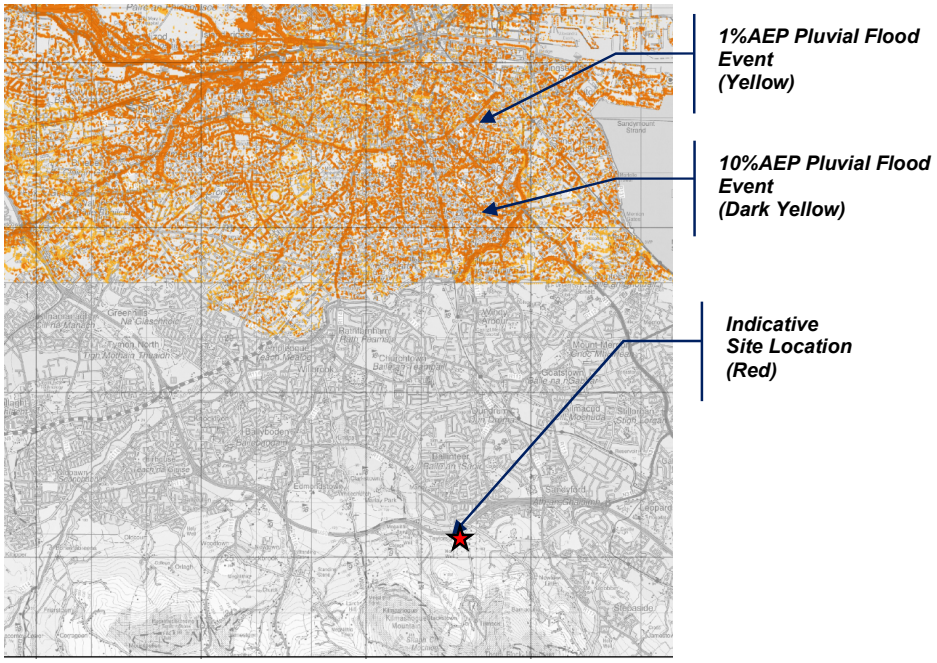


Figure 7.6 – Pluvial Flood Extent (www.floodinfo.ie)

Figure 7.6 illustrates the indicative location of the pluvial flooding, however, it can be seen that the extent of modelling does not include the proposed site.

The measures below outline in *Section 7.4.2* the steps that that have been taken to ensure that pluvial flooding is not considered to be a risk to the proposed development.

Refer to **Appendix H** for a copy of the pluvial flood risk map.

7.4.2 PROPOSED DEVELOPMENT CONTEXT

The proposed development is to contain a new gravity surface water network that is to discharge an attenuated flow of 7.1 l/s. Attenuation systems are to be provided at strategic locations, as a result of the restricted development discharge rates associated with design rainfall events up to, and including, the 1% AEP including a 20% allowance for climate change and a 10% increase due to urban creep. Details of the proposed surface water drainage strategy associated with the subject development site are provided in *Section 3* of this report.

The surface water network, which is to serve the proposed development, includes *Sustainable Drainage Systems (SuDS)* that are a collection of water management practices that aim to align modern drainage systems with natural water processes as set out in *Section 3.4.3* of this report.

The proposed surface water drainage network has been designed to ensure that no flooding is experienced during design rainfall events up to and including the 5% AEP including an additional 20% intensity for climate change projections and 10% for urban creep.

This ensures that pluvial flooding is **not** considered to be a significant risk to the proposed development.

7.5 GROUNDWATER FLOODING

Groundwater flooding occurs when the water table rises above the land surface, this means the natural underground drainage system is incapable of sufficiently draining itself, resulting in the emergence of groundwater at the surface. It generally requires sustained rainfall over relatively longer duration than other forms of flooding, its location is discontinuous, and they can last for weeks or months. The GSI have developed flood risk maps that shows the groundwater flooding and historic groundwater flooding. The groundwater flooding is classified as Low Probability, Medium Probability and High Probability.

Refer to *Figure 7.9 – Groundwater Flooding*, below.

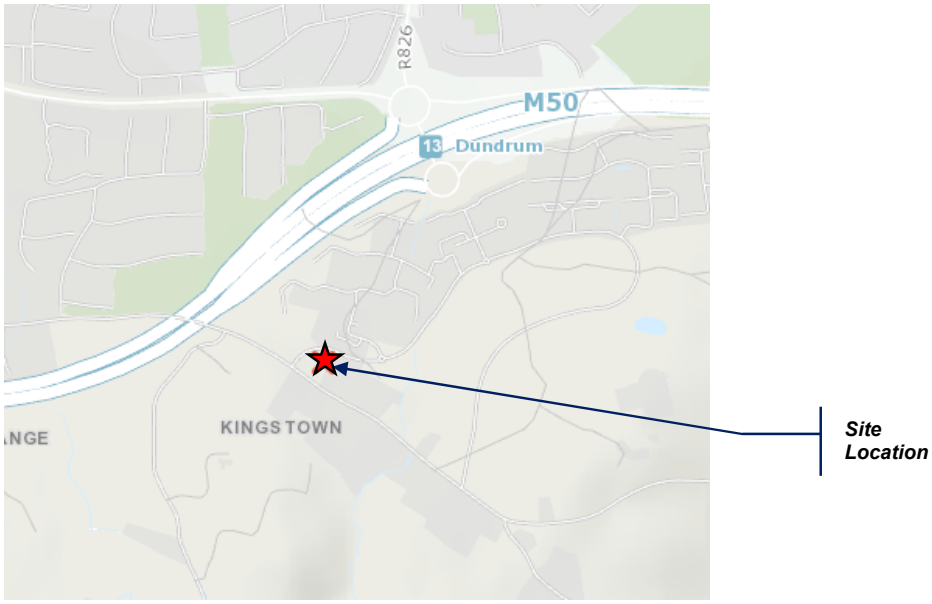


Figure 7.9 – Groundwater Flood Extent (www.gsi.ie)

The site is also not in vicinity of any tidally influenced area of groundwater flood and is therefore **not** considered at Risk from Groundwater flooding.

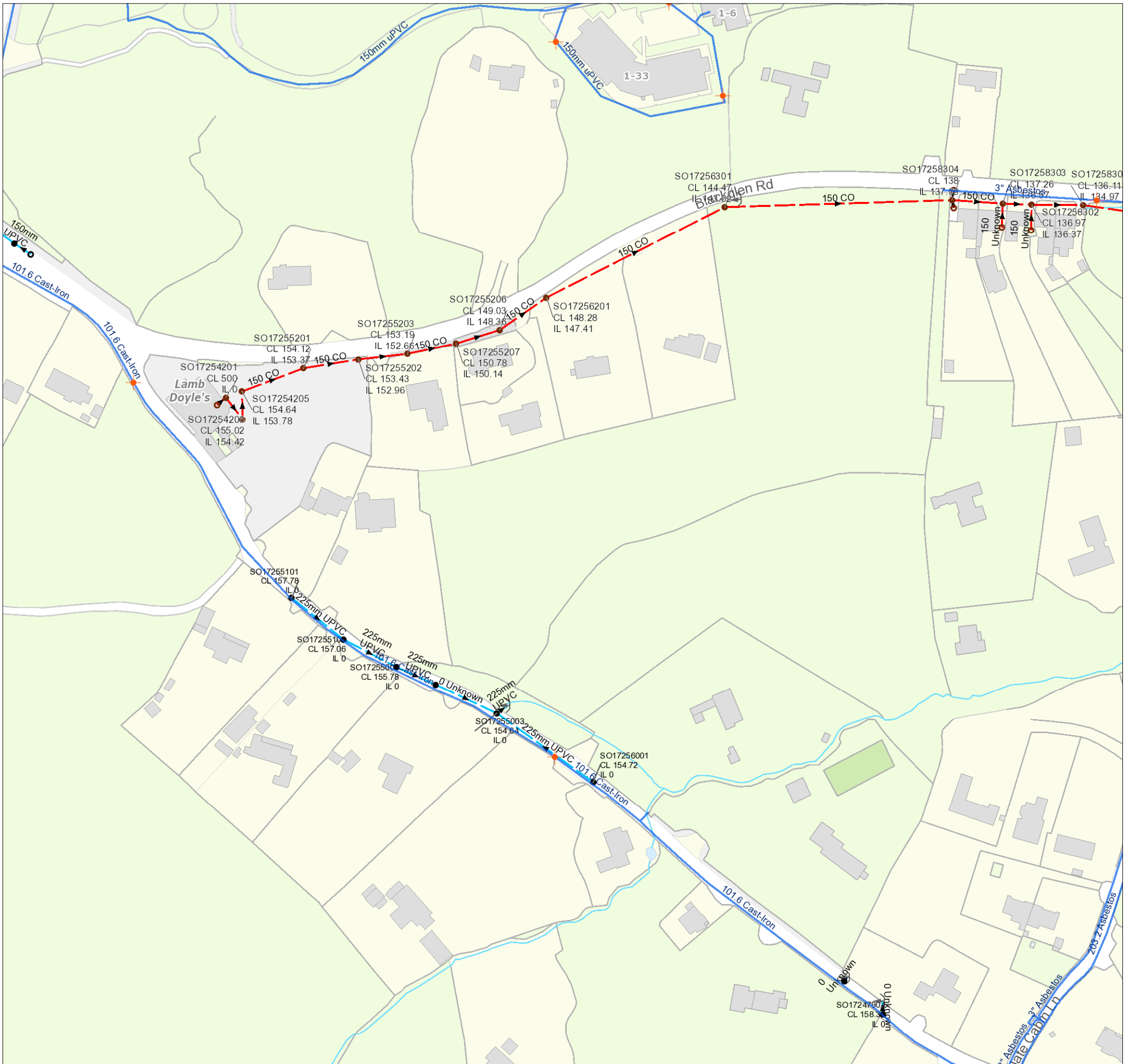
8 VERIFICATION

This report was compiled and verified by:

Kyle Gray BEng (Hons) (Civil), MA, MIEI
Civil Engineer
O'Connor Sutton Cronin & Associates

Appendix A EXISTING DRAINAGE INFRASTRUCTURE RECORDS APPENDIX

black glen road



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

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

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

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

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

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

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

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

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

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

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

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

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

Inlet Type
- Gully
- Standard
- Other; Unknown

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

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

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

ESB Networks

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

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

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

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

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

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Service connection pipes are not generally shown but their presence should be anticipated.

