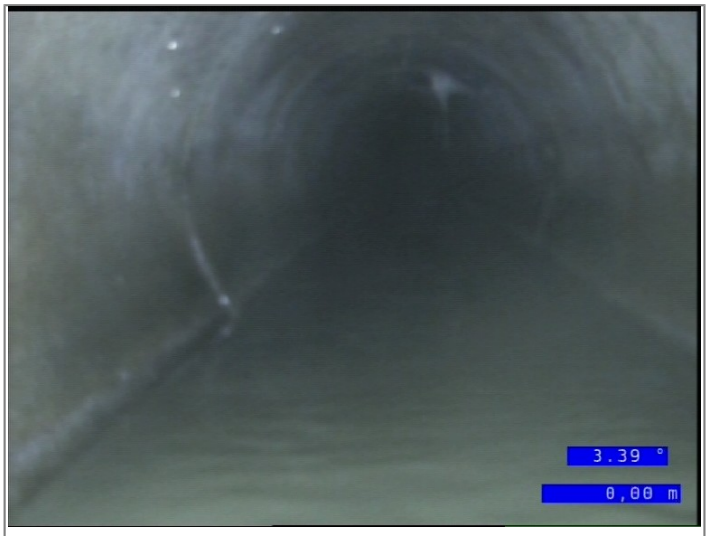
MH,F2 Internal



Start of Survey Length



Start node type, manhole, reference MH,F2



Water level 10% height/diameter

MHF,1

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Finish survey length

MHF,1 Internal - Unable to open

MHF,1 Location

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MH,F2 X**	**29/11/2021**	**Not Cleaned**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
1 - Dry		**0/0**	**45HB4JCDDY**	**4**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **CON**
Category

Start Node **MH,F2**
End Node **MHF,3**
Total length **24.78 metres**

Scale **1:1.26**
Direction **Downstream**

Start Node Ref:MH,F2 | I/L :mm | Depth: 1400mm

Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874800	Comment / 0
0.00	MH	Start node type, manhole, reference MH,F2	5874801	Comment / 0
0.00	WL	Water level 5% height/diameter	5874802	Comment / 0
4.26	CN	Connection at 9 o'clock, diameter 150mm	5874803	Comment / 0
24.78	REM	MHF,3	5874804	Comment / 0
24.78	FH	Finish survey length	5874805	Comment / 0

End Node Ref:MHF,3 | I/L :mm

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Photos

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

MH,F2 Location

MH,F2 Internal

Start of Survey Length

Start node type, manhole, reference MH,F2

Water level 5% height/diameter

Connection at 9 o'clock, diameter 150mm

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

MHF,3

Finish survey length

MHF,3 Internal - Unable to open, surface lifting with frame

MHF,3 Location

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MHF,3 X**	**29/11/2021**	**Not Cleaned**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
1 - Dry		**0/0**	**45HB4JCDDY**	**5**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **CON**
Category

Start Node **MHF,4**
End Node **MHF,3**
Total length **84.08 metres**

Scale **1:4.41**
Direction **Upstream**

Start Node Ref:MHF,4 | I/L :mm | Depth: 3900mm

Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874806	Comment / 0
0.00	MH	Start node type, manhole, reference MHF,4	5874807	Comment / 0
0.00	WL	Water level 10% height/diameter	5874808	Comment / 0
84.08	REM	MHF.3	5874809	Comment / 0
84.08	FH	Finish survey length	5874810	Comment / 0

End Node Ref:MHF,3 | I/L :mm

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

MHF,4 Location

MHF,4 Location

MHF,4 Internal

Start of Survey Length

Start node type, manhole, reference MHF,4

Water level 10% height/diameter

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

MHF.3

Finish survey length

MHF,3 Internal - Unable to open, surface lifting with frame

MHF,3 Location

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MHF,4 X**	**29/11/2021**	**Not Cleaned**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
1 - Dry		**4/0**	**45HB4JCDDY**	**6**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **CON**
Category

Start Node **MHF,4**
End Node **MHF,5**
Total length **2.22 metres**

Scale **1:0.10**
Direction **Downstream**

Start Node Ref:MHF,4 | I/L :mm | Depth: 3900mm

Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874811	Comment / 0
0.00	MH	Start node type, manhole, reference MHF,4	5874812	Comment / 0
0.00	WL	Water level 20% height/diameter	5874813	Comment / 0
2.22	REM	CAN NOT DRIVE IN SILT	5874814	Comment / 0
2.22	DES	Debris Silt 50% cross sectional area loss	5874815	Service / 4
2.22	FH	Finish survey length	5874816	Comment / 0

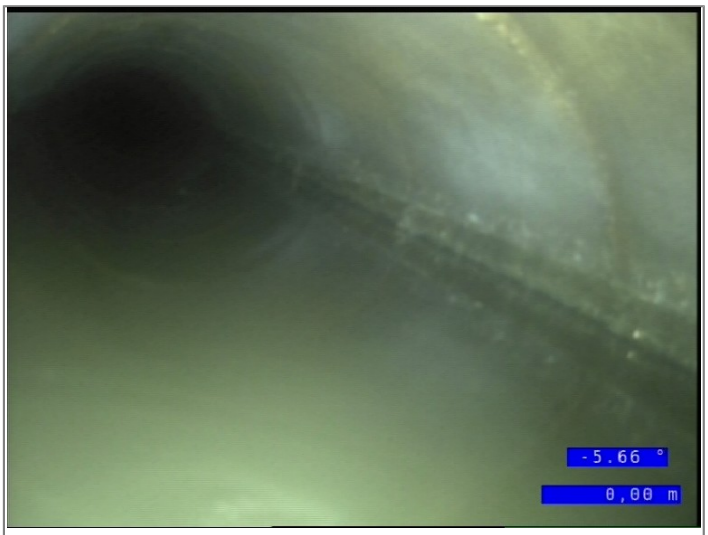
End Node Ref:MHF,5 | I/L :mm

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

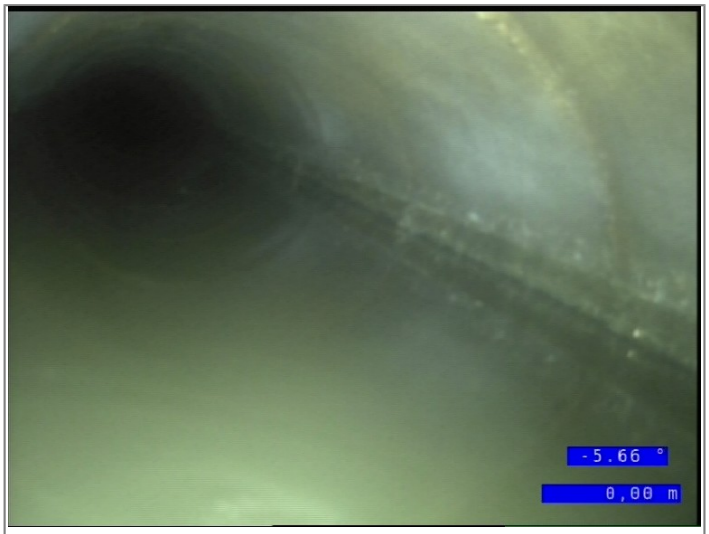
MHF,4 Location

MHF,4 Location

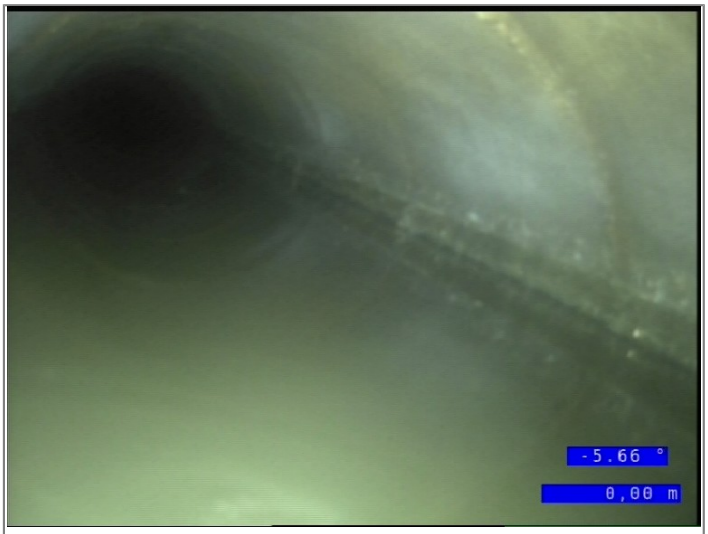
MHF,4 Internal



Start of Survey Length



Start node type, manhole, reference MHF,4



Water level 20% height/diameter

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

CAN NOT DRIVE IN SILT

Debris Silt 50% cross sectional area loss

Finish survey length

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MHF.4 X**	**16/12/2021**	**Flushed through to enable survey**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
4 - Showers		**0/0**	**45HB4JCDDY**	**7**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **Concrete**
Category

