MEATH COUNTY COUNCIL

Proposed Library Development
Seaview Terrace,
Bettystown,
Co. Meath.

Engineering Services
Design Report
(ESDR01)

June 2020

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For and on behalf of
MPA Consulting Engineers

DOCUMENT CONTROL SHEET

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Contents:

APPENDICES:

1.0 INTRODUCTION

1.1 General

1.1.1 This Engineering Services Design Report (ESDR) has been prepared by MPA Consulting Engineers at the request of our client Meath County Council

1.1.2 This report contains information on the design of roads & transport infrastructure, flooding, foul drainage, storm water management systems and watermain to be constructed for the proposed development.

1.1.3 The Engineering designs have been carried out to take account of all development proposed on the site.

1.1.4 The design of the development has been carried out to take account of the requirements of the Design Manual for Urban Roads and Streets (DMURS) and the requirements of Meath County Council.

1.1.5 The design of the drainage systems has been carried out to take account of the Building Regulations, BS EN 752:2008 – Drain & Sewer Systems Outside Buildings, the Discharge Units Method of design in accordance with BS EN 12056-2:2000 – Gravity Drainage System and the requirements of Irish Water and Meath County Council.

1.1.6 The proposed foul system is a gravity fed system. Effluent will flow through a gravity feed system serving the new building and adjoining properties and shall discharge to the existing foul sewer located on the public road to the Southwest of the site. This is shown in drawing 191018-C-003.

1.1.7 The storm water management system proposed for the development is a sustainable storm water management system which is in accordance with the GDSDS. It will involve a formal piped gravity system discharging to an existing storm water main which is located on Seaview Terrace, attenuation shall be provided in the form of an underground concrete tank and the flow to the main sewer shall be controlled via a flow control device. Rainwater harvesting will also be provided on site with recycled water used in the toilets of the proposed development refer to drawing 191018-C-004 for details.

1.1.8 The proposed watermain will connect to the existing watermain network which is located on the R150 Golf Links Road, as shown in drawing 191018-C-005. The watermain is to be laid out to comply with Irish Water Document: Water Infrastructure Standard Details (Document Number: IW-CDS-5020-01).

1.2 Site

1.2.1 The site is located at Seaview Terrace, Bettystown, Co. Meath. The total site area of the development is approximately 0.1 hectares. The topography of this site is flat, which currently contains terraced housing and open space.

1.3 Proposed Development

1.3.1 In accordance with the plans prepared by Robin Lee Architecture, the proposal seeks to develop the site for the purpose of a four-storey building comprising;

- A library with a gross internal area(GIA) of 1,046 square meters;
- An adjoining lifeguard station with a gross internal area of 55 square meters; and
- Public toilets with a gross internal area of 74 square meters

2.0 FLOODING

2.1 Flood Risk Assessment

2.1.1 Please refer to Flood Risk Assessment as prepared by JBA Consulting.

3.0 TRANSPORT & ACCESS

3.1 Transport Assessment Report

3.1.1 Please refer to document 191018/TAR/F01 Transport Assessment Report as prepared by MPA Consulting Engineers.

3.1.2 Please also refer to 191018/CTMP/F01 Construction Traffic Management Plan as prepared by MPA Consulting Engineers.

4.0 FOUL DRAINAGE SYSTEM

4.1 General

4.1.1 The foul sewer has been designed in accordance with the Colebrook-White formulas, B.S. 752: 2008, Drain & Sewer Systems and the current Building Regulations. Calculations of design flows were carried out using the Discharge Units Method in accordance with BS EN 12056-2:2000.

4.1.2 The drawings included with this submission show the proposed Foul Sewer Layout (Drawing No. 191018/C/003) and Foul Sewer Longitudinal Sections (Drawing No. 191018/C/020).

4.1.3 The proposed system consists of gravity sewers which convey all the effluent from the proposed development to the existing foul sewer main on Seaview Terrace.