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'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

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Appendix B RETURN PERIOD RAINFALL DEPTHS

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 317685, Northing: 225188,

	Interval		Years									
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	120,
5 mins	2.6,	3.7,	4.3,	5.3,	5.9,	6.4,	8.1,	9.9,	11.2,	13.0,	14.6,	15.8,	16.7,
10 mins	3.6,	5.2,	6.0,	7.4,	8.2,	8.9,	11.2,	13.9,	15.6,	18.1,	20.3,	22.1,	23.2,
15 mins	4.2,	6.1,	7.1,	8.6,	9.7,	10.5,	13.2,	16.3,	18.4,	21.3,	23.9,	25.9,	27.3,
30 mins	5.6,	8.0,	9.3,	11.2,	12.5,	13.5,	16.8,	20.6,	23.2,	26.7,	29.9,	32.3,	34.0,
1 hours	7.4,	10.4,	12.1,	14.5,	16.1,	17.3,	21.5,	26.1,	29.2,	33.5,	37.3,	40.3,	42.3,
2 hours	9.9,	13.7,	15.7,	18.7,	20.7,	22.3,	27.4,	33.1,	36.8,	42.0,	46.7,	50.2,	52.6,
3 hours	11.6,	16.0,	18.3,	21.7,	24.0,	25.8,	31.5,	38.0,	42.2,	48.0,	53.2,	57.2,	59.8,
4 hours	13.1,	17.9,	20.4,	24.2,	26.7,	28.6,	34.9,	41.9,	46.4,	52.8,	58.3,	62.6,	65.5,
6 hours	15.4,	20.9,	23.8,	28.1,	31.0,	33.2,	40.2,	48.1,	53.2,	60.3,	66.5,	71.3,	74.5,
9 hours	18.1,	24.5,	27.8,	32.7,	35.9,	38.4,	46.4,	55.2,	60.9,	68.8,	75.8,	81.1,	84.6,
12 hours	20.4,	27.4,	31.0,	36.4,	39.9,	42.6,	51.3,	60.9,	67.1,	75.6,	83.1,	88.9,	92.7,
18 hours	24.0,	32.1,	36.2,	42.3,	46.3,	49.4,	59.2,	69.9,	76.8,	86.4,	94.7,	101.1,	105.3,
24 hours	27.0,	35.9,	40.4,	47.1,	51.4,	54.8,	65.5,	77.1,	84.6,	95.0,	104.0,	110.8,	115.4,
2 days	33.7,	43.6,	48.6,	55.9,	60.7,	64.3,	75.6,	87.9,	95.7,	106.3,	115.5,	122.4,	127.0,
3 days	39.3,	50.2,	55.6,	63.4,	68.5,	72.4,	84.4,	97.3,	105.4,	116.4,	125.9,	133.1,	137.8,
4 days	44.3,	56.0,	61.9,	70.2,	75.6,	79.6,	92.3,	105.7,	114.2,	125.6,	135.4,	142.8,	147.7,
6 days	53.4,	66.5,	73.0,	82.2,	88.1,	92.6,	106.3,	120.8,	129.9,	142.1,	152.5,	160.3,	165.4,
8 days	61.6,	76.0,	83.1,	93.0,	99.4,	104.2,	118.9,	134.4,	144.0,	156.8,	167.8,	175.9,	181.3,
10 days	69.3,	84.8,	92.4,	103.0,	109.8,	114.9,	130.6,	146.8,	156.9,	170.4,	181.8,	190.4,	196.0,
12 days	76.6,	93.2,	101.2,	112.5,	119.7,	125.0,	141.5,	158.5,	169.1,	183.2,	195.0,	203.9,	209.7,
16 days	90.4,	108.9,	117.8,	130.2,	138.1,	144.0,	161.9,	180.3,	191.7,	206.8,	219.5,	229.0,	235.1,
20 days	103.5,	123.7,	133.4,	146.8,	155.3,	161.6,	180.8,	200.6,	212.7,	228.7,	242.2,	252.1,	258.6,
25 days	119.1,	141.3,	151.9,	166.5,	175.7,	182.5,	203.2,	224.4,	237.3,	254.4,	268.7,	279.2,	286.1,

NOTES:
These values are derived from a Depth Duration Frequency (DDF) Model update 2023
For details refer to:
'Mateus C., and Coonan, B. 2023. Estimation of point rainfall frequencies in Ireland. Technical Note No. 68. Met Eireann',
Available for download at:
http://hdl.handle.net/2262/102417

Appendix C Q_{BAR} RUNOFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	5	Soil	0.370
Area (ha)	3.830	Urban	0.000
SAAR (mm)	965	Region Number	User Defined

User Defined Growth Curve

Filename GDSDS.gcfx Description GDSDS

Return Period (years)	Growth Curve Factor
1	0.850
2	0.000
5	0.000
10	0.000
20	0.000
25	0.000
30	2.100
50	0.000
100	2.600
200	0.000
500	0.000
1000	0.000

Results	l/s
QBAR Rural	16.0
QBAR Urban	16.0
Q5 years	0.0
Q1 year	13.6
Q30 years	34.0
Q100 years	41.8

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Appendix D SURFACE WATER DESIGN REPORT

- Generated by Causeway Flow (Causeway Technologies Ltd.)

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.135	5.00	156.840	1200	717522.859	725200.948	1.425
2	0.021	5.00	155.260	1200	717534.607	725158.277	1.650
3	0.106	5.00	154.965	1200	717538.552	725152.974	1.715
4	0.033	5.00	154.547	1200	717530.875	725120.254	1.704
5	0.015	5.00	153.694	1200	717557.418	725103.373	1.964
6	0.028	5.00	152.943	1350	717584.001	725123.996	2.700
7	0.074	5.00	153.431	1200	717556.388	725196.229	1.425
8	0.017	5.00	153.526	1200	717561.359	725178.182	1.726
9	0.072	5.00	153.394	1200	717565.305	725172.878	1.933
10	0.027	5.00	151.334	1350	717610.637	725144.660	2.775
11	0.066	5.00	152.724	1200	717582.933	725208.468	1.350
12			152.400	1200	717585.398	725199.619	1.550
13	0.122	5.00	152.107	1200	717589.524	725194.455	1.832
14	0.017	5.00	149.802	1350	717637.086	725164.792	2.627
15	0.013	5.00	148.930	1350	717650.074	725179.233	2.530
16			148.300	1350	717654.943	725194.084	1.970
17			148.070	1350	717641.811	725200.531	2.670
18	0.002	5.00	151.300	1200	717604.442	725226.996	0.750
19	0.012	5.00	150.500	1200	717607.502	725216.261	0.750
20	0.002	5.00	148.800	1200	717633.063	725199.954	3.150
21			147.050	1500	717646.530	725219.395	2.550
22			145.950	1350	717662.372	725214.789	2.405
23	0.021	5.00	148.095	1200	717651.436	725199.764	2.125
24	0.026	5.00	146.799	1200	717658.089	725220.180	2.159
25	0.002	5.00	145.450	1200	717681.420	725215.887	1.050
26	0.005	5.00	145.400	1350	717683.360	725211.676	2.280
27	0.046	5.00	144.546	1200	717699.968	725222.022	1.975
28	0.033	5.00	143.602	1200	717703.744	725250.274	1.556
29			143.530	1200	717696.395	725255.396	2.185
30			143.490	1350	717689.610	725266.846	2.490
31	0.041	5.00	143.197	1350	717689.813	725283.423	2.287
32	0.018	5.00	142.590	1200	717686.336	725305.670	3.190
33	0.118	5.00	140.500	1200	717692.280	725308.776	1.900
34	0.060	5.00	140.930	1200	717670.447	725335.451	1.350
35			141.510	1200	717671.554	725323.398	3.150
36			140.500	1350	717676.894	725321.336	2.200
37	0.170	5.00	153.000	10	717660.726	725266.335	1.425
38			153.000	10	717656.421	725266.257	1.451
39			153.000	10	717651.491	725266.413	10.605
40			143.000	10	717647.812	725270.092	0.705
41			143.013	1200	717647.016	725275.030	0.833

Please note: Links and manholes in this report which do not appear on the drainage layout (Dwg. C-0500-502) are for modelling purposes only and can be ignored.

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
42			143.000	1200	717642.675	725298.964	2.350
43			141.500	1200	717640.956	725310.222	2.350
44	0.066	5.00	141.200	1200	717622.576	725330.349	1.050
45			141.000	1200	717626.967	725315.267	1.925
46	0.028	5.00	141.000	1200	717648.562	725314.601	2.500
47	0.016	5.00	140.900	1350	717663.303	725320.220	2.700
48			140.920	1350	717660.171	725341.649	3.020
49			140.632	1350	717669.288	725343.809	2.847
50			140.526	1350	717668.211	725349.413	2.796

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	44.259	0.600	155.415	153.610	1.805	24.5	225	5.28	41.3
1.001	2	3	6.609	0.600	153.610	153.274	0.336	19.7	225	5.32	41.2
1.002	3	6	53.901	0.600	153.250	151.318	1.932	27.9	300	5.62	40.4
2.000	4	5	31.456	0.600	152.843	152.344	0.499	63.0	225	5.32	41.2
2.001	5	6	33.645	0.600	151.730	151.318	0.412	81.7	300	5.64	40.3
1.003	6	10	33.712	0.600	150.243	149.634	0.609	55.4	375	5.87	39.7
3.000	7	8	18.719	0.600	152.006	151.800	0.206	90.9	225	5.23	41.5
3.001	8	9	6.611	0.600	151.800	151.461	0.339	19.5	225	5.26	41.4
3.002	9	10	53.397	0.600	151.461	149.784	1.677	31.8	225	5.65	40.3
1.004	10	14	33.239	0.600	148.559	148.102	0.457	72.7	375	6.13	39.1
4.000	11	12	9.186	0.600	151.374	150.850	0.524	17.5	150	5.06	41.9
4.001	12	13	6.610	0.600	150.850	150.350	0.500	13.2	150	5.10	41.8
4.002	13	14	56.054	0.600	150.275	148.252	2.023	27.7	225	5.48	40.8
1.005	14	15	19.422	0.600	147.175	147.000	0.175	111.0	375	6.32	38.6
1.006	15	16	15.629	0.600	146.400	146.330	0.070	223.3	375	6.53	38.1
1.007	16	17	14.629	0.600	146.330	146.000	0.330	44.3	375	6.62	37.9
1.008	17	21	19.445	0.600	146.000	145.800	0.200	97.2	375	6.80	37.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.653	105.5	20.1	1.200	1.425	0.135	0.0	66	2.057
1.001	2.963	117.8	23.2	1.425	1.466	0.156	0.0	67	2.314
1.002	2.988	211.2	38.2	1.415	1.325	0.262	0.0	86	2.284
2.000	1.650	65.6	4.9	1.479	1.125	0.033	0.0	41	0.968
2.001	1.741	123.1	6.9	1.664	1.325	0.048	0.0	48	0.949
1.003	2.439	269.4	48.4	2.325	1.325	0.337	0.0	107	1.861
3.000	1.372	54.5	11.1	1.200	1.501	0.074	0.0	69	1.085
3.001	2.976	118.3	13.6	1.501	1.708	0.091	0.0	51	2.003
3.002	2.326	92.5	23.8	1.708	1.325	0.163	0.0	78	1.960
1.004	2.126	234.9	74.5	2.400	1.325	0.527	0.0	145	1.895
4.000	2.417	42.7	10.0	1.200	1.400	0.066	0.0	49	1.971
4.001	2.785	49.2	9.9	1.400	1.607	0.066	0.0	45	2.183
4.002	2.495	99.2	27.7	1.607	1.325	0.188	0.0	81	2.149
1.005	1.719	189.9	102.2	2.252	1.555	0.733	0.0	196	1.749
1.006	1.208	133.4	102.8	2.155	1.595	0.746	0.0	248	1.328
1.007	2.727	301.2	102.2	1.595	1.695	0.746	0.0	151	2.477
1.008	1.837	202.9	101.1	1.695	0.875	0.746	0.0	187	1.836

Please note: Links and manholes in this report which do not appear on the drainage layout (Dwg. C-0500-502) are for modelling purposes only and can be ignored.