Start Node **MHF.4**
End Node **MHF.5**
Total length **0 metres**

Scale **1:0.00**
Direction **Downstream**

Start Node Ref:MHF.4 | I/L : metres

Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874817	Comment / 0
0.00	MH	Start node type, manhole, reference MHF.4	5874818	Comment / 0
0.00	WL	Water level 40% height/diameter	5874819	Comment / 0

End Node Ref:MHF.5 | I/L : metres

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**16/12/2021**

Start of Survey Length

Start node type, manhole, reference MHF.4

Water level 40% height/diameter

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MHF.4 X**	**16/12/2021**	**Flushed through to enable survey**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
4 - Showers		**0/2**	**45HB4JCDDY**	**8**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **Concrete**
Category

Start Node **MHF.4**
End Node **MHF.5**
Total length **1.2 metres**

Scale **1:0.05**
Direction **Downstream**

Start Node Ref:MHF.4 | I/L : metres

Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874820	Comment / 0
0.00	MH	Start node type, manhole, reference MHF.4	5874821	Comment / 0
0.00	WL	Water level 40% height/diameter	5874822	Comment / 0
0.32	CL	Crack longitudinal at 12 o'clock	5874823	Structural / 2
0.50	GO	General observation at this point - Remark: Obstruction in pipe 3 meters D/S Possible concrete block	5874824	Comment / 0
0.50	SA	Survey abandoned - Remark: Camera unable to travel	5874825	Comment / 0
0.50	FH	Finish survey length	5874826	Comment / 0

End Node Ref:MHF.5 | I/L : metres

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Photos

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Unit P1, Marina Commercial Park
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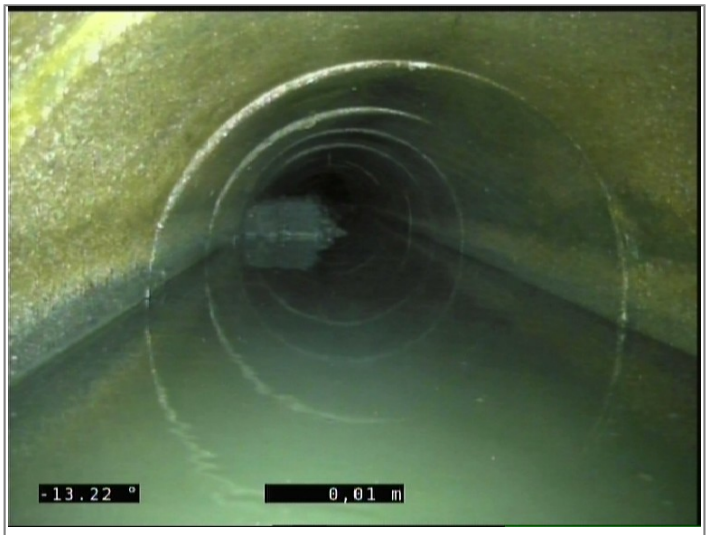
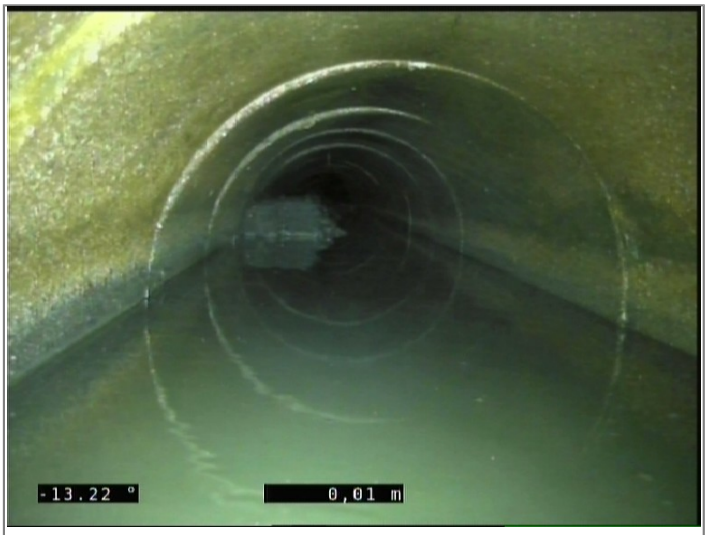
Cork City
County Cork
EIRE
Ireland

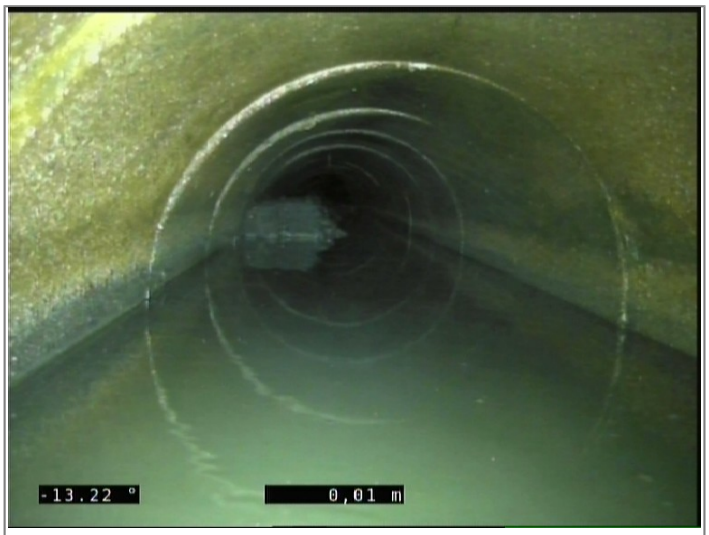
Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**16/12/2021**



Start of Survey Length



Start node type, manhole, reference MHF.4



Water level 40% height/diameter

Crack longitudinal at 12 o'clock

General observation at this point - Remark: Obstruction in pipe 3 meters D/S Possible concrete block

Survey abandoned - Remark: Camera unable to travel

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**16/12/2021**

Finish survey length

DYNO-ROD
Drain Cleaning, Inspection & Repair

CCTV Inspection Report

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Surveyed by (Operator)	Job Number	Pipe Length Reference(PLR)	Date	Pre Cleaned
J O BRIEN	**Q309604-REV 1**	**MHF.4 X**	**16/12/2021**	**Flushed through to enable survey**
Weather	Customer Present	Service Grade/Structural Grade	Base Unit	Section Number
4 - Showers		**0/2**	**45HB4JCDDY**	**9**

Road **KINSALE ROAD**
Place **CORK**
Location

Division
District
Location Details

Purpose
Duty **Foul**
Catchment

Shape/Size **600mm**
Material **Concrete**
Category

Start Node **MHF.4**
End Node **MHF.5**
Total length **1.19 metres**

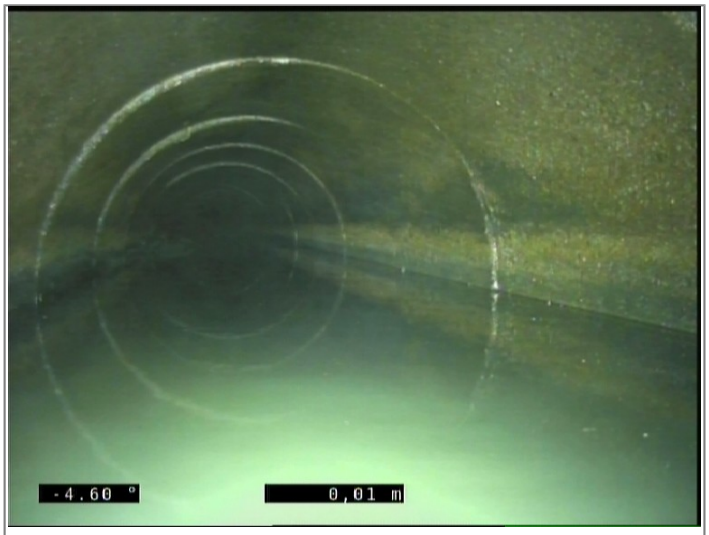
Scale **1:0.05**
Direction **Downstream**