4.1.4 A pre-Connection Enquiry has been sent to Irish Water; the response confirming that a connection is available is included in Appendix A.

4.2 Gravity System

4.2.1 The foul sewers conveying the effluent from the buildings to the foul drainage system will generally consist of 100mm pipes at min falls of 1:60. The main system has been designed to take account of all foul drainage requirements on the site.

4.2.2 The foul sewer has been designed in accordance with the Colebrook-White formulas, B.S. 752: 2008, Drain & Sewer Systems and the current Building Regulations. Calculations of design flows were carried out using the Discharge Units Method in accordance with BS EN 12056-2:2000. As can be seen in the Foul Design Sheet in Appendix B, all pipes have adequate capacity.

4.2.3 The pipes for the proposed foul sewerage system consist of 150mm diameter uPVC pipes (as per Irish Water guidelines, at gradients varying from 1:60 to 1:80. The foul system has been designed to take account of all foul drainage requirements on the proposed site.

4.2.4 The foul sewer design sheet is shown in Appendix B. It can be seen here that the maximum peak flow is 6.8 l/s. This figure was determined based on the proposed buildings design and calculated in accordance with BS EN 12056-2:2000.

4.2.5 As noted on drawing 191018/C/003, the foul sewer from an adjacent commercial property is discharging through the proposed site, accordingly this existing discharge will be accommodated in the design of the proposed foul sewer. An allowance of 42 discharge units has been included in the design to ensure adequate capacity exists in the new system.

4.2.6 The proportional velocities have been extrapolated from the Wavinsewer Systems Design Manual for uPVC pipes based on the proportional capacity, and from this the partial velocity / design velocity has been calculated.

4.2.7 It can be seen in Appendix B that all pipes have been designed with adequate capacity and the partial velocities for all pipes are above 0.70 m/s, in accordance with BS EN 752: 2008, thereby ensuring adequate self-cleansing velocities for the entire system.

5.0 STORM WATER MANAGEMENT SYSTEM

5.1 General

5.1.1 In order to comply with the requirements of Meath County Council it is necessary to include a SuDS based storm water management system in accordance with the GDSDS.

5.1.2 Site investigations including site infiltration testing was carried out on the site, a high water table was encountered in the test holes which further rose during the test, it was determined that full infiltration of stormwater was not possible on the site.

5.1.3 It was decided to use a combination of suitable SuDS components namely a stormwater attenuation system and rain water harvesting and incorporate them into the drainage system for the site.

5.1.4 It is proposed that the main infrastructure on site, i.e. the main building and the surrounding hardstanding shall be provided with a formal gravity sewer on site, discharging to the attenuation system within the curtilage of the site. The storm water flow will be controlled by means of a *hydrobrake* flow control device which will have a maximum outflow of 2 l/s, discharging to the existing stormwater main on Seaview Terrace.

5.1.5 The storm sewer system has been designed in accordance with the Colebrook-White formulas and the Modified Rational Method, where

$Q_p = CiA$

and

Q_p = Peak Flow (l/s)

$C = C_v \times C_r$ ($C_v = 0.75$ & $C_r = 1.3$)

i = Rainfall intensity (mm/hr)

5.1.6 A storm sewer layout has been included with this submission (Drawing No. 191018/C/004), and also Storm Sewer Longitudinal Sections (Drawing No. 191018/C/021).

5.2 Gravity System

5.2.1 The pipe network has been designed in accordance with the Modified Rational Method, utilising rainfall data for the Meath area from Met Eireann, included in Appendix C. The rational design sheet has been included in Appendix D of this report.

5.2.2 As can be seen from these tables the storm frequency proposed is 1 in 5 year, thereby ensuring an appropriate level of service for the storm drainage system. The time of entry has been taken to be 6 minutes in accordance with Recommendations for Site Development Works.

Appropriate pipe roughness coefficients have been taken from the pipe manufacturer's literature.