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
5.000	18	19	11.163	0.600	150.550	149.750	0.800	14.0	150	5.07	41.9
5.001	19	20	30.320	0.600	149.750	148.050	1.700	17.8	150	5.28	41.3
5.002	20	21	23.650	0.600	146.250	146.100	0.150	157.7	150	5.77	40.9
1.009	21	22	16.498	0.600	144.500	144.145	0.355	46.5	375	6.90	37.2
1.010	22	26	21.218	0.600	144.145	143.825	0.320	66.3	375	7.06	36.9
6.000	23	24	21.473	0.600	145.970	145.750	0.220	97.6	150	5.35	41.1
6.001	24	25	23.723	0.600	144.640	144.400	0.240	98.8	150	5.74	40.0
6.002	25	26	4.636	0.600	144.400	143.843	0.557	8.3	150	5.77	40.0
1.011	26	27	19.567	0.600	143.120	142.571	0.549	35.6	300	7.19	36.6
1.012	27	28	28.503	0.600	142.571	142.046	0.525	54.3	300	7.41	36.2
1.013	28	29	8.958	0.600	142.046	141.945	0.101	88.7	300	7.50	36.0
1.014	29	30	13.309	0.600	141.945	141.700	0.245	54.3	300	7.60	35.8
1.015	30	31	16.578	0.600	141.000	140.910	0.090	184.2	375	7.81	35.4
1.016	31	32	22.517	0.600	140.910	140.400	0.510	44.2	300	7.97	35.1
1.017	32	33	6.707	0.600	139.400	139.200	0.200	33.5	300	8.01	35.0
1.018	33	36	19.862	0.600	139.200	138.900	0.300	66.2	300	8.18	34.7
7.000	34	35	12.104	0.600	139.580	139.460	0.120	100.9	150	5.20	41.5
7.001	35	36	5.724	0.600	138.960	138.860	0.100	57.2	150	5.27	41.3
1.019	36	47	13.637	0.600	138.300	138.200	0.100	136.4	375	8.33	34.5
8.000	37	38	4.306	0.600	151.575	151.549	0.026	165.6	300	5.06	41.9
8.001	38	39	4.932	0.600	151.549	151.519	0.030	164.4	225	5.14	41.7
8.002	39	40	5.203	0.600	142.395	142.295	0.100	52.0	225	5.19	41.6
8.003	40	41	5.002	0.600	142.295	142.180	0.115	43.5	225	5.23	41.5
8.004	41	42	24.324	0.600	142.180	141.950	0.230	105.8	225	5.55	40.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
5.000	2.711	47.9	0.3	0.600	0.600	0.002	0.0	9	0.773
5.001	2.396	42.3	2.1	0.600	0.600	0.014	0.0	23	1.245
5.002	0.798	14.1	2.3	2.400	0.800	0.016	0.0	41	0.587
1.009	2.663	294.2	102.4	2.175	1.430	0.762	0.0	152	2.430
1.010	2.228	246.0	101.6	1.430	1.200	0.762	0.0	167	2.123
6.000	1.017	18.0	3.1	1.975	0.899	0.021	0.0	42	0.767
6.001	1.011	17.9	6.8	2.009	0.900	0.047	0.0	64	0.943
6.002	3.514	62.1	7.0	0.900	1.407	0.049	0.0	34	2.329
1.011	2.642	186.7	107.8	1.980	1.675	0.815	0.0	164	2.733
1.012	2.138	151.1	112.6	1.675	1.256	0.861	0.0	194	2.335
1.013	1.670	118.0	116.4	1.256	1.285	0.894	0.0	243	1.892
1.014	2.137	151.1	115.7	1.285	1.490	0.894	0.0	197	2.346
1.015	1.331	147.1	114.4	2.115	1.912	0.894	0.0	249	1.465
1.016	2.372	167.7	118.7	1.987	1.890	0.936	0.0	187	2.564
1.017	2.724	192.5	120.6	2.890	1.000	0.953	0.0	173	2.871
1.018	1.935	136.8	134.3	1.000	1.300	1.071	0.0	243	2.192
7.000	1.000	17.7	9.0	1.200	1.900	0.060	0.0	76	1.005
7.001	1.332	23.5	8.9	2.400	1.490	0.060	0.0	64	1.243
1.019	1.549	171.1	141.0	1.825	2.325	1.131	0.0	260	1.722
8.000	1.219	86.1	25.7	1.125	1.151	0.170	0.0	112	1.069
8.001	1.017	40.4	25.6	1.226	1.256	0.170	0.0	130	1.073
8.002	1.817	72.2	25.5	10.380	0.480	0.170	0.0	92	1.661
8.003	1.989	79.1	25.5	0.480	0.608	0.170	0.0	87	1.776
8.004	1.271	50.5	24.9	0.608	0.825	0.170	0.0	111	1.265

Please note: Links and manholes in this report which do not appear on the drainage layout (Dwg. C-0500-502) are for modelling purposes only and can be ignored.

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
8.005	42	43	11.388	0.600	140.650	139.750	0.900	12.7	150	5.62	40.4
8.006	43	46	8.776	0.600	139.750	139.550	0.200	43.9	150	5.71	40.2
9.000	44	45	15.708	0.600	140.150	139.675	0.475	33.1	225	5.11	41.8
9.001	45	46	21.605	0.600	139.675	139.475	0.200	108.0	225	5.40	41.0
8.007	46	47	15.776	0.600	138.500	138.275	0.225	70.1	300	5.85	39.9
1.020	47	48	21.657	0.600	138.200	137.900	0.300	72.2	375	8.49	34.1
1.021	48	49	9.369	0.600	137.900	137.785	0.115	81.5	375	8.57	34.0
1.022	49	50	5.707	0.600	137.785	137.730	0.055	103.8	375	8.63	33.9

Please note: Links and manholes in this report which do not appear on the drainage layout (Dwg. C-0500-502) are for modelling purposes only and can be ignored.

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
8.005	2.847	50.3	24.8	2.200	1.600	0.170	0.0	74	2.833
8.006	1.523	26.9	24.7	1.600	1.300	0.170	0.0	113	1.722
9.000	2.283	90.8	10.0	0.825	1.100	0.066	0.0	51	1.520
9.001	1.257	50.0	9.8	1.100	1.300	0.066	0.0	67	0.980
8.007	1.880	132.9	38.0	2.200	2.325	0.264	0.0	109	1.628
1.020	2.134	235.7	173.9	2.325	2.645	1.411	0.0	241	2.327
1.021	2.008	221.8	173.4	2.645	2.472	1.411	0.0	250	2.211
1.022	1.778	196.4	172.9	2.472	2.421	1.411	0.0	274	1.995

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	44.259	24.5	225	Circular	156.840	155.415	1.200	155.260	153.610	1.425
1.001	6.609	19.7	225	Circular	155.260	153.610	1.425	154.965	153.274	1.466
1.002	53.901	27.9	300	Circular	154.965	153.250	1.415	152.943	151.318	1.325
2.000	31.456	63.0	225	Circular	154.547	152.843	1.479	153.694	152.344	1.125
2.001	33.645	81.7	300	FilterCarrier	153.694	151.730	1.664	152.943	151.318	1.325
1.003	33.712	55.4	375	FilterCarrier	152.943	150.243	2.325	151.334	149.634	1.325
3.000	18.719	90.9	225	Circular	153.431	152.006	1.200	153.526	151.800	1.501
3.001	6.611	19.5	225	Circular	153.526	151.800	1.501	153.394	151.461	1.708
3.002	53.397	31.8	225	Circular	153.394	151.461	1.708	151.334	149.784	1.325
1.004	33.239	72.7	375	FilterCarrier	151.334	148.559	2.400	149.802	148.102	1.325
4.000	9.186	17.5	150	Circular	152.724	151.374	1.200	152.400	150.850	1.400
4.001	6.610	13.2	150	Circular	152.400	150.850	1.400	152.107	150.350	1.607

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	6	1350	Manhole	Adoptable
2.000	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
2.001	5	1200	Manhole	Adoptable	6	1350	Manhole	Adoptable
1.003	6	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable
3.000	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
3.001	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
3.002	9	1200	Manhole	Adoptable	10	1350	Manhole	Adoptable
1.004	10	1350	Manhole	Adoptable	14	1350	Manhole	Adoptable
4.000	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
4.001	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.002	56.054	27.7	225	Circular	152.107	150.275	1.607	149.802	148.252	1.325
1.005	19.422	111.0	375	FilterCarrier	149.802	147.175	2.252	148.930	147.000	1.555
1.006	15.629	223.3	375	FilterCarrier	148.930	146.400	2.155	148.300	146.330	1.595
1.007	14.629	44.3	375	Circular	148.300	146.330	1.595	148.070	146.000	1.695
1.008	19.445	97.2	375	Circular	148.070	146.000	1.695	147.050	145.800	0.875
5.000	11.163	14.0	150	FilterCarrier	151.300	150.550	0.600	150.500	149.750	0.600
5.001	30.320	17.8	150	FilterCarrier	150.500	149.750	0.600	148.800	148.050	0.600
5.002	23.650	157.7	150	FilterCarrier	148.800	146.250	2.400	147.050	146.100	0.800
1.009	16.498	46.5	375	Circular	147.050	144.500	2.175	145.950	144.145	1.430
1.010	21.218	66.3	375	Circular	145.950	144.145	1.430	145.400	143.825	1.200
6.000	21.473	97.6	150	FilterCarrier	148.095	145.970	1.975	146.799	145.750	0.899
6.001	23.723	98.8	150	FilterCarrier	146.799	144.640	2.009	145.450	144.400	0.900
6.002	4.636	8.3	150	Circular	145.450	144.400	0.900	145.400	143.843	1.407
1.011	19.567	35.6	300	Circular	145.400	143.120	1.980	144.546	142.571	1.675
1.012	28.503	54.3	300	Circular	144.546	142.571	1.675	143.602	142.046	1.256
1.013	8.958	88.7	300	Circular	143.602	142.046	1.256	143.530	141.945	1.285
1.014	13.309	54.3	300	Circular	143.530	141.945	1.285	143.490	141.700	1.490
1.015	16.578	184.2	375	Circular	143.490	141.000	2.115	143.197	140.910	1.912
1.016	22.517	44.2	300	Circular	143.197	140.910	1.987	142.590	140.400	1.890
1.017	6.707	33.5	300	Circular	142.590	139.400	2.890	140.500	139.200	1.000
1.018	19.862	66.2	300	Circular	140.500	139.200	1.000	140.500	138.900	1.300
7.000	12.104	100.9	150	Circular	140.930	139.580	1.200	141.510	139.460	1.900
7.001	5.724	57.2	150	Circular	141.510	138.960	2.400	140.500	138.860	1.490
1.019	13.637	136.4	375	Circular	140.500	138.300	1.825	140.900	138.200	2.325
8.000	4.306	165.6	300	Circular	153.000	151.575	1.125	153.000	151.549	1.151