Start Node Ref:MHF.4 | I/L : metres

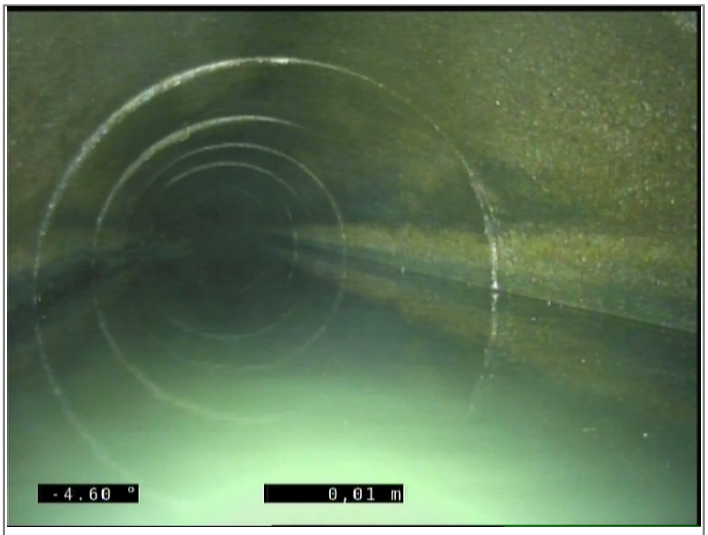
Position	Code	Description	Photo	Type/Grade
0.00	ST	Start of Survey Length	5874827	Comment / 0
0.00	MH	Start node type, manhole, reference MHF.4	5874828	Comment / 0
0.00	WL	Water level 40% height/diameter	5874829	Comment / 0
0.01	CL	Crack longitudinal at 12 o'clock	5874830	Structural / 2
1.14	SA	Survey abandoned - Remark: CAMERA WILL NOT TRAVEL...SILT DEBRIS IN DRAIN.	5874831	Comment / 0
1.19	CLJ	Crack longitudinal at 11 o'clock at joint	5874832	Structural / 2

End Node Ref:MHF.5 | I/L : metres

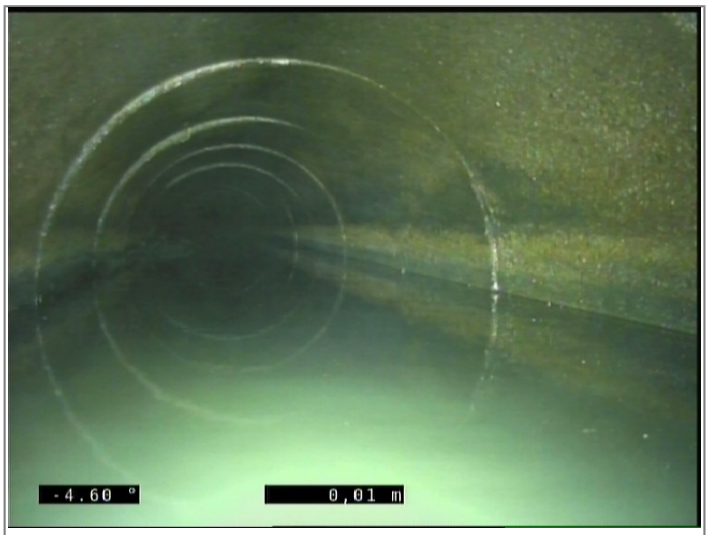
Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**16/12/2021**



Start of Survey Length



Start node type, manhole, reference MHF.4



Water level 40% height/diameter

Crack longitudinal at 12 o'clock

Survey abandoned - Remark: CAMERA WILL NOT TRAVEL...SILT DEBRIS IN DRAIN.

Crack longitudinal at 11 o'clock at joint

DYNO-ROD
Drain Cleaning, Inspection & Repair

Report Summary

Dyno Rod Cork
Unit P1, Marina Commercial Park
Centre Park Road
Cork City
County Cork
EIRE
Ireland

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Job Information

Total Distance Surveyed: **158.96 metres**
Engineer: **J O BRIEN**
Number of Surveys: **9**
Number of Surveys grade 4 or above: **0**

Section 1 Overview (29/11/2021)

Manholes: **MH.S1 to MH,S2**
Pipe Length: **10.7 metres**
Structural Grade: **0**
Service Grade: **0**
Material: **PVC**
Pipe Size: **225mm**
Use: **STORM**

Section 2 Overview (29/11/2021)

Manholes: **MH.S1 to RIVER**
Pipe Length: **8.27 metres**
Structural Grade: **0**
Service Grade: **0**
Material: **PVC**
Pipe Size: **225mm**
Use: **STORM**

Section 3 Overview (29/11/2021)

Manholes: **MH,F2 to MHF,1**
Pipe Length: **26.52 metres**
Structural Grade: **0**
Service Grade: **0**
Material: **CON**
Pipe Size: **600mm**
Use: **Foul**

Section 4 Overview (29/11/2021)

Manholes: **MH,F2 to MHF,3**
Pipe Length: **24.78 metres**
Structural Grade: **0**
Service Grade: **0**
Material: **CON**
Pipe Size: **600mm**
Use: **Foul**

Section 5 Overview (29/11/2021)

Manholes: **MHF,4 to MHF,3**
Pipe Length: **84.08 metres**
Structural Grade: **0**
Service Grade: **0**
Material: **CON**
Pipe Size: **600mm**
Use: **Foul**

Job Number	Surveyed by (Operator)	Base Unit	Date
Q309604-REV 1	**J O BRIEN**	**45HB4JCDDY**	**29/11/2021**

Section 6 Overview (29/11/2021)

Manholes: **MHF,4 to MHF,5**
Pipe Length: **2.22 metres**
Structural Grade: **0**
Service Grade: **4**
Material: **CON**
Pipe Size: **600mm**
Use: **Foul**

Section 7 Overview (16/12/2021)

Manholes: **MHF.4 to MHF.5**
Pipe Length: **0 metres**
Structural Grade: **0**
Service Grade: **0**
Material: **Concrete**
Pipe Size: **600mm**
Use: **Foul**

50% SILT + DEBRIS IN DRAIN CAMERA WILL NOT TRAVEL. LINE WILL NEED TO BE HIGH JETTED AND DEBRIS + SILT REMOVED FROM DRAIN TO CARRY ON THE SURVEY.

Section 8 Overview (16/12/2021)

Manholes: **MHF.4 to MHF.5**
Pipe Length: **1.2 metres**
Structural Grade: **2**
Service Grade: **0**
Material: **Concrete**
Pipe Size: **600mm**
Use: **Foul**

Section 9 Overview (16/12/2021)

Manholes: **MHF.4 to MHF.5**
Pipe Length: **1.19 metres**
Structural Grade: **2**
Service Grade: **0**
Material: **Concrete**
Pipe Size: **600mm**
Use: **Foul**

Appendix G

Foul Water Pumping Station Information

FLYGT
a xylem brand

Flygt Concertor™

THE WORLD'S FIRST WASTEWATER PUMPING SYSTEM WITH INTEGRATED INTELLIGENCE

xylem
Let's Solve Water

A new level of thinking to solve modern wastewater challenges

Are you prepared to meet the future challenges of the wastewater industry? Like never before, aging infrastructure, global urbanization, increasing energy costs and the need for sustainable solutions are making cost reduction an urgent priority for all. Just imagine that by 2050, an estimated 70% of all the world's population will be living in cities – an urban wastewater challenge on a scale we've never seen before.

The solution to all these challenges is not more components and complexity but intelligent, flexible and leaner solutions. This is why, for decades, we've been dedicated to developing sophisticated wastewater pumping solutions that substantially boost your efficiency while dramatically reducing your total equipment footprint and cost of ownership. It's a complex challenge that only the most innovative and integrated designs can solve.

Innovation and integration – it's part of Xylem's DNA

For more than 60 years, Xylem's Flygt brand has continuously raised industry standards for compact, trouble-free pumping. Ever since introducing the world's first submersible pumps, the focus has been on integrating technologies to reduce complexity and costs. The breakthroughs that have emerged along the way have been a huge benefit to wastewater pumping stations all over the world.

Our commitment to deliver peace of mind

At the end of the day, your peace of mind is the true measure of our success. And we remain as determined as ever to raise your expectations for smarter, more reliable and user-friendly pumping systems. Our new wastewater pumping system with integrated intelligence takes these expectations to the next level. A new level of technology, and a new level of thinking.

Sixty years of innovative, integrated techologies

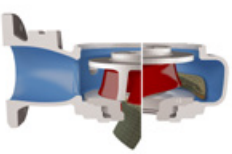
1947
First submersible dewatering pump prototype – the "Parrot Cage"– was designed.