5.2.3 The pipes required to drain the proposed development are of 150mm in diameter. The pipes are at gradients ranging from 1:100 to 1:150.

5.2.4 It can be seen in Appendix D that all pipes have been designed with adequate capacity and the partial velocities for all pipes are above 0.70 m/s, in accordance with BS EN 752: 2008, thereby ensuring adequate self-cleansing velocities for the entire system.

5.3 SUDS System (GDSDS Compliance)

Rainwater Harvesting

5.3.1 As a SUDS measure it is proposed to collect roof water from the proposed development in a separate system for re-use within the proposed building.

5.3.2 The proposed rainwater harvesting system will be used to provide water, for use in the public & library toilets in the proposed development.

5.3.3 The system proposed will discharge the run off into an underground storage tank sized to provide water to cover for up to 7 days of continuous dry periods. A $7m^3$ underground tank will be provided. This runoff will be pumped to a header tank in the building, which will feed the toilets and external taps of the proposed development. A back up connection to the water main for dry periods of seven days or greater will be provided on the system.

5.3.4 Any surplus rain run-off will be diverted to the onsite attenuation tank via an overflow pipe.

Attenuation Systems

5.3.5 It is proposed that the storm pipework will collect storm water from the main building and hardstanding area and will convey the storm water to a stormwater attenuation system located on the site (as shown in Drawing No. 191018/C/004).

5.3.6 In order to comply with the requirements of Meath County Council, the maximum level of outfall from the attenuation system will be restricted to 2l/s as per GDSDS guidelines, with a minimum orifice size of 80mm.

5.3.7 Water exiting the site will be controlled by means of a flow-control hydrobrake located in the downstream manhole of the attenuation system as shown on Drawing No. 191018/C/004.

5.3.8 Based on the values above $15m^3$ of storage is required for the site. This will be provided using a concrete basin capable of retaining water, a 5.9m x 5.9m x 0.45m deep tank will be used. The storm water storage design sheet for the attenuation system is shown in Appendix E.

6.0 WATERMAIN

6.1 General

6.1.1 The water main will be laid out as per Drawing No. 191018/C/005 - Proposed Watermain Layout. Watermain Details (Drawing No. 191018/C/032-033) have also been included in this submission.

6.1.2 A 100mm diameter MDPE (to IS EN 12201: Part 1 and 2 and IS EN 12203-3) watermain will serve the development. This will be served by connecting to the existing water supply network which is located on the Coast Road R150 West of the proposed development as shown on Drawing 191018/C/005.

6.1.3 A Pre-Connection Enquiry has been sent to Irish Water; the response confirming that a connection is available is included in Appendix A.

6.2 Design Data

6.2.1 The supply shall be metered in accordance with the requirements of Irish Water. A boundary box and meter will be installed at the entrance to the site.

6.2.2 All sluice valves, boundary box, water meters, air valves, scour valves, hydrants, stop cocks, will be provided around the site as shown on the Proposed Watermain Layout Drawing No. 191018/C/005.

6.2.3 A looped water main layout is to be adopted to ensure no dead ends and provide balanced pressure throughout.

6.2.4 Screw down type fire hydrants complying with BS 750:2012 will be provided as shown, as can be seen hydrants are not located in roadways or parking spaces, and buildings are not more than 46m from a hydrant. Hydrant outlets will be no more than 300mm below finished ground level.

6.2.5 A summary of the expected average and daily demand is shown in Table 6.1 below. Daily demand has been calculated in accordance with Irish Water Code of Practice IW-CDS-5020-03 – Appendix D, 10l/d/person applies to Public Facilities & Community Meeting Rooms. These figures have been applied using the projected maximum attendance numbers. The daily demand for the Library building & the Life Guard Station has been estimated based on water usage in similar facilities. Peak flow has been calculated based on 6 x average flow.