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.002	13	1200	Manhole	Adoptable	14	1350	Manhole	Adoptable
1.005	14	1350	Manhole	Adoptable	15	1350	Manhole	Adoptable
1.006	15	1350	Manhole	Adoptable	16	1350	Manhole	Adoptable
1.007	16	1350	Manhole	Adoptable	17	1350	Manhole	Adoptable
1.008	17	1350	Manhole	Adoptable	21	1500	Manhole	Adoptable
5.000	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
5.001	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
5.002	20	1200	Manhole	Adoptable	21	1500	Manhole	Adoptable
1.009	21	1500	Manhole	Adoptable	22	1350	Manhole	Adoptable
1.010	22	1350	Manhole	Adoptable	26	1350	Manhole	Adoptable
6.000	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
6.001	24	1200	Manhole	Adoptable	25	1200	Manhole	Adoptable
6.002	25	1200	Manhole	Adoptable	26	1350	Manhole	Adoptable
1.011	26	1350	Manhole	Adoptable	27	1200	Manhole	Adoptable
1.012	27	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
1.013	28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
1.014	29	1200	Manhole	Adoptable	30	1350	Manhole	Adoptable
1.015	30	1350	Manhole	Adoptable	31	1350	Manhole	Adoptable
1.016	31	1350	Manhole	Adoptable	32	1200	Manhole	Adoptable
1.017	32	1200	Manhole	Adoptable	33	1200	Manhole	Adoptable
1.018	33	1200	Manhole	Adoptable	36	1350	Manhole	Adoptable
7.000	34	1200	Manhole	Adoptable	35	1200	Manhole	Adoptable
7.001	35	1200	Manhole	Adoptable	36	1350	Manhole	Adoptable
1.019	36	1350	Manhole	Adoptable	47	1350	Manhole	Adoptable
8.000	37	10	Manhole	Adoptable	38	10	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
8.001	4.932	164.4	225	Circular	153.000	151.549	1.226	153.000	151.519	1.256
8.002	5.203	52.0	225	Circular	153.000	142.395	10.380	143.000	142.295	0.480
8.003	5.002	43.5	225	Circular	143.000	142.295	0.480	143.013	142.180	0.608
8.004	24.324	105.8	225	FilterCarrier	143.013	142.180	0.608	143.000	141.950	0.825
8.005	11.388	12.7	150	Circular	143.000	140.650	2.200	141.500	139.750	1.600
8.006	8.776	43.9	150	Circular	141.500	139.750	1.600	141.000	139.550	1.300
9.000	15.708	33.1	225	FilterCarrier	141.200	140.150	0.825	141.000	139.675	1.100
9.001	21.605	108.0	225	Circular	141.000	139.675	1.100	141.000	139.475	1.300
8.007	15.776	70.1	300	Circular	141.000	138.500	2.200	140.900	138.275	2.325
1.020	21.657	72.2	375	Circular	140.900	138.200	2.325	140.920	137.900	2.645
1.021	9.369	81.5	375	Circular	140.920	137.900	2.645	140.632	137.785	2.472
1.022	5.707	103.8	375	Circular	140.632	137.785	2.472	140.526	137.730	2.421

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
8.001	38	10	Manhole	Adoptable	39	10	Manhole	Adoptable
8.002	39	10	Manhole	Adoptable	40	10	Manhole	Adoptable
8.003	40	10	Manhole	Adoptable	41	1200	Manhole	Adoptable
8.004	41	1200	Manhole	Adoptable	42	1200	Manhole	Adoptable
8.005	42	1200	Manhole	Adoptable	43	1200	Manhole	Adoptable
8.006	43	1200	Manhole	Adoptable	46	1200	Manhole	Adoptable
9.000	44	1200	Manhole	Adoptable	45	1200	Manhole	Adoptable
9.001	45	1200	Manhole	Adoptable	46	1200	Manhole	Adoptable
8.007	46	1200	Manhole	Adoptable	47	1350	Manhole	Adoptable
1.020	47	1350	Manhole	Adoptable	48	1350	Manhole	Adoptable
1.021	48	1350	Manhole	Adoptable	49	1350	Manhole	Adoptable
1.022	49	1350	Manhole	Adoptable	50	1350	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	717522.859	725200.948	156.840	1.425	1200	 0	1.000	155.415	225
2	717534.607	725158.277	155.260	1.650	1200	 1	1.000	153.610	225
						0	1.001	153.610	225
3	717538.552	725152.974	154.965	1.715	1200	 1	1.001	153.274	225
						0	1.002	153.250	300
4	717530.875	725120.254	154.547	1.704	1200	 0	2.000	152.843	225
5	717557.418	725103.373	153.694	1.964	1200	 1	2.000	152.344	225
						0	2.001	151.730	300

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	717584.001	725123.996	152.943	2.700	1350	1	2.001	151.318	300
						2	1.002	151.318	300
						0	1.003	150.243	375
7	717556.388	725196.229	153.431	1.425	1200	0	3.000	152.006	225
8	717561.359	725178.182	153.526	1.726	1200	1	3.000	151.800	225
						0	3.001	151.800	225
9	717565.305	725172.878	153.394	1.933	1200	1	3.001	151.461	225
						0	3.002	151.461	225
10	717610.637	725144.660	151.334	2.775	1350	1	3.002	149.784	225
						2	1.003	149.634	375
						0	1.004	148.559	375
11	717582.933	725208.468	152.724	1.350	1200	0	4.000	151.374	150
12	717585.398	725199.619	152.400	1.550	1200	1	4.000	150.850	150
						0	4.001	150.850	150
13	717589.524	725194.455	152.107	1.832	1200	1	4.001	150.350	150
						0	4.002	150.275	225
14	717637.086	725164.792	149.802	2.627	1350	1	4.002	148.252	225
						2	1.004	148.102	375
						0	1.005	147.175	375
15	717650.074	725179.233	148.930	2.530	1350	1	1.005	147.000	375
						0	1.006	146.400	375
16	717654.943	725194.084	148.300	1.970	1350	1	1.006	146.330	375
						0	1.007	146.330	375
17	717641.811	725200.531	148.070	2.670	1350	1	1.007	146.000	375
						0	1.008	146.000	375
18	717604.442	725226.996	151.300	0.750	1200	0	5.000	150.550	150

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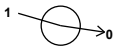
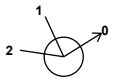
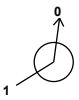
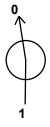
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
19	717607.502	725216.261	150.500	0.750	1200	 1	5.000	149.750	150
						0	5.001	149.750	150
20	717633.063	725199.954	148.800	3.150	1200	 1	5.001	148.050	150
						0	5.002	146.250	150
21	717646.530	725219.395	147.050	2.550	1500	1	5.002	146.100	150
						 2	1.008	145.800	375
						0	1.009	144.500	375
22	717662.372	725214.789	145.950	2.405	1350	1	1.009	144.145	375
									
						0	1.010	144.145	375
23	717651.436	725199.764	148.095	2.125	1200				
						0	6.000	145.970	150
24	717658.089	725220.180	146.799	2.159	1200	1	6.000	145.750	150
									
						0	6.001	144.640	150
25	717681.420	725215.887	145.450	1.050	1200	1	6.001	144.400	150
									
						0	6.002	144.400	150
26	717683.360	725211.676	145.400	2.280	1350	1	6.002	143.843	150
						 2	1.010	143.825	375
						0	1.011	143.120	300
27	717699.968	725222.022	144.546	1.975	1200	1	1.011	142.571	300
									
						0	1.012	142.571	300
28	717703.744	725250.274	143.602	1.556	1200	1	1.012	142.046	300
									
						0	1.013	142.046	300
29	717696.395	725255.396	143.530	2.185	1200	1	1.013	141.945	300
									
						0	1.014	141.945	300
30	717689.610	725266.846	143.490	2.490	1350	1	1.014	141.700	300
									
						0	1.015	141.000	375
31	717689.813	725283.423	143.197	2.287	1350	1	1.015	140.910	375
									
						0	1.016	140.910	300

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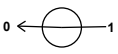
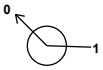
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
32	717686.336	725305.670	142.590	3.190	1200	 1	1.016	140.400	300
						0	1.017	139.400	300
33	717692.280	725308.776	140.500	1.900	1200	 1	1.017	139.200	300
						0	1.018	139.200	300
34	717670.447	725335.451	140.930	1.350	1200	 0	7.000	139.580	150
35	717671.554	725323.398	141.510	3.150	1200	 1	7.000	139.460	150
						0	7.001	138.960	150
36	717676.894	725321.336	140.500	2.200	1350	1	7.001	138.860	150
						 2	1.018	138.900	300
						0	1.019	138.300	375
37	717660.726	725266.335	153.000	1.425	10	 0	8.000	151.575	300
38	717656.421	725266.257	153.000	1.451	10	 1	8.000	151.549	300
						0	8.001	151.549	225
39	717651.491	725266.413	153.000	10.605	10	 1	8.001	151.519	225
						0	8.002	142.395	225
40	717647.812	725270.092	143.000	0.705	10	 1	8.002	142.295	225
						0	8.003	142.295	225
41	717647.016	725275.030	143.013	0.833	1200	 1	8.003	142.180	225
						0	8.004	142.180	225
42	717642.675	725298.964	143.000	2.350	1200	 1	8.004	141.950	225
						0	8.005	140.650	150
43	717640.956	725310.222	141.500	2.350	1200	 1	8.005	139.750	150
						0	8.006	139.750	150
44	717622.576	725330.349	141.200	1.050	1200	 0	9.000	140.150	225

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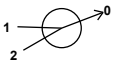
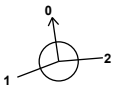
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
45	717626.967	725315.267	141.000	1.925	1200	 1	9.000	139.675	225
						0	9.001	139.675	225
46	717648.562	725314.601	141.000	2.500	1200	1	9.001	139.475	225
						 2	8.006	139.550	150
						0	8.007	138.500	300
47	717663.303	725320.220	140.900	2.700	1350	 1	8.007	138.275	300
						2	1.019	138.200	375
						0	1.020	138.200	375
48	717660.171	725341.649	140.920	3.020	1350	1	1.020	137.900	375
						 0	1.021	137.900	375
49	717669.288	725343.809	140.632	2.847	1350	 1	1.021	137.785	375
						0	1.022	137.785	375
50	717668.211	725349.413	140.526	2.796	1350	 1	1.022	137.730	375

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	360
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	0.0
M5-60 (mm)	17.300	Check Discharge Rate(s)	✓
Ratio-R	0.270	1 year (l/s)	5.9
Summer CV	1.000	30 year (l/s)	11.7
Winter CV	1.000	100 year (l/s)	13.9
Analysis Speed	Detailed	Check Discharge Volume	✓
Skip Steady State	x	100 year +20% 360 minute (m³)	516

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	20	10	0
30	20	10	0
100	20	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.37
Greenfield Method	IH124	Region	11
Positively Drained Area (ha)	1.691	Growth Factor 1 year	0.83
SAAR (mm)	965	Growth Factor 30 year	1.65
Soil Index	3	Growth Factor 100 year	1.96

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Pre-development Discharge Rate

Betterment (%)	0	Q 30 year (l/s)	11.7
QBar	7.1	Q 100 year (l/s)	13.9
Q 1 year (l/s)	5.9		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	20
Positively Drained Area (ha)	1.691	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.37	PR	0.421
CWI	124.913	Runoff Volume (m^3)	516

Node 6 Online Orifice Control

Flap Valve	x	Invert Level (m)	150.243	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.190		

Node 10 Online Orifice Control

Flap Valve	x	Invert Level (m)	148.559	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.230		