1997
Introduction of the first N-pump with a unique self-cleaning impeller.

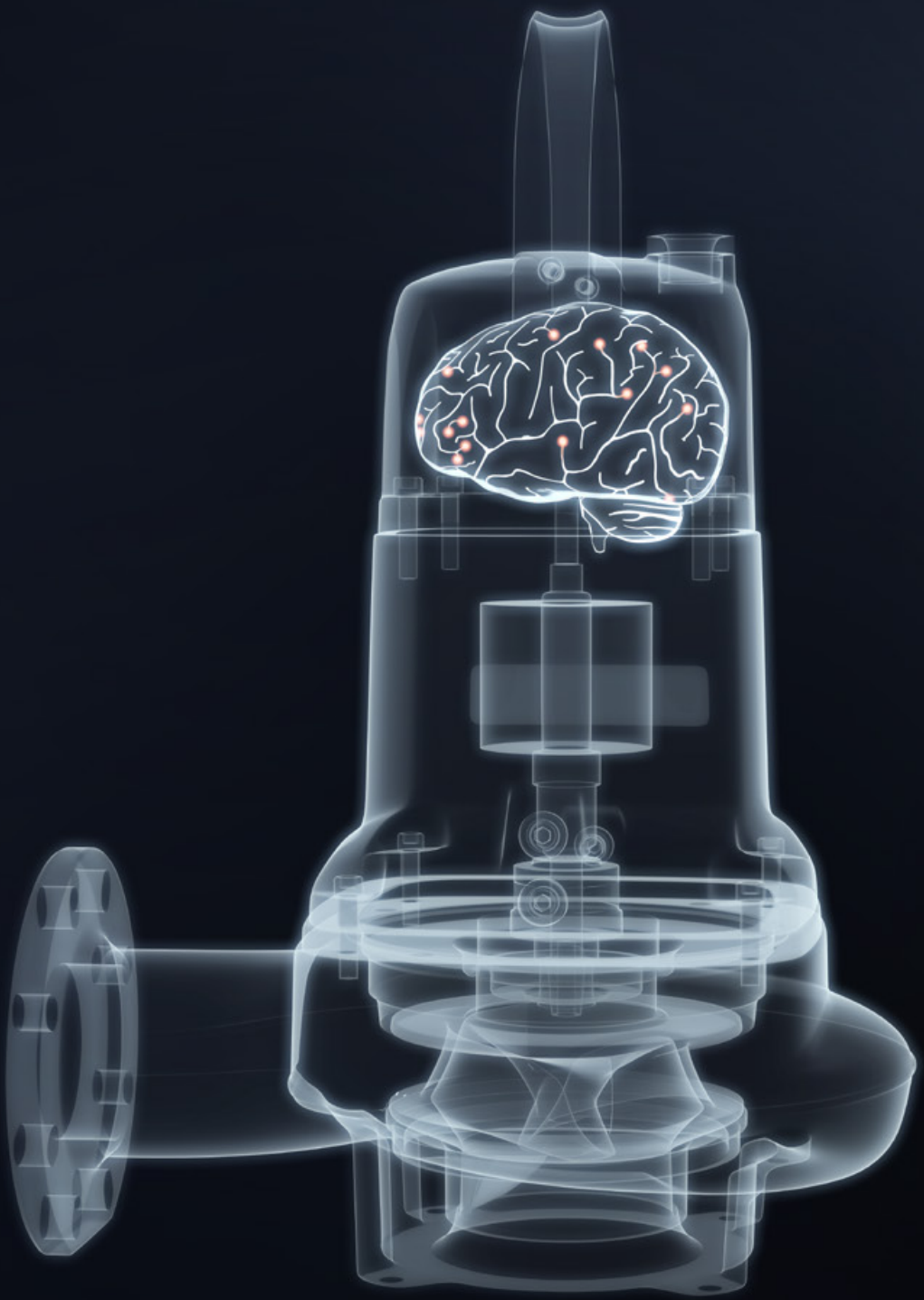
2011
Flygt *SmartRun®, a new intelligent pre-programmed pump control system for water pump station, is launched.*

1901 ——— ***2016*** →

1956
Creation of the C-pump: the first-ever submersible wastewater pump, which vastly reduced the space required for modern pumping stations.



2009
Launch of the Adaptive N-Pump impeller, which moves upwards to allow larger objects and debris to pass through.



Flygt Concertor™ A new level of technology with unlimited possibilities

Xylem is proud to introduce the world's first wastewater pumping system with integrated intelligence. A real breakthrough innovation, Flygt Concertor™ is capable of sensing the operating conditions of its environment, adapting its performance in real time and providing feedback to pumping station operators. With this new system, Xylem is now bringing smart and interconnected solutions to the world of wastewater pumping.

The name Concertor is based on the Latin word "concentare", which means working together to orchestrate harmony. It relates to the system's unique synergy between software functions and state-of-the-art hardware and the remarkable benefits this innovation can bring to our customers around the world.

A new way of thinking
Concertor combines a fully integrated control system with IE4 motor efficiency, our patented Adaptive N-hydraulics and intelligent functionalities. The control system automatically adapts to the changing pumping environment, delivering the optimal level of performance at the lowest cost of ownership. The built-in intelligence also makes it easier to set up and operate, as well as allowing for a significantly smaller footprint.

One powerful solution, unlimited possibilities.
Concertor's advanced technology gives you a wide range of benefits covering four main categories. The whole idea is to give you greater peace of mind while reducing your total costs.

EFFICIENT ASSET MANAGEMENT	TROUBLE-FREE PUMPING	ENERGY SAVINGS	REDUCED TOTAL INVESTMENT
– Selection from a performance field instead of a fixed performance curve allows for enhanced operational flexibility. – Adaptive technology automatically selects the duty points to optimize performance. – Performance can be fine-tuned on site without changing the impeller.	– Built-in sump and pipe cleaning reduces odor and maintenance. – Clog detection and pump cleaning functions ensure clog-free operation. – Built-in self-monitoring functionality prevents overheating and extends pump lifetime. – Automatic rotation settings prevent incorrect impeller rotation.	– Patented Energy Minimizer automatically optimizes performance to reduce energy costs. – Adaptive N-technology delivers sustained efficiency. – Super premium IE4 motor efficiency.	– Pre-engineered solution with simple set-up wizard saves engineering time and makes start-up quick and easy. – A smaller, simplified cabinet frees up space and reduces cost.

EFFICIENT ASSET MANAGEMENT

From complex selection . . .

Flygt Concertor™ offers a pump performance field covering a wide range of pump curves. No need for the perfect station design data. No need for a large inventory. One pump self-adjusts or can be adjusted to fit changing conditions – without having to change impeller diameters or motor sizes.

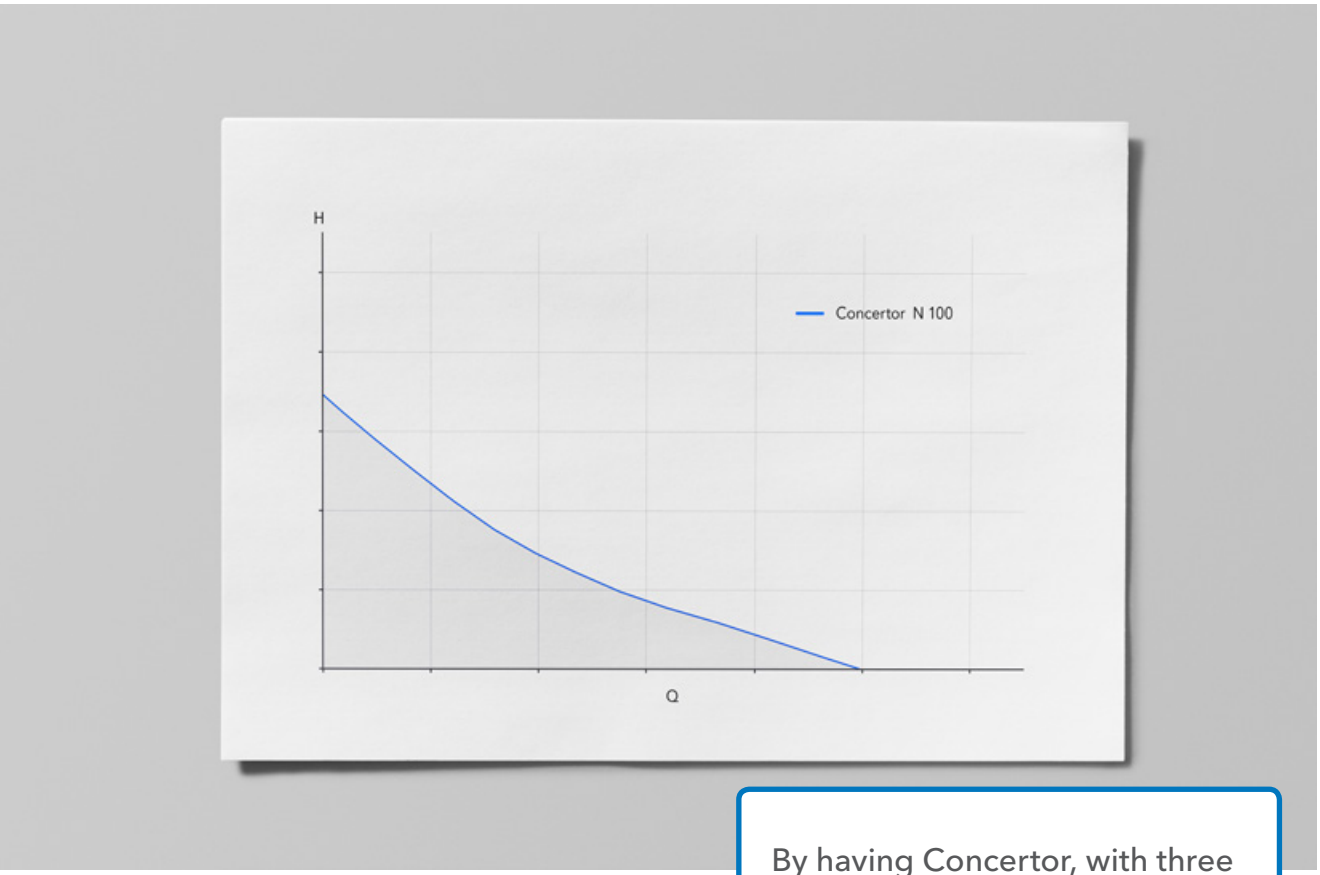
As wastewater volumes increase, it is often necessary to upgrade the pump and control equipment to manage the additional flow rates. Even an experienced professional may have difficulty in selecting just the right performance curves due to uncertain conditions. Concertor simplifies product selections and at the same time reduces your inventory.