Table 6.1 Water Demand				
Building use Category	Public Facilities	Library	Meeting Rooms	Life Guard Station
Max. Users	200	n/a	20	n/a
Daily Demand (litres/Person/day)	10	n/a	10	n/a
Total Daily Demand (litres/day)	2000	1000	200	300
Average Demand (litres/second)*	0.0694	0.0347	0.007	0.01
Peak Flow (litres/second)	0.4164	0.208	0.042	0.06
Total Peak Flow	**0.75l/s**			

7.0 SUMMARY AND CONCLUSIONS

7.1 Summary

7.1.1 This Engineering Services Design Report (ESDR) which has been prepared by MPA Consulting Engineers at the request of our client Meath County Council, contains information on design of foul drainage, storm water management systems and watermain to be constructed for the proposed residential development at Seaview Terrace, Bettystown, Co. Meath.

7.1.2 The proposed access to the development has been assessed in the Transport Assessment Report (191018/TAR/F01) submitted with this report which indicates that a safe access for vehicles and pedestrians is being provided.

7.1.3 A Flood Risk Assessment has been carried out and is submitted with this report which indicates that the proposed site as designed will not suffer from fluvial, pluvial or coastal flooding.

7.1.4 The foul system has been designed to both Irish Water and Meath County Council standards.

7.1.5 The proposed foul system consists of gravity sewers on the site which convey all the effluent from the proposed development to the existing storm drainage network along Seaview Terrace.

7.1.6 The storm management system has been designed to best practice principles for SuDS and the requirements of the Greater Dublin Strategic Drainage Study (GDSDS).

7.1.7 The storm water management system proposed for the development consists of a formal piped gravity system discharging to an attenuation system of 15m^3, which will discharge through a flow control device with a maximum outflow of 2l/s to an existing storm main. A 7m^3 rainwater harvesting system is also proposed as a further SuDS measure.

7.1.8 All pipes in the proposed foul and storm gravity systems have been set up so as to ensure adequate capacity and self-cleansing velocities are obtained. These velocities are a minimum of 0.70 m/s for the estimated design flow as per BS EN 752:2008 – Drain & Sewer Systems Outside Buildings.

7.1.9 The water supplies will be provided via a connection to a potable water supply watermain located on the Golf Links Road R150, east of the proposed site as shown on Drawing 191018/C/005.

7.1.10 The proposed watermain has been designed to Irish Water (IS EN 12201: Part 1 and 2 and IS EN 12203-3) and Meath County Council standards.

7.2 Conclusions

7.2.1 In conclusion the proposed site is deemed suitable for development, it has been designed to mitigate against flood risk(refer to JBA report) and does not pose a risk to flooding of any adjacent lands.

7.2.2 The proposed access to the development has been designed in accordance with the DMURS guidelines and will provide safe access & egress from the development.

7.2.3 The report has shown that the foul drainage proposed for the site has sufficient capacity and a connection to an appropriate public main can be established without difficulty, thus ensuring adequate drainage for the proposed development.

7.2.4 As can be seen from the preceding information, the storm management system on the site has sufficient capacity, provides storage in the attenuation tank and connection to an appropriate outfall can be established without difficulty, thus ensuring adequate drainage for the proposed development.

7.2.5 A connection to a potable water supply can be made for the proposed development ensuring adequate service for the proposals.

Appendix A

Irish Water Pre-Connection Enquiry Response

Martin Peters
Ormonde Road
Kilkenny

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

15 April 2020

Dear Martin Peters,

Re: Connection Reference No CDS20002286 pre-connection enquiry - Subject to contract | Contract denied

Connection for Business Connection of 4 unit(s) at Seaview Terrace, Bettystown, Co. Meath.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Seaview Terrace, Bettystown, Co. Meath. Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network can be facilitated.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

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

If you have any further questions, please contact us on **1850 278 278** or **+353 1 707 2828, 8.00am-4.30pm, Mon-Fri** or email **newconnections@water.ie**. For further information, visit **www.water.ie/connections.**