Node 14 Online Orifice Control

Flap Valve	x	Invert Level (m)	147.175	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.325		

Node 15 Online Orifice Control

Flap Valve	x	Invert Level (m)	146.400	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.325		

Node 16 Online Orifice Control

Flap Valve	x	Invert Level (m)	146.330	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.275		

Node 19 Online Orifice Control

Flap Valve	x	Invert Level (m)	149.750	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

Node 20 Online Orifice Control

Flap Valve	x	Invert Level (m)	146.250	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

Node 42 Online Orifice Control

Flap Valve	x	Invert Level (m)	140.650	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

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Node 45 Online Orifice Control

Flap Valve	x	Invert Level (m)	139.675	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.120		

Node 21 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	144.500	Product Number	CTL-SHE-0144-1340-2500-1340
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.4	Min Node Diameter (mm)	1500

Node 26 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	143.120	Product Number	CTL-SHE-0105-6500-2000-6500
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.5	Min Node Diameter (mm)	1200

Node 30 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	141.000	Product Number	CTL-SHE-0099-6400-2450-6400
Design Depth (m)	2.450	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.4	Min Node Diameter (mm)	1200

Node 38 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.300	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.9		
Invert Level (m)	151.549	Diameter (m)	0.028		

Node 46 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	138.500	Product Number	CTL-SHE-0050-1700-2500-1700
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.7	Min Node Diameter (mm)	1200

Node 47 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	138.200	Product Number	CTL-SHE-0114-7100-1700-7100
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.1	Min Node Diameter (mm)	1200

Node 24 Online Orifice Control

Flap Valve	x	Invert Level (m)	144.640	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

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Node 25 Online Orifice Control

Flap Valve	x	Invert Level (m)	144.400	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

Node 17 Online Orifice Control

Flap Valve	x	Invert Level (m)	146.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.375		

Node 22 Online Orifice Control

Flap Valve	x	Invert Level (m)	144.145	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.375		

Node 29 Online Orifice Control

Flap Valve	x	Invert Level (m)	141.945	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.300		

Node 28 Online Orifice Control

Flap Valve	x	Invert Level (m)	142.046	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.300		

Node 46 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	138.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	88.0	0.0	1.500	88.0	0.0	1.501	0.0	0.0

Node 26 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	143.120
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	306.3	0.0	1.500	306.3	0.0	1.501	0.0	0.0

Node 21 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	145.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	324

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	249.8	0.0	1.500	249.8	0.0	1.501	0.0	0.0

Node 30 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	141.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	

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Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	118.4	0.0	1.500	118.4	0.0	1.501	0.0	0.0

Node 36 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	138.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	165.7	0.0	1.500	165.7	0.0	1.501	0.0	0.0

Node 6 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	2.001
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	151.318	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	9	Diameter (mm)	900

Node 10 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.003
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	149.634	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	10	Diameter (mm)	900

Node 14 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.004
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	148.102	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	11	Diameter (mm)	900

Node 15 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.005
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	147.000	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	12	Diameter (mm)	900

Node 16 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.006
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	146.330	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	12	Diameter (mm)	900

Node 24 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	6.000
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	145.750	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	26	Diameter (mm)	900

Node 25 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	6.001
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	144.400	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	900

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Node 19 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	5.000
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	149.750	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	13	Diameter (mm)	900

Node 20 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	5.001
Side Inf Coefficient (m/hr)	0.05760	Invert Level (m)	148.050	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	0	Diameter (mm)	900

Node 42 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	8.004
Side Inf Coefficient (m/hr)	0.01490	Invert Level (m)	141.950	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	0	Diameter (mm)	900

Node 45 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	9.000
Side Inf Coefficient (m/hr)	0.01490	Invert Level (m)	139.675	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	7	Diameter (mm)	900

Node 38 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	151.549
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1157.0	0.0	0.400	1157.0	0.0	0.401	0.0	0.0

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Results for 5 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	155.511	0.096	40.6	0.1086	0.0000	OK
15 minute summer	2	10	153.725	0.115	46.7	0.1297	0.0000	OK
15 minute summer	3	10	153.376	0.126	78.1	0.1423	0.0000	OK
15 minute summer	4	10	152.902	0.059	9.8	0.0671	0.0000	OK
15 minute summer	5	10	151.798	0.068	14.1	0.0765	0.0000	OK
15 minute summer	6	12	151.587	1.344	101.2	2.5942	0.0000	SURCHARGED
15 minute summer	7	10	152.113	0.107	22.3	0.1215	0.0000	OK
15 minute summer	8	10	151.878	0.078	27.2	0.0877	0.0000	OK
15 minute summer	9	10	151.579	0.118	48.9	0.1331	0.0000	OK
15 minute summer	10	12	150.052	1.493	138.7	3.2093	0.0000	SURCHARGED
15 minute summer	11	10	151.452	0.078	19.8	0.0883	0.0000	OK
15 minute summer	12	10	150.924	0.074	19.7	0.0834	0.0000	OK
15 minute summer	13	10	150.399	0.124	56.5	0.1401	0.0000	OK
15 minute summer	14	13	148.516	1.341	188.8	3.3037	0.0000	SURCHARGED
30 minute summer	15	22	147.983	1.583	173.2	6.9930	0.0000	SURCHARGED
30 minute summer	16	22	147.470	1.139	159.7	6.4640	0.0000	SURCHARGED
30 minute summer	17	22	146.475	0.475	157.5	0.6798	0.0000	SURCHARGED
15 minute summer	18	10	150.563	0.013	0.7	0.0142	0.0000	OK
30 minute summer	19	20	150.028	0.278	3.9	0.4732	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	40.3	2.214	0.383	0.8070	
15 minute summer	2	1.001	3	46.2	2.460	0.392	0.1248	
15 minute summer	3	1.002	6	78.8	2.640	0.373	2.4563	
15 minute summer	4	2.000	5	9.6	1.173	0.147	0.2582	
15 minute summer	5	2.001	6	14.0	1.089	0.113	1.3026	
15 minute summer	6	Orifice	10	84.2				
15 minute summer	6	Infiltration		0.1				
15 minute summer	7	3.000	8	22.1	1.442	0.406	0.2882	
15 minute summer	8	3.001	9	27.1	1.662	0.229	0.1095	
15 minute summer	9	3.002	10	49.6	2.248	0.536	1.5983	
15 minute summer	10	Orifice	14	129.6				
15 minute summer	10	Infiltration		0.1				
15 minute summer	11	4.000	12	19.7	2.208	0.462	0.0821	
15 minute summer	12	4.001	13	19.6	2.446	0.399	0.0531	
15 minute summer	13	4.002	14	56.2	2.539	0.567	1.6401	
15 minute summer	14	Orifice	15	172.2				
15 minute summer	14	Infiltration		0.1				
15 minute summer	15	Orifice	16	160.2				
30 minute summer	15	Infiltration		0.3				
30 minute summer	16	Orifice	17	157.5				
30 minute summer	16	Infiltration		0.3				
30 minute summer	17	Orifice	21	157.4				
15 minute summer	18	5.000	19	0.7	0.074	0.014	0.1022	
30 minute summer	19	Orifice	20	2.6				
30 minute summer	19	Infiltration		0.0				

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Results for 5 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	20	22	146.533	0.283	2.9	0.3196	0.0000	SURCHARGED
240 minute summer	21	184	145.618	1.118	75.1	150.1864	0.0000	SURCHARGED
15 minute summer	22	91	144.224	0.079	12.4	0.1137	0.0000	OK
15 minute summer	23	10	146.031	0.061	6.3	0.0693	0.0000	OK
30 minute summer	24	22	146.025	1.385	13.2	2.5949	0.0000	SURCHARGED
60 minute summer	25	49	144.928	0.528	6.1	3.5028	0.0000	SURCHARGED
1440 minute summer	26	1110	144.066	0.946	14.0	279.6029	0.0000	SURCHARGED
15 minute summer	27	10	142.632	0.061	14.0	0.0690	0.0000	OK
2880 minute winter	28	2820	142.393	0.347	6.7	0.3919	0.0000	SURCHARGED
2880 minute winter	29	2820	142.391	0.446	6.7	0.5045	0.0000	SURCHARGED
2880 minute winter	30	2820	142.390	1.390	6.7	159.9547	0.0000	SURCHARGED
30 minute summer	31	18	140.968	0.058	13.2	0.0832	0.0000	OK
15 minute summer	32	11	139.466	0.066	18.2	0.0744	0.0000	OK
15 minute summer	33	10	139.340	0.140	53.6	0.1579	0.0000	OK
15 minute summer	34	10	139.722	0.142	18.1	0.1604	0.0000	OK
15 minute summer	35	11	139.072	0.112	17.6	0.1271	0.0000	OK
1440 minute summer	36	1140	138.943	0.643	12.5	103.1292	0.0000	SURCHARGED
15 minute winter	37	7	152.316	0.741	48.0	0.0000	0.0000	SURCHARGED
4320 minute summer	38	2820	151.754	0.205	2.6	94.7623	0.0000	OK
4320 minute summer	39	2820	142.411	0.016	0.7	0.0000	0.0000	OK
4320 minute summer	40	2820	142.310	0.015	0.7	0.0000	0.0000	OK
4320 minute summer	41	2820	142.199	0.019	0.7	0.0213	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	20	Orifice	21	2.6				
15 minute summer	20	Infiltration		0.0				
15 minute summer	21	Hydro-Brake®	22	12.4				
15 minute summer	22	Orifice	26	12.4				
15 minute summer	23	6.000	24	6.3	0.880	0.352	0.2594	
15 minute summer	24	Orifice	25	6.0				
30 minute summer	24	Infiltration		0.1				
60 minute summer	25	Orifice	26	3.7				
60 minute summer	25	Infiltration		0.2				
120 minute summer	26	Hydro-Brake®	27	5.7				
15 minute summer	27	1.012	28	13.9	0.798	0.092	0.6311	
15 minute summer	28	Orifice	29	23.4				
15 minute summer	29	Orifice	30	23.5				
180 minute summer	30	Hydro-Brake®	31	5.0				
30 minute summer	31	1.016	32	13.1	1.403	0.078	0.2107	
15 minute summer	32	1.017	33	18.2	0.985	0.094	0.1457	
15 minute summer	33	1.018	36	53.0	1.744	0.388	0.6046	
15 minute summer	34	7.000	35	17.6	1.090	0.995	0.1974	
15 minute summer	35	7.001	36	17.7	1.347	0.750	0.0749	
30 minute winter	36	1.019	47	20.0	0.512	0.117	1.2335	
15 minute summer	37	8.000	38	52.3	1.973	0.608	0.1548	
4320 minute summer	38	Orifice	39	0.7				
4320 minute summer	39	8.002	40	0.7	0.588	0.010	0.0063	
4320 minute summer	40	8.003	41	0.7	0.524	0.009	0.0068	
4320 minute summer	41	8.004	42	0.7	0.456	0.014	0.0382	