INVENTORY CAN BE REDUCED BY UP TO

80%

DUE TO **CONCERTOR'S FLEXIBLE PERFORMANCE**

to an easy decision with one flexible solution



By having Concertor, with three outlet dimensions, we could drastically reduce our inventory.

Anders Sjöstrand, Lomma Municipality, Sweden

Self-optimizing performance
Unlike the fixed performance curves of conventional pumps, Concertor offers an entire performance field from which to choose the right operating point. Not only does this make selection extremely simple, but operating performance can easily be changed and fine-tuned on site or remotely, as required.

Reduced backup inventory
Since the system covers a broad performance field and adapts automatically to different duty points, your pump inventory can be significantly reduced. This also simplifies the process when searching for a spare or emergency pump.

EFFICIENT ASSET MANAGEMENT

- Easier product selection
- Adjustable performance curves
- Fine-tune remotely or on site
- Reduced backup inventory
- Easier spare part handling
- Reduced delivery lead times

From dirty troublemaker . . .

Cleaning out sludge, sand, grease and other debris from a sump tank can be an unpleasant and costly task. While Flygt pumps are equipped with the latest technology to solve these challenges, Flygt Concertor™ takes trouble-free pumping to an entirely new level.

This big improvement is enabled by a unique combination of technology and intelligent functionalities to keep your wet well clean and your pump clog-free at all times.

Cleaner wet wells and clog-free pumping
To reduce sedimentation, odor build-up and unplanned call-outs, we've added built-in sump and pipe cleaning functions in a single integrated wastewater pumping system

CLOG-FREE PUMPING OPERATION AND CLEAN WET WELLS SAVE UP TO

80%

ON VACUUM **CLEANING COSTS**

to clean wet wells at all times

We used to call the vacuum truck once a month to manually remove sediment and grease. That is now a thing of the past. With Concertor, we have saved both money and time.

R. Ramesh, Sultan Qaboos University, Oman

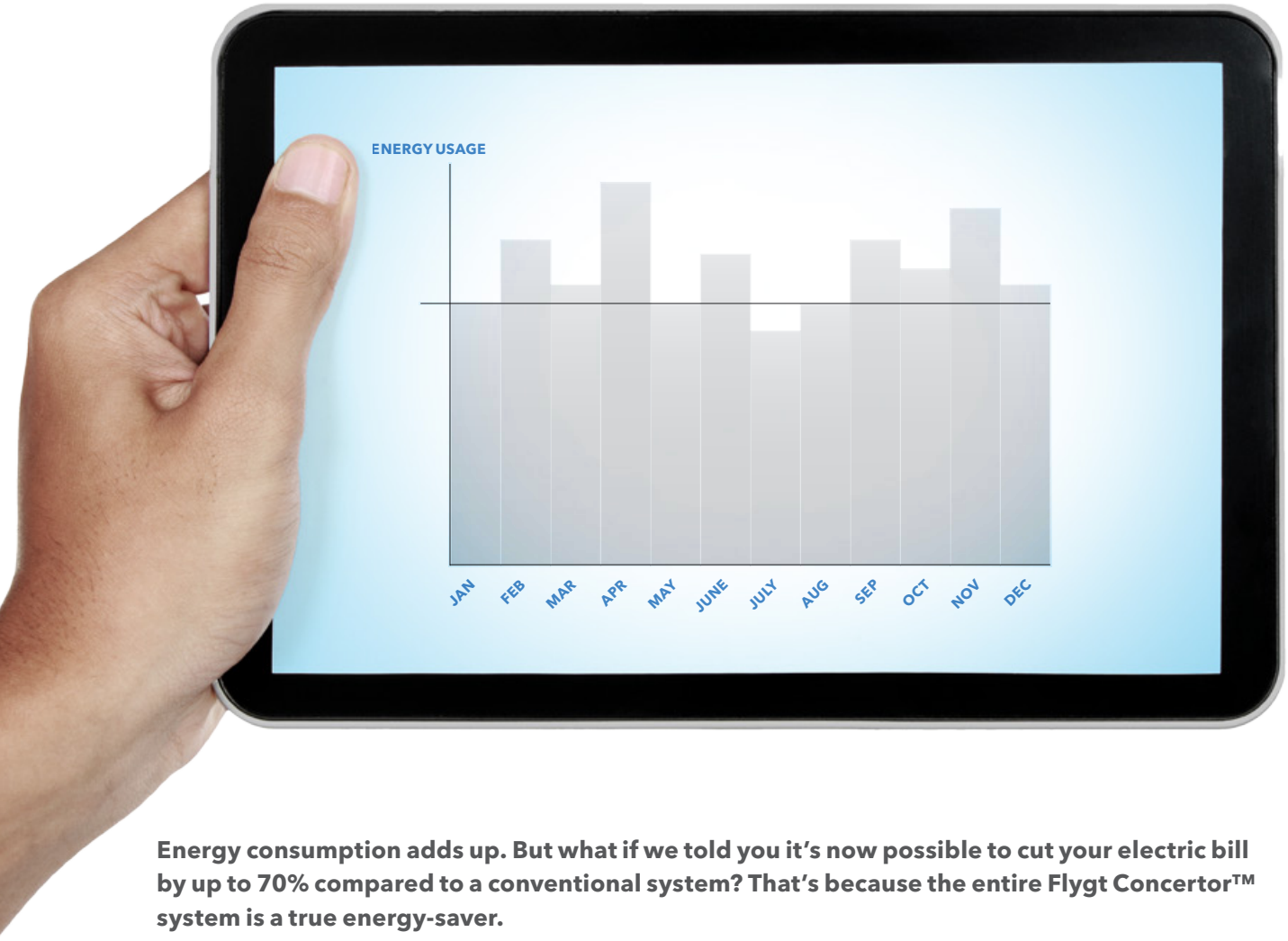
for the first time ever. Extensive trials show that this dramatically minimizes unplanned and costly maintenance. An integrated pump cleaning function, together with our patented Adaptive N-technology, detects and resolves clogging from large debris.

Increased reliability and product life cycle time
The pump provides self-monitoring functionality that will prevent overheating and motor failures due to external conditions. The innovative motor technology and Energy Minimizer increase the lifetime of the motors, seals and bearings. Finally, and very significantly, the control system inside the pump is placed in a stable environment, which protects it from unfavorable external conditions.

TROUBLE-FREE PUMPING

- Built-in sump and pipe cleaning
- Integrated pump cleaning function
- Self-cleaning hydraulics
- Self-monitoring functionality
- Self-tuning to preserve key components
- Electronics placed in stable submerged environment

From thirsty consumer . . .



Energy consumption adds up. But what if we told you it's now possible to cut your electric bill by up to 70% compared to a conventional system? That's because the entire Flygt Concertor™ system is a true energy-saver.

Equipped with a seamless combination of new software and next-generation hardware, Concertor is designed for automatic self-optimization to assure the lowest possible energy consumption. This is largely due to our patented Energy Minimizer function, which automatically ensures that all the pumps in your stations

ENERGY SAVINGS OF UP TO

70%

COMPARED TO **CONVENTIONAL PUMPING** SYSTEMS

to smart energy saver

We've not only improved our overall pumping performance, but also reduced our energy bill by 53% at one of our pumping stations.

Ian Jolly, Heathrow Airport Water Services Department, UK

are running at their most efficient duty points, at all times.

Energy savings is about more than just sophisticated built-in software. Unparalleled pumping efficiency is also enabled by state-of-the-art components such as our new Super Premium IE4 Efficiency motor and new mechanical self-cleaning Adaptive N-hydraulics. And since there is no need for ventilation, cooling or heating of cabinets, you get substantial savings over the total lifecycle.

ENERGY SAVINGS

- Automatic self-optimizing Energy Minimizer
- State-of-the-art components
- Premium Efficiency IE4 motor
- Adaptive N-hydraulics
- Climate control savings

REDUCED TOTAL INVESTMENT

From bulky equipment . . .

Advanced functionality is desirable, but it often requires additional components, custom engineering and large cabinets. Flygt Concertor™ solves this by integrating everything into one single system with a smaller footprint and even more attractive features.