Yours sincerely,

M Dwyer

Maria O'Dwyer

Connections and Developer Services

Appendix B

Foul Sewer Design Sheet

Project: Bettystown Library, Seaview Terrace, Bettystown, Co. Meath **Project No:** 191018 **Drawing Ref.** 191018-C-003	**Calc. Sheet No.** Page 1 of 1 **Calculations by** LMJ **Checked by** MJP **Date** 07/05/2020	**Martin Peters Associates** **Consulting Engineers** **Ormonde Road** **Kilkenny** **R95 AHX8** **T: + 353 56 77 02761** **E: info@mpa.ie** **W: www.mpa.ie**

FOUL SEWER NETWORK SCHEDULE

Design in accordance with B.S. EN 752:2008 DRAIN & SEWER SYSTEMS OUTSIDE BUILDINGS

Design Data:

Frequency Type **Frequent Use, e.g. hospital, school, hotel**

As per Table 3 of EN 12056-2:2000

Frequency Factors (K) **0.7**

Pipe Material **uPVC**

Effective Roughness (Ks) **0.6**

US MH Ref:		US MH CL [mod]	US MH IL [mod]	DS MH IL [mod]	Length [m]	Fall [m]	Gradient [1 in…]	Pipe Diameter [mm]	Cover to US Soffit [m]	Velocity [m/s]	Discharge Units Per Run	Discharge Units Cum	Peak Flow [l/s]	Cap [l/s]	Proportional Capacity	Proportional Velocity	Design Velocity [m/s]
F1.0	F1.1	4.200	3.300	3.223	4.6	0.077	60	150	0.750	1.30	7	7	1.9	22.93	0.081	0.560	0.73
F1.1	F1.2	4.200	3.223	3.168	4.4	0.055	80	150	0.827	1.12	5	12	2.4	19.82	0.122	0.685	0.77
F1.2	F1.3	4.200	3.168	3.102	5.3	0.066	80	150	0.882	1.12	0	12	2.4	19.78	0.123	0.686	0.77
F1.3	F1.4	4.200	3.102	2.800	24.1	0.302	80	150	0.948	1.12	0	12	2.4	19.84	0.122	0.685	0.77
F1.4	Ex MH	4.190	2.800	2.746	4.3	0.054	80	150	1.240	1.12	81	93	6.8	19.86	0.340	0.885	0.99
F2.0	F2.1	4.200	3.102	3.041	4.9	0.061	80	150	0.948	1.12	5	5	1.6	19.78	0.079	0.554	0.70*
F2.1	F2.2	4.200	3.041	2.901	11.2	0.140	80	150	1.009	1.12	34	39	4.4	19.82	0.221	0.805	0.90
F2.2	F1.4	4.200	2.901	2.800	8.1	0.101	80	150	1.149	1.12	42	81	6.3	19.79	0.318	0.869	0.97

Notes:

* Denotes imperical pipe design as per Section 9.6.3.1 Design for Self Cleansing in B.S. EN 752:2008 - Drain & Sewer Systems Outside Buildings