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Results for 5 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	42	2820	140.695	0.045	0.7	0.0514	0.0000	OK
4320 minute summer	43	2820	139.767	0.017	0.7	0.0194	0.0000	OK
15 minute summer	44	10	140.221	0.071	19.9	0.0805	0.0000	OK
15 minute summer	45	12	140.042	0.367	19.8	1.0340	0.0000	SURCHARGED
2880 minute summer	46	2400	139.067	0.567	2.4	48.5287	0.0000	SURCHARGED
1440 minute summer	47	1140	138.942	0.742	20.2	1.0623	0.0000	SURCHARGED
180 minute winter	48	136	137.947	0.047	7.0	0.0674	0.0000	OK
180 minute summer	49	136	137.837	0.052	7.0	0.0741	0.0000	OK
180 minute summer	50	136	137.778	0.048	7.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
4320 minute summer	42	Orifice	43	0.7				
15 minute summer	42	Infiltration		0.0				
4320 minute summer	43	8.006	46	0.7	0.651	0.027	0.0096	
15 minute summer	44	9.000	45	19.8	0.934	0.218	0.3968	
15 minute summer	45	Orifice	46	16.7				
15 minute summer	45	Infiltration		0.0				
1440 minute summer	46	Hydro-Brake®	47	1.0				
180 minute summer	47	Hydro-Brake®	48	7.0				
180 minute winter	48	1.021	49	7.0	0.825	0.032	0.0802	
180 minute winter	49	1.022	50	7.0	0.813	0.036	0.0495	206.6

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Results for 30 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	155.535	0.120	59.6	0.1356	0.0000	OK
15 minute summer	2	10	153.760	0.150	68.6	0.1698	0.0000	OK
15 minute summer	3	10	153.406	0.156	114.8	0.1760	0.0000	OK
15 minute summer	4	10	152.916	0.073	14.4	0.0822	0.0000	OK
15 minute summer	5	13	152.157	0.426	27.7	0.4823	0.0000	SURCHARGED
15 minute summer	6	13	152.121	1.878	147.0	8.1806	0.0000	SURCHARGED
15 minute summer	7	10	152.141	0.135	32.7	0.1529	0.0000	OK
15 minute summer	8	10	151.899	0.099	40.0	0.1124	0.0000	OK
15 minute summer	9	11	151.611	0.150	71.7	0.1699	0.0000	OK
30 minute summer	10	21	150.613	2.054	172.4	8.8051	0.0000	SURCHARGED
15 minute summer	11	10	151.476	0.102	29.1	0.1148	0.0000	OK
15 minute summer	12	10	150.946	0.096	29.0	0.1082	0.0000	OK
15 minute summer	13	10	150.430	0.155	82.9	0.1757	0.0000	OK
30 minute summer	14	21	149.055	1.880	224.3	8.9937	0.0000	SURCHARGED
30 minute summer	15	23	148.407	2.006	191.8	10.1912	0.0000	SURCHARGED
30 minute summer	16	23	147.772	1.442	178.2	8.3900	0.0000	SURCHARGED
30 minute summer	17	23	146.543	0.543	175.1	0.7770	0.0000	SURCHARGED
15 minute summer	18	10	150.565	0.015	1.0	0.0169	0.0000	OK
30 minute summer	19	21	150.189	0.439	5.8	0.9018	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	59.2	2.383	0.562	1.0985	
15 minute summer	2	1.001	3	68.0	2.602	0.577	0.1727	
15 minute summer	3	1.002	6	114.2	2.669	0.541	2.8923	
15 minute summer	4	2.000	5	14.1	1.303	0.216	0.3413	
30 minute summer	5	2.001	6	24.1	1.089	0.196	2.3693	
15 minute summer	6	Orifice	10	94.1				
15 minute summer	6	Infiltration		0.3				
15 minute summer	7	3.000	8	32.5	1.553	0.595	0.3913	
15 minute summer	8	3.001	9	39.8	1.790	0.336	0.1473	
15 minute summer	9	3.002	10	71.1	2.269	0.769	1.8138	
15 minute summer	10	Orifice	14	139.5				
30 minute summer	10	Infiltration		0.4				
15 minute summer	11	4.000	12	29.0	2.362	0.679	0.1127	
15 minute summer	12	4.001	13	28.8	2.646	0.586	0.0720	
15 minute summer	13	4.002	14	82.5	2.682	0.831	1.9341	
15 minute summer	14	Orifice	15	187.7				
30 minute summer	14	Infiltration		0.4				
30 minute summer	15	Orifice	16	178.2				
30 minute summer	15	Infiltration		0.4				
30 minute summer	16	Orifice	17	175.1				
30 minute summer	16	Infiltration		0.4				
30 minute summer	17	Orifice	21	175.0				
15 minute summer	18	5.000	19	1.0	0.093	0.020	0.1033	
30 minute summer	19	Orifice	20	3.4				
30 minute summer	19	Infiltration		0.0				

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Results for 30 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	20	23	146.695	0.445	3.8	0.5035	0.0000	SURCHARGED
240 minute winter	21	232	146.098	1.598	73.2	266.1515	0.0000	SURCHARGED
1440 minute winter	22	1320	144.568	0.423	12.4	0.6056	0.0000	SURCHARGED
30 minute summer	23	22	146.305	0.334	8.8	0.3783	0.0000	SURCHARGED
30 minute summer	24	23	146.299	1.659	19.2	4.7140	0.0000	SURCHARGED
60 minute summer	25	61	145.091	0.691	6.6	4.9054	0.0000	SURCHARGED
1440 minute winter	26	1320	144.567	1.447	13.8	427.4120	0.0000	SURCHARGED
7200 minute winter	27	4920	143.110	0.539	6.1	0.6092	0.0000	SURCHARGED
7200 minute winter	28	4920	143.109	1.063	6.4	1.2022	0.0000	SURCHARGED
7200 minute winter	29	4920	143.106	1.161	6.4	1.3132	0.0000	SURCHARGED
7200 minute winter	30	4920	143.103	2.103	8.0	173.5627	0.0000	SURCHARGED
30 minute summer	31	18	140.982	0.072	20.0	0.1031	0.0000	OK
4320 minute summer	32	4440	139.509	0.108	6.2	0.1227	0.0000	OK
4320 minute summer	33	4500	139.525	0.325	16.0	0.3677	0.0000	SURCHARGED
15 minute summer	34	10	139.918	0.338	26.5	0.3820	0.0000	SURCHARGED
4320 minute summer	35	4440	139.486	0.526	1.2	0.5944	0.0000	SURCHARGED
4320 minute summer	36	4440	139.486	1.186	14.7	190.3141	0.0000	SURCHARGED
15 minute winter	37	6	152.455	0.880	70.4	0.0000	0.0000	SURCHARGED
2880 minute summer	38	2040	151.830	0.281	4.5	129.9224	0.0000	SURCHARGED
2880 minute summer	39	2040	142.413	0.018	0.8	0.0000	0.0000	OK
2880 minute summer	40	2040	142.312	0.016	0.8	0.0000	0.0000	OK
2880 minute summer	41	2040	142.200	0.020	0.8	0.0231	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	20	Orifice	21	3.4				
15 minute summer	20	Infiltration		0.0				
15 minute summer	21	Hydro-Brake®	22	12.4				
1440 minute winter	22	Orifice	26	12.7				
15 minute summer	23	6.000	24	8.8	0.895	0.491	0.3780	
15 minute summer	24	Orifice	25	6.4				
30 minute summer	24	Infiltration		0.2				
60 minute summer	25	Orifice	26	4.3				
60 minute summer	25	Infiltration		0.2				
60 minute summer	26	Hydro-Brake®	27	5.7				
15 minute summer	27	1.012	28	20.4	0.803	0.135	0.8874	
15 minute summer	28	Orifice	29	34.3				
15 minute summer	29	Orifice	30	34.4				
7200 minute winter	30	Hydro-Brake®	31	6.0				
30 minute summer	31	1.016	32	19.9	1.576	0.119	0.2844	
30 minute summer	32	1.017	33	27.2	1.010	0.141	0.1962	
15 minute summer	33	1.018	36	78.1	1.905	0.571	0.8151	
15 minute summer	34	7.000	35	25.7	1.462	1.457	0.2099	
15 minute summer	35	7.001	36	25.9	1.471	1.100	0.0993	
15 minute summer	36	1.019	47	19.5	0.437	0.114	1.3295	
15 minute summer	37	8.000	38	76.8	2.189	0.892	0.1610	
2880 minute summer	38	Orifice	39	0.8				
2880 minute summer	39	8.002	40	0.8	0.619	0.012	0.0071	
2880 minute summer	40	8.003	41	0.8	0.553	0.011	0.0077	
2880 minute summer	41	8.004	42	0.8	0.480	0.017	0.0429	

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Results for 30 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	42	2040	140.701	0.051	0.8	0.0579	0.0000	OK
2880 minute summer	43	2040	139.769	0.019	0.8	0.0210	0.0000	OK
15 minute summer	44	12	140.268	0.118	29.2	0.1333	0.0000	OK
15 minute summer	45	12	140.252	0.577	29.1	2.1772	0.0000	SURCHARGED
2880 minute summer	46	2940	139.557	1.056	3.1	90.4441	0.0000	SURCHARGED
4320 minute summer	47	4500	139.486	1.286	17.4	1.8396	0.0000	SURCHARGED
600 minute summer	48	300	137.947	0.047	7.0	0.0674	0.0000	OK
60 minute summer	49	214	137.837	0.052	7.0	0.0741	0.0000	OK
60 minute summer	50	214	137.778	0.048	7.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute summer	42	Orifice	43	0.8				
15 minute summer	42	Infiltration		0.0				
2880 minute summer	43	8.006	46	0.8	0.684	0.031	0.0108	
15 minute summer	44	9.000	45	29.1	0.958	0.320	0.4777	
15 minute summer	45	Orifice	46	21.6				
15 minute summer	45	Infiltration		0.0				
7200 minute summer	46	Hydro-Brake®	47	1.0				
60 minute summer	47	Hydro-Brake®	48	7.0				
600 minute summer	48	1.021	49	7.0	0.825	0.032	0.0802	
60 minute summer	49	1.022	50	7.0	0.813	0.036	0.0495	170.0