Concertor's system design results in compact control cabinets since traditional components, such as motor protection, variable frequency drives (VFDs) and climate control equipment, are no longer fitted in the cabinet. They are either eliminated or built into the pump. The pump's integrated intelligence reduces the size of the cabinet while also enabling more monitoring functionalities.

CONCERTOR CAN **REDUCE THE SIZE** OF CABINETS UP TO

50%

COMPARED TO **CONVENTIONAL** CABINETS

to slim and smart controls

> The compact design allowed us to fit it into the existing position within the pump station, without any extra investment.
>
> Ian Jolly, Heathrow Airport Water Services Department, UK

Simple set-up for advanced systems
All monitoring and control functions are pre-engineered, configured and tested as a total solution – straight from the factory – giving you peace of mind from a single supplier. Installation and commissioning are also swift and stress-free thanks to a helpful set-up wizard and the straightforward cabinet design. All of this reduces the need for engineering hours, both at the design stage and at the time of pump station commissioning. In short, you reduce your total investment costs.

REDUCED TOTAL INVESTMENT

- Pre-engineered as total solution
- Factory configured and tested
- Smaller and simplified cabinet design
- User-friendly installation wizard
- Built-in supervision and monitoring functions
- No need for climate control equipment

How the Flygt Concertor™ integrated intelligence works

Concertor is a breakthrough innovation based on Flygt Dirigo™ technology. This new system is enabled by integrating a processor, software, sensors, power electronics, a synchronous electric motor and self-cleaning hydraulics into a submersible shell. The term "intelligent" refers to the system's ability to automatically deliver optimal pumping performance while reducing the total cost of ownership.

Concertor is capable of sensing the environment it is operating in as well as the load it is subjected to, adjusting its performance in real time to meet your optimization targets. By collecting and analyzing relevant data, the pump system can make smart decisions about how it operates and what relevant feedback to give you.

New Dirigo platform

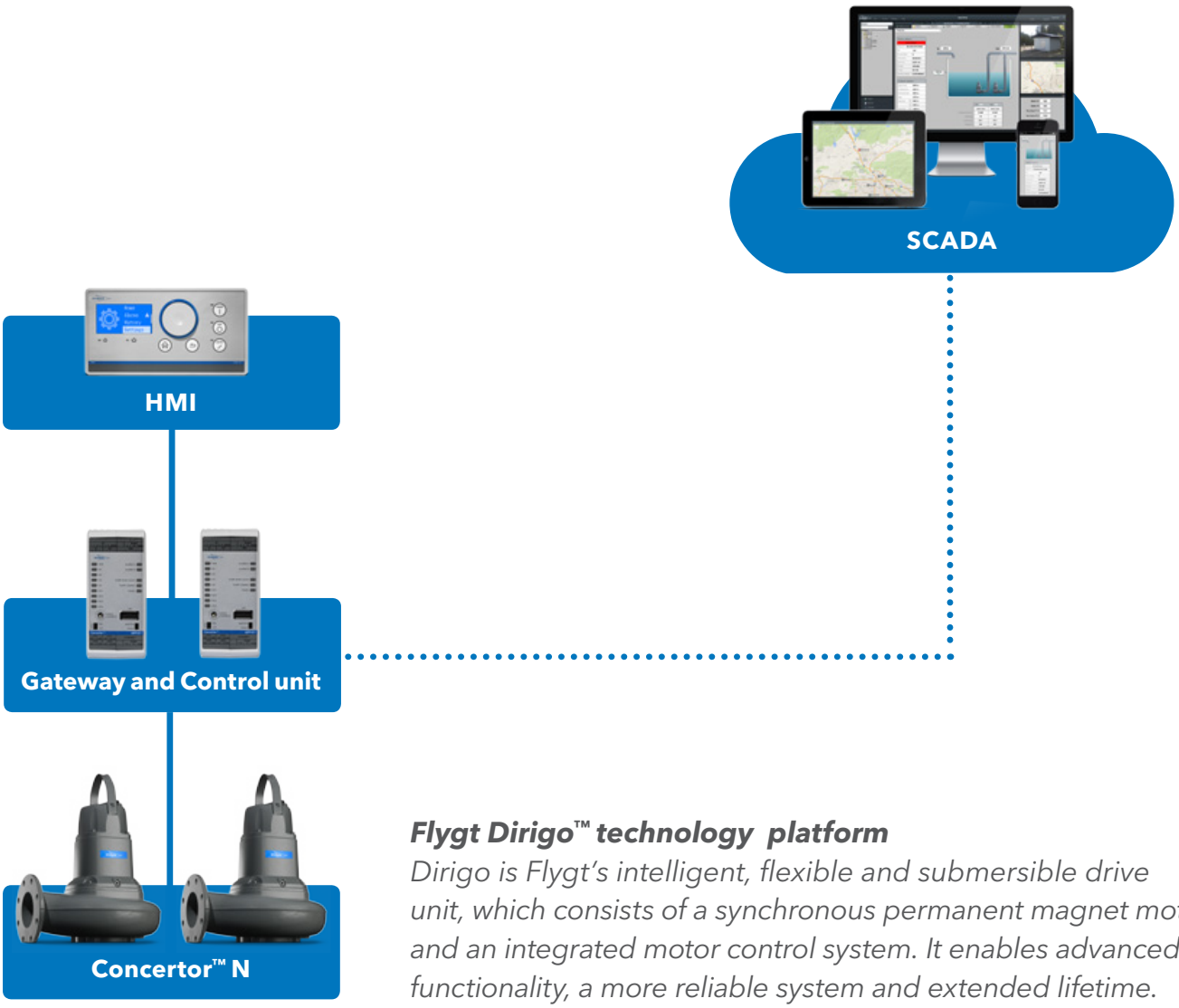
This higher level of integrated intelligence is enabled by our Dirigo platform that consists of a motor, control electronics and software. Dirigo delivers significant cost savings, a more precise level of motor control, reduced risk of clogging, substantial energy savings, comprehensive data reporting and more.

One fully scalable system

Thanks to the scalable nature of the system, you can always add new functionality without having to throw away your initial investment. The Concertor XPC, our most advanced wastewater pumping system, is pre-engineered and pre-configured so you can simply hook it up and start operating. For more basic on/ off operated pump stations, Concertor EA and N are also flexible choices that can easily be upgraded.

Self-adjusting functionality

There are several crucial differences between Concertor and standard systems. Firstly, the power



Flygt Dirigo™ technology platform

Dirigo is Flygt's intelligent, flexible and submersible drive unit, which consists of a synchronous permanent magnet motor and an integrated motor control system. It enables advanced functionality, a more reliable system and extended lifetime.

electronics are built into the pump, eliminating the need for a variable frequency drive (VFD) and other external electronics that require bulky cabinets. Secondly, all hardware and software features are designed to work in harmony with each other, allowing for semi- or autonomous self-adjustment during operation. This avoids the need to remove the pump to trim or change an impeller since a different duty point can be met at the touch of a button.

Full connectivity

Since Concertor covers a broad performance field, your main decision is not about duty points, but selecting the required level of connectivity. As shown in the diagram, you can connect it to a gateway, controller or via modem to a SCADA system. You can also add our HMI monitor if you prefer. A lot will depend on your current set-up and whether you are using a third-party system. Even if you already have a cabinet, the electronic components of Concertor are so few and compact that they can easily fit inside. In other words, the system gives you a proven way to reduce your total cost of ownership.

One scalable system

Flygt Concertor™ delivers high performance in four scalable configurations. The right solution for you will depend on your specific application requirements. And since the system is scalable and flexible, you can migrate from one solution to another as your needs evolve.

	Concertor™ XPC	Concertor™ DP	Concertor™ EA	Concertor™ N
Easy product selection	+ + +	+ + +	+ + +	+ + +
Reduced inventory	+ + +	+ + +	+ + +	+ + +
Flexible on-site operation	+ + +	+ + +	+ + +	+
Small-sized cabinets	+ + +	+ + +	+	+
Clog-free pumping	+ + +	+ +	+ +	+ +
Energy savings	+ + +	+ +	+ +	+ +
Increased reliability and extended lifetime	+ + +	+ +	+ +	+ +
Compact product with fewer components	+ + +	+ +	+	+
Free up engineering and installation hours	+ + +	+ +	+	+
Clean wet wells	+ + +			

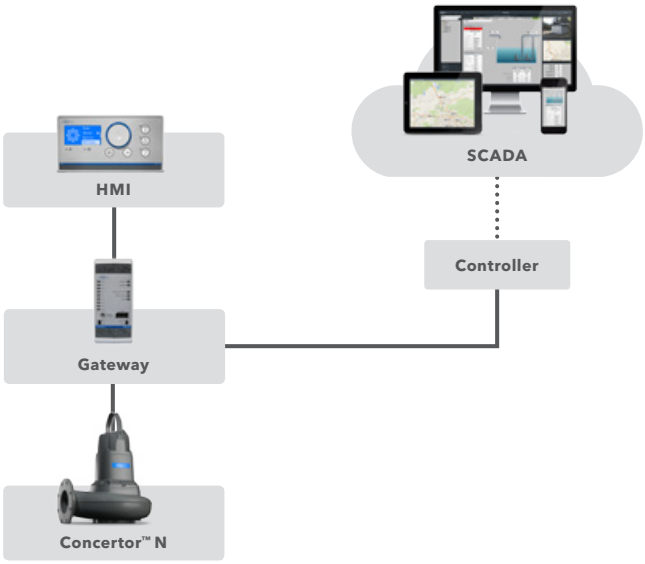
Concertor benefits compared to conventional wastewater pumping systems.