Appendix C

Met Éireann Rainfall data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 316033, Northing: 273531,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.5,	4.0,	4.8,	5.3,	5.7,	7.0,	8.5,	9.4,	10.8,	11.9,	12.8,	14.2,	15.3,	16.2,	N/A ,
10 mins	3.6,	4.9,	5.6,	6.7,	7.4,	8.0,	9.8,	11.8,	13.1,	15.0,	16.6,	17.9,	19.8,	21.3,	22.6,	N/A ,
15 mins	4.2,	5.8,	6.6,	7.9,	8.7,	9.4,	11.5,	13.9,	15.5,	17.6,	19.6,	21.0,	23.3,	25.1,	26.5,	N/A ,
30 mins	5.6,	7.6,	8.6,	10.1,	11.1,	11.9,	14.4,	17.2,	19.0,	21.5,	23.7,	25.4,	27.9,	29.9,	31.5,	N/A ,
1 hours	7.5,	9.9,	11.2,	13.0,	14.2,	15.1,	18.1,	21.3,	23.4,	26.2,	28.7,	30.6,	33.4,	35.6,	37.4,	N/A ,
2 hours	10.0,	12.9,	14.5,	16.7,	18.1,	19.2,	22.6,	26.3,	28.7,	31.9,	34.7,	36.8,	40.0,	42.5,	44.5,	N/A ,
3 hours	11.8,	15.1,	16.8,	19.3,	20.8,	22.0,	25.8,	29.8,	32.4,	35.9,	38.8,	41.1,	44.5,	47.1,	49.2,	N/A ,
4 hours	13.3,	16.9,	18.8,	21.4,	23.0,	24.3,	28.3,	32.6,	35.3,	38.9,	42.0,	44.4,	47.9,	50.6,	52.8,	N/A ,
6 hours	15.8,	19.8,	21.8,	24.7,	26.6,	28.0,	32.3,	36.9,	39.8,	43.7,	47.0,	49.5,	53.3,	56.1,	58.4,	N/A ,
9 hours	18.7,	23.2,	25.4,	28.6,	30.6,	32.1,	36.8,	41.8,	44.9,	49.1,	52.6,	55.2,	59.2,	62.2,	64.6,	N/A ,
12 hours	21.0,	25.9,	28.3,	31.7,	33.8,	35.5,	40.5,	45.7,	48.9,	53.3,	56.9,	59.7,	63.8,	66.9,	69.3,	N/A ,
18 hours	24.9,	30.3,	33.0,	36.7,	39.0,	40.8,	46.1,	51.7,	55.2,	59.8,	63.7,	66.6,	70.9,	74.1,	76.7,	N/A ,
24 hours	28.1,	33.9,	36.7,	40.6,	43.1,	45.0,	50.7,	56.5,	60.1,	64.9,	68.9,	71.9,	76.4,	79.7,	82.3,	91.2,
2 days	33.8,	40.6,	44.0,	48.6,	51.5,	53.6,	60.3,	67.1,	71.3,	76.8,	81.5,	85.0,	90.1,	94.0,	97.0,	107.2,
3 days	38.5,	46.2,	49.9,	55.0,	58.3,	60.7,	68.1,	75.8,	80.4,	86.7,	91.9,	95.7,	101.5,	105.7,	109.1,	120.4,
4 days	42.6,	51.0,	55.1,	60.7,	64.3,	67.0,	75.1,	83.4,	88.5,	95.3,	101.0,	105.2,	111.4,	116.0,	119.8,	132.1,
6 days	49.8,	59.5,	64.2,	70.7,	74.8,	77.9,	87.2,	96.7,	102.6,	110.4,	116.9,	121.7,	128.8,	134.1,	138.4,	152.4,
8 days	56.2,	67.1,	72.3,	79.6,	84.1,	87.5,	97.9,	108.5,	115.0,	123.7,	130.9,	136.3,	144.2,	150.0,	154.8,	170.3,
10 days	62.0,	74.0,	79.7,	87.7,	92.7,	96.4,	107.7,	119.3,	126.4,	135.8,	143.7,	149.6,	158.2,	164.6,	169.7,	186.7,
12 days	67.5,	80.4,	86.6,	95.2,	100.6,	104.6,	116.8,	129.4,	137.0,	147.2,	155.7,	162.0,	171.3,	178.2,	183.7,	201.9,
16 days	77.6,	92.4,	99.4,	109.2,	115.3,	119.9,	133.7,	147.9,	156.6,	168.1,	177.8,	184.9,	195.4,	203.2,	209.4,	230.0,
20 days	87.0,	103.4,	111.2,	122.0,	128.9,	133.9,	149.3,	165.1,	174.7,	187.5,	198.1,	206.0,	217.6,	226.2,	233.1,	255.9,
25 days	97.9,	116.3,	125.0,	137.1,	144.7,	150.4,	167.5,	185.1,	195.8,	210.0,	221.8,	230.6,	243.5,	253.1,	260.8,	286.1,