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Results for 100 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	155.557	0.142	77.3	0.1601	0.0000	OK
15 minute summer	2	10	153.798	0.188	89.1	0.2125	0.0000	OK
30 minute summer	3	19	153.465	0.215	142.9	0.2433	0.0000	OK
15 minute summer	4	10	152.927	0.084	18.7	0.0948	0.0000	OK
30 minute summer	5	22	152.869	1.139	39.1	1.2886	0.0000	SURCHARGED
30 minute summer	6	21	152.874	2.631	167.8	17.2418	0.0000	FLOOD RISK
15 minute summer	7	12	152.317	0.311	42.5	0.3520	0.0000	SURCHARGED
15 minute summer	8	12	152.219	0.419	51.9	0.4743	0.0000	SURCHARGED
15 minute summer	9	12	152.149	0.688	87.5	0.7782	0.0000	SURCHARGED
30 minute summer	10	22	151.302	2.743	192.3	17.0989	0.0000	FLOOD RISK
15 minute summer	11	12	151.782	0.408	37.7	0.4617	0.0000	SURCHARGED
15 minute summer	12	12	151.403	0.553	36.1	0.6257	0.0000	SURCHARGED
15 minute summer	13	12	151.093	0.818	101.8	0.9254	0.0000	SURCHARGED
30 minute summer	14	22	149.614	2.439	239.5	15.6391	0.0000	FLOOD RISK
30 minute summer	15	23	148.821	2.421	207.9	13.3222	0.0000	FLOOD RISK
30 minute summer	16	24	148.064	1.734	194.7	10.2427	0.0000	FLOOD RISK
240 minute winter	17	232	146.997	0.997	91.0	1.4266	0.0000	SURCHARGED
15 minute summer	18	10	150.567	0.017	1.3	0.0192	0.0000	OK
30 minute summer	19	21	150.332	0.582	7.6	1.3787	0.0000	FLOOD RISK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	76.9	2.476	0.729	1.3662	
15 minute summer	2	1.001	3	88.2	2.649	0.749	0.2332	
15 minute summer	3	1.002	6	146.1	2.684	0.692	3.3469	
15 minute summer	4	2.000	5	18.4	1.399	0.281	0.8020	
15 minute winter	5	2.001	6	30.7	1.079	0.249	2.3693	
15 minute summer	6	Orifice	10	98.0				
30 minute summer	6	Infiltration		0.7				
15 minute summer	7	3.000	8	42.2	1.595	0.774	0.7445	
30 minute summer	8	3.001	9	48.5	1.811	0.409	0.2629	
30 minute summer	9	3.002	10	83.1	2.222	0.898	2.1237	
15 minute summer	10	Orifice	14	145.0				
30 minute summer	10	Infiltration		0.7				
15 minute summer	11	4.000	12	36.1	2.441	0.845	0.1617	
15 minute summer	12	4.001	13	35.3	2.608	0.717	0.1164	
15 minute summer	13	4.002	14	99.0	2.649	0.998	2.2293	
30 minute summer	14	Orifice	15	202.8				
30 minute summer	14	Infiltration		0.7				
30 minute summer	15	Orifice	16	194.7				
30 minute summer	15	Infiltration		0.5				
30 minute summer	16	Orifice	17	190.5				
30 minute summer	16	Infiltration		0.4				
30 minute summer	17	Orifice	21	190.5				
15 minute summer	18	5.000	19	1.3	0.115	0.027	0.1044	
30 minute summer	19	Orifice	20	3.9				
30 minute summer	19	Infiltration		0.0				

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Results for 100 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	20	232	146.996	0.746	1.9	0.8436	0.0000	SURCHARGED
240 minute winter	21	232	146.994	2.494	92.9	364.3582	0.0000	FLOOD RISK
1440 minute winter	22	1440	145.372	1.227	12.4	1.7565	0.0000	SURCHARGED
30 minute summer	23	23	146.596	0.626	11.5	0.7080	0.0000	SURCHARGED
30 minute summer	24	23	146.588	1.948	23.2	6.9949	0.0000	FLOOD RISK
1440 minute winter	25	1470	145.345	0.945	2.7	7.0850	0.0000	FLOOD RISK
1440 minute winter	26	1440	145.369	2.249	14.1	444.4366	0.0000	FLOOD RISK
2160 minute winter	27	1980	143.421	0.850	7.1	0.9609	0.0000	SURCHARGED
2160 minute winter	28	1980	143.420	1.374	7.6	1.5538	0.0000	FLOOD RISK
2160 minute winter	29	1980	143.417	1.472	11.7	1.6644	0.0000	FLOOD RISK
2160 minute winter	30	1980	143.414	2.414	10.2	174.0066	0.0000	FLOOD RISK
30 minute summer	31	18	140.993	0.083	26.1	0.1185	0.0000	OK
2880 minute winter	32	2820	139.955	0.555	7.5	0.6279	0.0000	SURCHARGED
2880 minute winter	33	2820	139.955	0.755	16.3	0.8537	0.0000	SURCHARGED
15 minute summer	34	11	140.133	0.553	34.4	0.6250	0.0000	SURCHARGED
2880 minute winter	35	2820	139.954	0.994	1.3	1.1243	0.0000	SURCHARGED
2880 minute winter	36	2820	139.954	1.654	14.7	241.0545	0.0000	SURCHARGED
15 minute winter	37	6	152.541	0.966	91.4	0.0000	0.0000	SURCHARGED
2880 minute summer	38	2100	151.898	0.349	5.4	161.3875	0.0000	SURCHARGED
2880 minute summer	39	2100	142.414	0.019	0.9	0.0000	0.0000	OK
2880 minute summer	40	2100	142.312	0.017	0.9	0.0000	0.0000	OK
2880 minute summer	41	2100	142.202	0.022	0.9	0.0243	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	20	Orifice	21	3.9				
15 minute summer	20	Infiltration		0.0				
240 minute winter	21	Hydro-Brake®	22	13.4				
960 minute winter	22	Orifice	26	16.2				
15 minute summer	23	6.000	24	10.5	0.843	0.583	0.3780	
30 minute summer	24	Orifice	25	6.8				
30 minute summer	24	Infiltration		0.3				
120 minute summer	25	Orifice	26	4.6				
1440 minute winter	25	Infiltration		0.3				
1440 minute winter	26	Hydro-Brake®	27	6.9				
15 minute summer	27	1.012	28	26.4	0.805	0.175	1.0922	
15 minute summer	28	Orifice	29	44.6				
15 minute summer	29	Orifice	30	44.6				
2160 minute winter	30	Hydro-Brake®	31	6.4				
30 minute summer	31	1.016	32	26.0	1.695	0.155	0.3451	
30 minute summer	32	1.017	33	35.6	1.013	0.185	0.2419	
15 minute summer	33	1.018	36	101.8	2.007	0.744	1.0082	
15 minute summer	34	7.000	35	33.4	1.897	1.889	0.2109	
15 minute summer	35	7.001	36	33.5	1.903	1.423	0.0998	
7200 minute winter	36	1.019	47	19.1	0.396	0.111	1.5041	
15 minute summer	37	8.000	38	99.3	2.335	1.153	0.1664	
2880 minute summer	38	Orifice	39	0.9				
2880 minute summer	39	8.002	40	0.9	0.640	0.013	0.0077	
2880 minute summer	40	8.003	41	0.9	0.575	0.012	0.0083	
2880 minute summer	41	8.004	42	0.9	0.496	0.019	0.0465	

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Results for 100 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	42	2100	140.708	0.058	0.9	0.0655	0.0000	OK
4320 minute summer	43	4380	140.318	0.568	0.9	0.6429	0.0000	SURCHARGED
15 minute summer	44	12	140.524	0.374	38.0	0.4230	0.0000	SURCHARGED
30 minute summer	45	20	140.472	0.797	34.7	3.4518	0.0000	SURCHARGED
4320 minute summer	46	4380	140.318	1.818	3.1	128.8185	0.0000	SURCHARGED
2880 minute winter	47	2820	139.954	1.754	15.7	2.5097	0.0000	SURCHARGED
2880 minute winter	48	2820	137.948	0.048	7.2	0.0683	0.0000	OK
2880 minute winter	49	2820	137.837	0.052	7.2	0.0749	0.0000	OK
2880 minute winter	50	2820	137.779	0.049	7.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute summer	42	Orifice	43	0.9				
15 minute summer	42	Infiltration		0.0				
2880 minute summer	43	8.006	46	0.9	0.704	0.035	0.1545	
30 minute summer	44	9.000	45	34.7	0.974	0.382	0.6247	
30 minute summer	45	Orifice	46	25.8				
30 minute summer	45	Infiltration		0.0				
8640 minute winter	46	Hydro-Brake®	47	1.2				
2880 minute winter	47	Hydro-Brake®	48	7.2				
2880 minute winter	48	1.021	49	7.2	0.829	0.033	0.0816	
2880 minute winter	49	1.022	50	7.2	0.818	0.037	0.0504	1121.0

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Please note: Links and manholes in this report which do not appear on the drainage layout (Dwg. C-0500) are for modelling purposes only and can be ignored.

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.003	5.00	144.400	1200		717706.909	725219.906	0.750
2	0.018	5.00	144.289	1200		717710.287	725208.290	0.751
3	0.006	5.00	143.150	1200		717712.146	725186.956	0.751
4			142.750	1200		717710.220	725177.885	1.050
A	0.172	5.00	152.000	10		717686.027	725162.071	1.425
B			152.000	10		717686.680	725166.301	1.451
C			152.000	10		717686.876	725170.808	10.690
D			142.500	10		717688.379	725175.446	1.225
10	0.044	5.00	142.773	1200		717690.276	725182.352	1.543
5			142.530	1200		717703.525	725170.439	2.055
6	0.002	5.00	142.200	1200		717707.585	725166.789	1.325
7	0.007	5.00	141.900	1200		717715.892	725155.943	2.000
8			141.720	1200		717722.856	725145.340	2.520
9			138.925	2000	1000	717727.380	725120.097	0.705

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	12.097	0.600	143.650	143.538	0.112	108.0	150	5.21	41.5
1.001	2	3	21.415	0.600	143.538	142.399	1.139	18.8	150	5.36	41.1
1.002	3	4	9.273	0.600	142.399	141.700	0.699	13.3	150	5.42	40.9
1.003	4	5	10.013	0.600	141.700	141.150	0.550	18.2	150	5.49	40.7
2.000	A	B	4.280	0.600	150.575	150.549	0.026	164.6	300	5.06	42.0
2.001	B	C	4.511	0.600	150.549	150.522	0.027	167.1	225	5.13	41.7
2.002	C	D	4.875	0.600	141.310	141.275	0.035	139.3	225	5.21	41.5
2.003	D	10	7.162	0.600	141.275	141.230	0.045	159.2	225	5.32	41.2
2.004	10	5	17.817	0.600	141.230	141.075	0.155	115.0	225	5.57	40.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.966	17.1	0.4	0.600	0.601	0.003	0.0	17	0.410
1.001	2.333	41.2	3.2	0.601	0.601	0.021	0.0	28	1.379
1.002	2.780	49.1	4.0	0.601	0.900	0.027	0.0	29	1.686
1.003	2.371	41.9	4.0	0.900	1.230	0.027	0.0	31	1.505
2.000	1.222	86.4	26.0	1.125	1.151	0.172	0.0	113	1.075
2.001	1.008	40.1	25.9	1.226	1.253	0.172	0.0	131	1.069
2.002	1.106	44.0	25.8	10.465	1.000	0.172	0.0	123	1.147
2.003	1.034	41.1	25.6	1.000	1.318	0.172	0.0	129	1.088
2.004	1.218	48.4	31.6	1.318	1.230	0.216	0.0	132	1.295

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	5	6	5.459	0.600	141.075	140.875	0.200	27.3	225	5.60	40.4
1.005	6	7	13.662	0.600	140.875	140.775	0.100	136.6	225	5.81	39.9
1.006	7	8	12.685	0.600	139.900	139.775	0.125	101.5	225	5.97	39.5
1.007	8	9	25.645	0.600	139.200	138.220	0.980	26.2	225	6.14	39.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	2.514	99.9	35.5	1.230	1.100	0.243	0.0	93	2.308
1.005	1.117	44.4	35.3	1.100	0.900	0.245	0.0	152	1.236
1.006	1.297	51.6	35.9	1.775	1.720	0.252	0.0	138	1.399
1.007	2.567	102.1	35.5	2.295	0.480	0.252	0.0	92	2.347