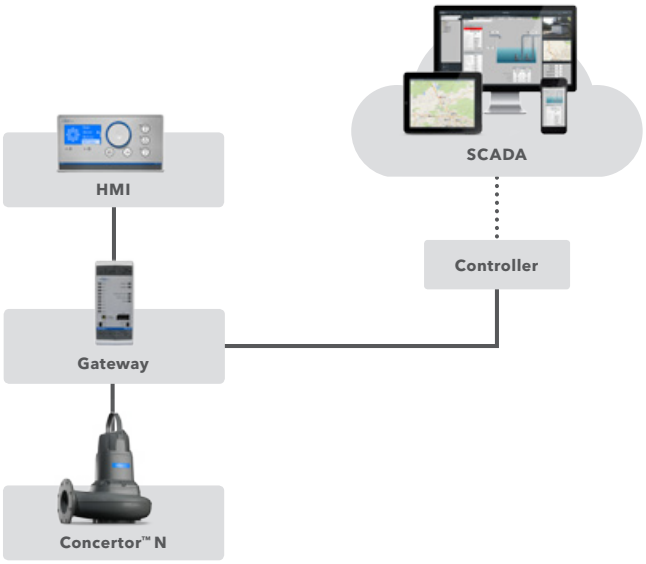
Concertor™ N
The most intelligent wastewater pump on the market. Suitable for customers operating traditional on/off pump stations who want to benefit from easily adjustable pump performance, soft start and constant power functions as well as motor protection.

Concertor™ EA (Easily Adjustable)

The most reliable and energy-efficient on/off controlled wastewater system on the market. It consists of individual pumps together with a gateway for each pump.

Suitable for customers who want to benefit from easily adjustable pump performance, soft start/soft stop functions, constant power and motor protection, among other features.





Concertor™ DP (Dynamic Performance)

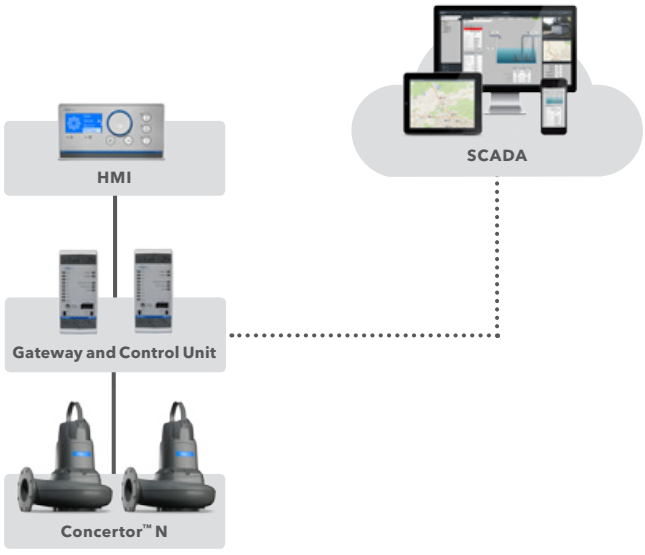
A process-controlled wastewater pumping system that consists of as many pumps as required by your application, as well as one gateway per pump.

Suitable for users with specially designed process control algorithms who want to benefit from lower capital costs, smaller control cabinets and higher pump system efficiencies.

Concertor™ XPC (Extended Performance Control)

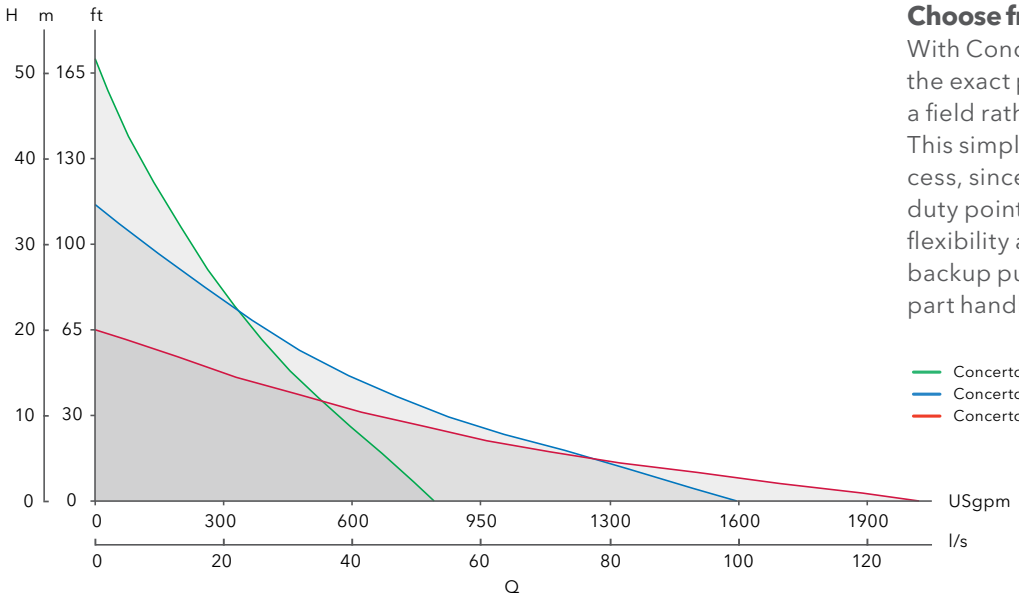
Specifically designed for sewage pumping stations in collection systems, the XPC system consists of one to four pumps, one XPC control unit and one to three DP gateways.

Perfect for users who desire the full functionality of the Concertor system, including maximum energy savings and clean wet wells.



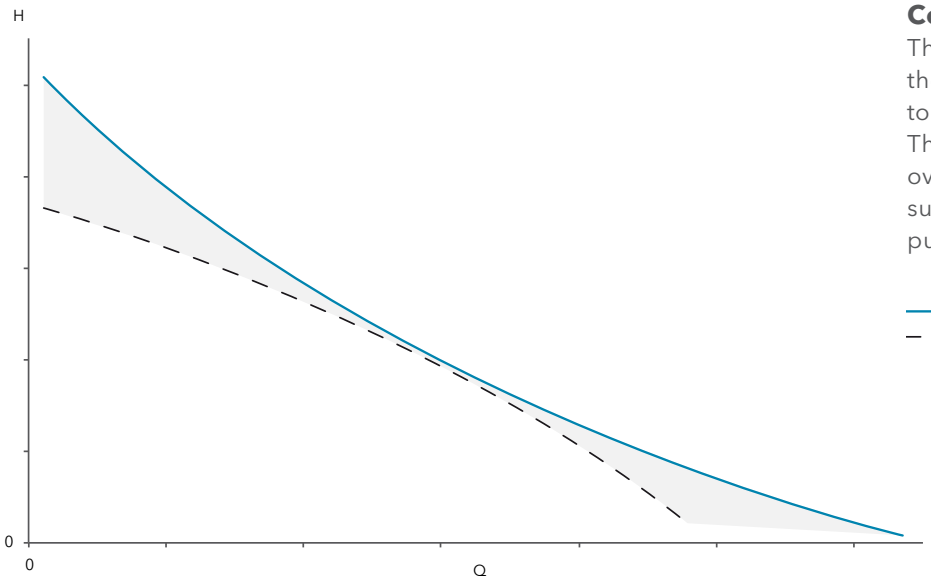
Easier product selection and reduced inventory

With Flygt Concertor™, pump selection has never been easier due to the unlimited number of performance curves. This reduces the need for backup inventory by up to 80% and enables pump performance to be easily changed on site or remotely.



Choose from a performance field

With Concertor, you can now choose the exact pump performance from a field rather than from fixed curves. This simplifies the selection process, since calculating your exact duty point is no longer critical. This flexibility also reduces the need for backup pumps and simplifies spare part handling.



Constant power functionality

This software function operates the pump at varying rotational speeds to achieve a constant motor power. The benefits are clear: no more overloading pump curves and substantially increased off-design pump performance.

KEY FEATURES TO ACHIEVE TROUBLE-FREE PUMPING

Clog-free pumps and clean wet wells

Flygt Concertor™ is designed to ensure clean wet wells, clog-free operation and a reduction in vacuum cleaning call-outs by up to 80%. Additional motor and pump system protection are part of the integrated offer for maximum reliability.