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

Appendix D

Storm Drainage Design Sheet

Project: Bettystown Library, Seaview Terrace, Bettystown, Co. Meath **Project No:** 191018 **Drawing Ref.** 191018-C-004	**Calc. Sheet No.** Page 1 of 1 **Calculations by** LMJ **Checked by** MJP **Date** 25.06.20	**Martin Peters Associates** **Consulting Engineers** **Ormonde Road** **Kilkenny** **R95 AHX8** **T: + 353 56 77 02761** **E: info@mpa.ie** **W: www.mpa.ie**

SURFACE WATER NETWORK SCHEDULE

Design Data:

Station Name	Meath	Pipe Material	uPVC
$M_{5\text{-}2min}$	3.1	Effective Roughness (Ks) =	0.06
Design Return Period	5		
Time to Entry	6		

US MH Ref:		US MH CL [mod]	US MH IL [mod]	DS MH IL [mod]	Length [m]	Gradient [1 in…]	Pipe Diameter [mm]	Cover to US Soffit [m]	Velocity [m/s]	Time of Flow [min]	Time of Conc. [min]	Rate of Rainfall [mm/hr]	Total Area [m2]	% Imperv.	Imperv. Area [m2]	Cumul. Imperv. Area [m2]	Actual Rate of Flow [m3/s]	Allow. Rate of Flow [m3/s]	Proportional Capacity	Proportional Velocity	Design Velocity [m/s]
S1.0	S1.1	4.200	3.500	3.415	12.75	150	150	0.550	1.01	0.210	6.210	62.00	35	100	35	35	0.001	0.018	0.03	0.296	0.70*
S1.1	S1.2	4.200	3.415	3.350	9.8	150	150	0.635	1.01	0.161	6.371	61.37	33	100	33	68	0.001	0.018	0.06	0.482	0.70*
S1.2	S1.3	4.200	3.350	3.282	10.1	150	150	0.700	1.01	0.166	6.537	60.74	46	100	46	114	0.002	0.018	0.10	0.641	0.70*
S1.3	S1.4	4.200	3.282	3.130	22.9	150	150	0.768	1.01	0.377	6.914	59.40	79	100	79	193	0.003	0.018	0.17	0.765	0.70*
S1.4	Ex. MH	4.200	2.742	2.670	10.8	150	150	1.308	1.01	0.178	7.092	58.80	-	-	-	-	0.002	0.018	0.11	0.660	0.70*
S2.0	S2.1	4.200	3.300	3.276	3.6	150	150	0.750	1.01	0.059	6.059	62.60	98	100	98	98	0.002	0.018	0.09	0.604	0.70*
S2.1	S2.2	4.200	3.276	3.239	5.6	150	150	0.774	1.01	0.092	6.151	62.23	0	100	0	98	0.002	0.018	0.09	0.602	0.70*
S2.2	S1.4	4.200	2.766	2.742	3.6	150	150	1.284	1.01	0.059	6.211	61.99	22	100	22	120	0.002	0.018	0.11	0.662	0.70*
S3.0	S3.1	4.200	3.500	3.413	13	150	150	0.550	1.01	0.214	6.214	61.98	129	100	129	129	0.002	0.018	0.12	0.682	0.70*
S3.1	S3.2	4.200	3.413	3.339	11.1	150	150	0.637	1.01	0.183	6.397	61.27	74	100	74	203	0.003	0.018	0.19	0.780	0.70*
S3.2	S3.3	4.200	3.339	3.261	11.7	150	150	0.711	1.01	0.193	6.589	60.55	0	100	0	203	0.003	0.018	0.19	0.778	0.70*
S3.3	S3.4	4.200	3.261	3.161	15.1	150	150	0.789	1.01	0.249	6.838	59.67	54	100	54	257	0.004	0.018	0.23	0.813	0.70*
S3.4	RWT	4.200	2.841	2.834	1	150	150	1.209	1.01	0.016	6.854	59.61	0	100	0	257	0.004	0.018	0.23	0.813	0.70*
RWT	S3.5	4.200	2.834	2.827	1	150	150	1.216	1.01	0.016	6.871	59.55	0	100	0	257	0.004	0.018	0.23	0.813	0.70*
S3.5	S1.4	4.200	2.827	2.817	1.5	150	150	1.223	1.01	0.025	6.895	59.47	0	100	0	257	0.004	0.018	0.23	0.812	0.70*
S4.0	S4.1	4.200	3.500	3.425	7.5	100	150	0.550	1.26	0.100	6.100	62.44	40	100	40	40	0.001	0.022	0.03	0.278	0.70*
S4.1	S4.2	4.200	3.425	3.389	3.6	100	150	0.625	1.26	0.048	6.147	62.25	18	100	18	58	0.001	0.022	0.04	0.373	0.70*
S4.2	S4.3	4.200	3.389	3.330	5.9	100	150	0.661	1.26	0.078	6.226	61.94	18	100	18	76	0.001	0.022	0.06	0.452	0.70*
S4.3	S4.4	4.200	3.330	3.190	14	100	150	0.720	1.26	0.186	6.411	61.22	0	100	0	76	0.001	0.022	0.06	0.448	0.70*
S4.4	S3.4	4.200	2.854	2.844	1	100	150	1.196	1.26	0.013	6.425	61.17	0	100	0	76	0.001	0.022	0.06	0.448	0.70*