Pump cleaning

The built-in clog detection function detects when the pump is about to clog and triggers the pump cleaning cycle. A pump cleaning cycle is initiated when a clogging instance is detected and the built-in intelligence will then operate the impeller at different speeds and directions, to remove the debris.

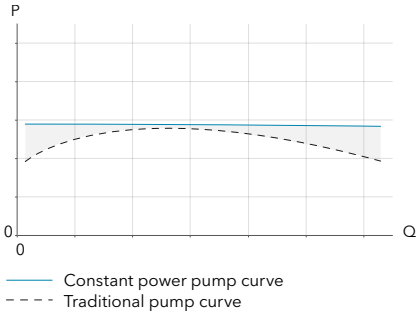
Sump and pipe cleaning

The sump cleaning function removes floating debris and sediments, eliminating the need for expensive wet well cleaning. The pipe cleaning function assures that pipe sediment is removed, minimizing the risk of pipe clogging.

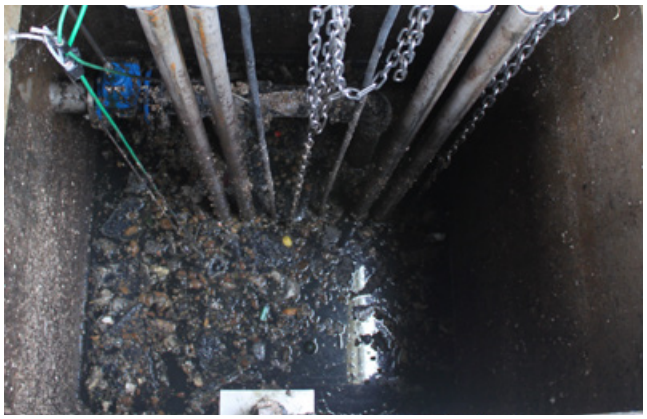
Increased reliability and extended lifetime

The self-monitoring function prevents motor failures due to external conditions. The control system inside the pump, which is placed in a stable and protected environment, will try to reset the pump automatically after a failure. The constant power and advanced motor protection functions ensure a high degree of reliability since the motor is never subjected to overloading.

The soft start function reduces electrical inrush currents and minimizes stress on the shaft, joints, bearings and impeller. By controlling acceleration and deceleration, the motor will be gently started and stopped.



This also reduces the risk for water hammer effects in the pump system. Concertor EA, DP and XPC also have built-in alarm management and history functionalities. Concertor XPC includes additional features such as pump alternation, emergency run at high level, random start and pump start/ stop delays.



To the left, a sump tank in one of our field trials before the Flygt Concertor™ system was installed and then after two weeks of operation (right).

Unparalleled pumping system efficiency

Flygt Concertor™ is capable of reducing energy consumption by up to 70%, compared to conventional pumps and control systems. This is enabled by a unique synergy between software features and state-of-the-art technology.

Energy Minimizer

This patented software algorithm assures that all pumps are continuously controlled to achieve the lowest possible specific energy usage. It has been field proven in thousands of installations, reducing our customers' energy usage by up to 50%, compared to regular on/off operated pumps under identical operating conditions.

State-of-the-art N-hydraulics

A new generation of our Adaptive N-technology enables high efficiency and lower energy usage. The Adaptive N-impeller moves axially upward when needed, allowing bulky fibrous material and debris to pass through smoothly. After the debris has passed, the hydraulic pressure returns the impeller to its original position. Not only does this prevent clogging and reduce stress on the shaft, seals and bearings, but it enables a sustained low usage of energy. As with all Flygt N-pumps, this feature delivers constant self-cleaning functionality.

Motor efficiency meeting IE4 levels

Concertor utilizes a new Super Premium IE4 motor based on a concentrated winding synchronous design. Compared to standard induction motors, it offers significant benefits including increased motor efficiency, greater control, dramatically improved low speed efficiency and reduced size. The concentrated stator winding design allows it to be shorter and more compact than an induction motor with a comparable rating. The rotor is equipped with strong permanent magnets that create and maintain the rotor's magnetic field. Due to the low losses, virtually no heat is generated in the rotor and thus no heat flows out to the bearings via the shaft ends. The result is a cooler running motor with longer motor and bearing life.

Concertor's IE4 motor is shorter and more compact than a conventional motor due to its concentrated stator winding design.

Power factor close to 1

A power factor below 1 requires the utility to generate more reactive power than is really needed. This increases generation and transmission costs. To avoid this situation, the Concertor system keeps the power factor close to 1.

Our new, improved Adaptive N-hydraulics ensures both clog-free operation as well as a higher total level of system efficiency.

Smaller control cabinets and easier commissioning

Flygt Concertor™ eliminates the need for traditional components in the cabinet such as motor protection, soft starters, variable frequency drives (VFDs) and climate control equipment. This gives you full process control functionality with a cabinet that can be up to 50% smaller.

Smaller control cabinets

The integration of intelligence in the Concertor system allows control cabinets to be simpler, more compact and cost-efficient. The following components, among others, are no longer needed:

- Motor protection devices
- Power and current measurement devices
- Soft starters
- VFDs
- Climate control equipment, fan, A/C equipment, particle filters

The intuitive HMI display features a set-up wizard that guides the user through the entire commissioning process.

Faster commissioning

A set-up wizard guides you through installation asking a set of pre-defined questions in a way that even an untrained user can understand and answer. After set-up, the system is ready to operate and communication to other systems, such as third-party PLC and SCADA, is possible through pre-configured interfaces.

Correct impeller rotation

The impeller in a pump is designed to rotate in one specific direction. For traditional three-phase pumps, this has to be checked at commissioning, since the impeller will rotate in the wrong direction if two of the phases are shifted. With Concertor's always-correct impeller rotation function, this potential problem is automatically eliminated.

The integration of intelligence in the Concertor system allows control cabinets to be simpler, more compact and cost-efficient.

Flygt Concertor™ feature and technical overview

Flygt Concertor™ System	XPC	DP	EA	N
Push a button to change pump performance		√	√	√*
Clog detection	√	√	√	√
Pump cleaning	√	√	√	√
Constant power	√	√	√	√
New generation Adaptive-N design	√	√	√	√
Motor efficiency in compliance with IE4	√	√	√	√
Power factor close to 1	√	√	√	√
Always correct impeller rotation	√	√	√	√
Automatic restart trials at faults	√	√	√	√
Soft start	√	√	√	√
Soft stop	√	√	√	
Pump sump alarm I/O, thermal and leakage	√	√	√	√
Multiple alarms, two priorities	√	√	√	
Set-up wizard	√	√	√	
External communication	√	√	√	
Status and history	√	√	√	
Human Machine Interface (HMI)	√	√	√	
Emergency run relay functionality		√	√	
Pump station controller	√			
Energy Minimizer	√			
Sump cleaning	√			
Discharge pipe cleaning	√			
External process control (4-20 mA or Modbus)		√		

** Service tool*

Concertor™ N	
Motor	Synchronous (concentrated winding) Permanent magnet rotor IE4 according to IEC/TS 60034-30-2 Ed. 1
Frequency	50-60 Hz
Voltage	380-480 V 200-260 V
Rated Power	2.2; 4.0; 5.5; 7.3 kW (3.0; 5.5; 7.5; 10.0 Hp)
Rated ambient temperature	40° C (104° F)
Hydraulic	Adaptive N Guide pin
Discharge sizes	80 mm (3") 100 mm (4") 150 mm (6")
Speed range	500-3600 rpm
Impeller material options	Grey Iron impeller Hard-Iron™ impeller Duplex stainless steel impeller
Seal system	Plug-in seal Active seal function
Seal materials options	WCCR/WCCR RSiC/WCCR
Cooling system	Liquid-free heat-conduction technology
Installation	P - Semi-permanent wet well installation S - Semi-permanent free standing installation T - Vertically mounted, permanent dry well installation Z - Horizontally mounted, permanent dry well installation
Sensors	Leakage detection in stator housing Two independent temperature sensors
Cable	Screened Flygt SUBCAB®, with integrated control wires 10, 16, 20, 30 m (30, 50, 60, 100 ft)
Approvals	CE, FM, ATEX, IECEx, CSA
XPC Controller, DP Gateway, EA Gateway	
Power supply	24 VDC
Ports	1 x USB 1 x RS485 1 x Ethernet RJ 45 1 x Display interface, CAN
Communication	Modbus RTU Aquacom Modbus TCP
Standard I/O	4 x Digital outputs 4 x Digital inputs 1 x Analog input 1 x Analog output
Pump interface	1 x Pump communcation port
User interface	14 x LED 1 x Rotator swirch
Data logging	1000 Data points
Environment class	Protection class: IP 20 Operation temperature: -20 ˚C to +70˚C
Size (Wx Lx H)	45x100x100 mm
Approvals	CE, UL, CSA
HMI	
Basic HMI	3.5" monochrome LCD screen
Touch HMI	7" TFT, Full color, analog-resistive

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1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com

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