Notes:

* Denotes imperical pipe design as per Section 9.6.3.1 Design for Self Cleansing in B.S. EN 752:2008 - Drain & Sewer Systems Outside Buildings

Appendix E

Surface Water Attenuation Design Sheet

Project: RLA - Seaview Terrace Bettystown, Co. Meath **Project No:** 191018 **Drawing ref.** 191018/C/003	**Calc. Sheet No.** Sheet 1 of 1 **Calculations by** LMJ **Checked by** MJP **Date** 20.04.20	**Martin Peters Associates** **Consulting Engineers** **Ormonde Road** **Kilkenny** **R95 AHX8** **T: + 353 56 77 02761** **E: info@mpa.ie** **W: www.mpa.ie**

ATTENUATION DESIGN

Design Data:

Station Name: **Bettystown**

Annual Rainfall: 800 mm

Allowable Outflow:

Outflow (O) = **2.0** Litres / sec

Refer to Enclosed Qbar Calculations

Discharge rate is in accordance with GDSDS Criterion 2.1 River Regime Protection

Catchment Details :

Roof Area =	**296**	(m^2)	@	95%
Road/Hardstanding =	**470**	(m^2)	@	80%
Permeable Paving =	**0**	(m^2)	@	30%
Open Area =	**0**	(m^2)	@	5%

Effective Area of Catchment (A)	**657**	**m^2**
	0.0657	**ha**

Rainfall Data :

Return Period (Yrs)	**100 year**

Storm Duration (D) (min)	Rainfall (R) (mm)
15	21.0
30	25.4
60	30.6
120	36.8
240	44.4
360	49.5
720	59.7
1440	71.9
2880	85.0

Inflow Volume Equation :

Storm Duration (D) (min)	Rainfall (R) (m^3/ha)	Intensity (mm/hr)	Inflow (I) (m^3)	Outflow (O) (m^3)	Storage Req'd (S) (m^3)
15	231	92.40	15	2	13
30	279	55.88	18	4	15
60	337	33.66	22	7	15
120	405	20.24	27	14	12
240	488	12.21	32	29	3
360	545	9.08	36	43	-7

Rainfall (R) inclues a 10% provision for climate change as per GDSDS

Six hours has been selected as the max duration of the design event to compute the storage required as per GDSDS Section 6.7 which satisfies the Criterion 4.3 for River Flood Proection

Storage Volume Required	**15**	**m^3**