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.097	108.0	150	FilterCarrier	144.400	143.650	0.600	144.289	143.538	0.601
1.001	21.415	18.8	150	FilterCarrier	144.289	143.538	0.601	143.150	142.399	0.601
1.002	9.273	13.3	150	FilterCarrier	143.150	142.399	0.601	142.750	141.700	0.900
1.003	10.013	18.2	150	FilterCarrier	142.750	141.700	0.900	142.530	141.150	1.230
2.000	4.280	164.6	300	Circular	152.000	150.575	1.125	152.000	150.549	1.151
2.001	4.511	167.1	225	Circular	152.000	150.549	1.226	152.000	150.522	1.253
2.002	4.875	139.3	225	Circular	152.000	141.310	10.465	142.500	141.275	1.000
2.003	7.162	159.2	225	Circular	142.500	141.275	1.000	142.773	141.230	1.318
2.004	17.817	115.0	225	Circular	142.773	141.230	1.318	142.530	141.075	1.230
1.004	5.459	27.3	225	FilterCarrier	142.530	141.075	1.230	142.200	140.875	1.100
1.005	13.662	136.6	225	FilterCarrier	142.200	140.875	1.100	141.900	140.775	0.900
1.006	12.685	101.5	225	Circular	141.900	139.900	1.775	141.720	139.775	1.720
1.007	25.645	26.2	225	Circular	141.720	139.200	2.295	138.925	138.220	0.480

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200		Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200		Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200		Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200		Manhole	Adoptable
2.000	A	10	Manhole	Adoptable	B	10		Manhole	Adoptable
2.001	B	10	Manhole	Adoptable	C	10		Manhole	Adoptable
2.002	C	10	Manhole	Adoptable	D	10		Manhole	Adoptable
2.003	D	10	Manhole	Adoptable	10	1200		Manhole	Adoptable
2.004	10	1200	Manhole	Adoptable	5	1200		Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200		Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200		Manhole	Adoptable
1.006	7	1200	Manhole	Adoptable	8	1200		Manhole	Adoptable
1.007	8	1200	Manhole	Adoptable	9	2000	1000	Manhole	Headwall

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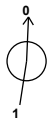
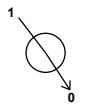
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
1	717706.909	725219.906	144.400	0.750	1200		 0	1.000	143.650	150
2	717710.287	725208.290	144.289	0.751	1200		 1 0	1.000 1.001	143.538 143.538	150 150
3	717712.146	725186.956	143.150	0.751	1200		 1 0	1.001 1.002	142.399 142.399	150 150
4	717710.220	725177.885	142.750	1.050	1200		 1 0	1.002 1.003	141.700 141.700	150 150
A	717686.027	725162.071	152.000	1.425	10		 0	2.000	150.575	300
B	717686.680	725166.301	152.000	1.451	10		 1 0	2.000 2.001	150.549 150.549	300 225
C	717686.876	725170.808	152.000	10.690	10		 1 0	2.001 2.002	150.522 141.310	225 225
D	717688.379	725175.446	142.500	1.225	10		 1 0	2.002 2.003	141.275 141.275	225 225
10	717690.276	725182.352	142.773	1.543	1200		 1 0	2.003 2.004	141.230 141.230	225 225
5	717703.525	725170.439	142.530	2.055	1200		 1 2 0	2.004 1.003 1.004	141.075 141.150 141.075	225 150 225
6	717707.585	725166.789	142.200	1.325	1200		 1 0	1.004 1.005	140.875 140.875	225 225
7	717715.892	725155.943	141.900	2.000	1200		 1 0	1.005 1.006	140.775 139.900	225 225
8	717722.856	725145.340	141.720	2.520	1200		 1 0	1.006 1.007	139.775 139.200	225 225

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
9	717727.380	725120.097	138.925	0.705	2000	1000	1	1	1.007	138.220	225

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	0.0
M5-60 (mm)	17.300	Check Discharge Rate(s)	✓
Ratio-R	0.270	1 year (l/s)	5.9
Summer CV	1.000	30 year (l/s)	11.7
Winter CV	1.000	100 year (l/s)	13.9
Analysis Speed	Detailed	Check Discharge Volume	✓
Skip Steady State	x	100 year +20% 360 minute (m³)	516

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	20	10	0
30	20	10	0
100	20	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	1.691	Betterment (%)	0
SAAR (mm)	965	QBar	7.1
Soil Index	3	Q 1 year (l/s)	5.9
SPR	0.37	Q 30 year (l/s)	11.7
Region	11	Q 100 year (l/s)	13.9
Growth Factor 1 year	0.83		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	20
Positively Drained Area (ha)	1.691	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.37	PR	0.421
CWI	124.913	Runoff Volume (m³)	516

Node 7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	139.900	Product Number	CTL-SHE-0050-1300-1385-1300
Design Depth (m)	1.385	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.3	Min Node Diameter (mm)	1200

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Node B Online Orifice Control

Flap Valve	x	Design Depth (m)	0.300	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.9		
Invert Level (m)	150.549	Diameter (m)	0.028		

Node 2 Online Orifice Control

Flap Valve	x	Invert Level (m)	143.538	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

Node 3 Online Orifice Control

Flap Valve	x	Invert Level (m)	142.399	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

Node 4 Online Orifice Control

Flap Valve	x	Invert Level (m)	141.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.050		

Node 5 Online Orifice Control

Flap Valve	x	Invert Level (m)	141.075	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.100		

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	139.900
Side Inf Coefficient (m/hr)	0.05980	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	88.6	0.0	1.500	88.6	61.5	1.501	0.0	61.5

Node B Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	150.549
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1157.0	0.0	0.400	1157.0	0.0	0.401	0.0	0.0

Node 2 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.000
Side Inf Coefficient (m/hr)	0.05980	Invert Level (m)	143.538	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	27	Diameter (mm)	900

Node 3 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.001
Side Inf Coefficient (m/hr)	0.05980	Invert Level (m)	142.399	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	28	Diameter (mm)	900

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Node 4 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.002
Side Inf Coefficient (m/hr)	0.05980	Invert Level (m)	141.700	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	21	Diameter (mm)	900

Node 5 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	1.003
Side Inf Coefficient (m/hr)	0.05980	Invert Level (m)	141.150	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	13	Diameter (mm)	900

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Results for 5 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	22	143.821	0.171	1.6	0.1938	0.0000	SURCHARGED
30 minute summer	2	22	143.818	0.280	5.2	1.0962	0.0000	SURCHARGED
30 minute summer	3	24	142.736	0.337	4.0	0.6977	0.0000	SURCHARGED
60 minute summer	4	47	141.994	0.294	2.9	0.5001	0.0000	SURCHARGED
15 minute winter	A	7	151.321	0.746	48.6	0.0000	0.0000	SURCHARGED
4320 minute summer	B	2820	150.757	0.208	2.7	96.2662	0.0000	OK
30 minute summer	C	20	141.393	0.083	1.0	0.0000	0.0000	OK
30 minute summer	D	20	141.393	0.118	2.1	0.0000	0.0000	OK
30 minute summer	10	20	141.392	0.162	12.5	0.1833	0.0000	OK
30 minute summer	5	20	141.389	0.314	12.3	0.5055	0.0000	SURCHARGED
30 minute summer	6	20	140.955	0.080	11.1	0.0910	0.0000	OK
960 minute summer	7	660	140.698	0.798	3.8	25.6513	0.0000	SURCHARGED
960 minute summer	8	660	139.216	0.016	1.0	0.0182	0.0000	OK
960 minute summer	9	660	138.236	0.016	1.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	-1.0	-0.087	-0.059	0.2124	
30 minute summer	2	Orifice	3	2.6				
30 minute summer	2	Infiltration		0.0				
30 minute summer	3	Orifice	4	2.9				
30 minute summer	3	Infiltration		0.0				
60 minute summer	4	Orifice	5	2.7				
60 minute summer	4	Infiltration		0.0				
15 minute summer	A	2.000	B	52.9	1.981	0.612	0.1539	
4320 minute summer	B	Orifice	C	0.7				
15 minute summer	C	2.002	D	-1.0	0.307	-0.024	0.0771	
15 minute summer	D	2.003	10	-2.4	0.315	-0.058	0.1754	
15 minute summer	10	2.004	5	11.9	0.554	0.246	0.6163	
30 minute summer	5	Orifice	6	10.7				
30 minute summer	5	Infiltration		0.0				
30 minute summer	6	1.005	7	11.1	0.905	0.250	0.1676	
960 minute summer	7	Hydro-Brake®	8	1.0				
960 minute summer	7	Infiltration		0.3				
960 minute summer	8	1.007	9	1.0	0.823	0.010	0.0318	54.5

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Results for 30 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	22	143.992	0.342	1.2	0.3870	0.0000	SURCHARGED
30 minute summer	2	22	143.991	0.453	8.3	1.9498	0.0000	FLOOD RISK
60 minute summer	3	43	142.890	0.491	4.8	1.2424	0.0000	FLOOD RISK
60 minute summer	4	52	142.122	0.422	3.6	0.8312	0.0000	SURCHARGED
15 minute winter	A	6	151.463	0.888	71.3	0.0000	0.0000	SURCHARGED
4320 minute summer	B	2820	150.833	0.284	3.5	131.3054	0.0000	SURCHARGED
30 minute summer	C	21	141.593	0.283	1.8	0.0000	0.0000	SURCHARGED
30 minute summer	D	21	141.593	0.318	3.3	0.0000	0.0000	SURCHARGED
30 minute summer	10	21	141.592	0.362	18.5	0.4099	0.0000	SURCHARGED
30 minute summer	5	21	141.584	0.509	16.6	1.0908	0.0000	SURCHARGED
1440 minute summer	6	990	141.080	0.205	3.7	0.2317	0.0000	OK
1440 minute summer	7	990	141.080	1.180	4.0	37.9164	0.0000	SURCHARGED
1440 minute summer	8	990	139.217	0.017	1.2	0.0197	0.0000	OK
1440 minute summer	9	990	138.237	0.017	1.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	-1.4	-0.112	-0.082	0.2130	
30 minute summer	2	Orifice	3	3.4				
30 minute summer	2	Infiltration		0.1				
60 minute summer	3	Orifice	4	3.6				
60 minute summer	3	Infiltration		0.1				
60 minute summer	4	Orifice	5	3.3				
60 minute summer	4	Infiltration		0.0				
15 minute summer	A	2.000	B	77.8	2.198	0.901	0.1602	
4320 minute summer	B	Orifice	C	0.9				
15 minute summer	C	2.002	D	-2.6	0.330	-0.059	0.1939	
15 minute summer	D	2.003	10	-4.8	0.341	-0.118	0.2848	
15 minute summer	10	2.004	5	14.4	0.624	0.297	0.7086	
30 minute summer	5	Orifice	6	14.1				
30 minute summer	5	Infiltration		0.0				
30 minute summer	6	1.005	7	14.7	0.974	0.331	0.2061	
1440 minute summer	7	Hydro-Brake®	8	1.2				
1440 minute summer	7	Infiltration		0.4				
1440 minute summer	8	1.007	9	1.2	0.868	0.012	0.0358	87.4

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Results for 100 year +20% CC +10% A Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	22	144.162	0.512	1.9	0.5786	0.0000	FLOOD RISK
30 minute summer	2	22	144.163	0.625	10.1	2.7993	0.0000	FLOOD RISK
60 minute summer	3	45	143.028	0.629	5.9	1.8473	0.0000	FLOOD RISK
60 minute summer	4	57	142.232	0.532	4.1	1.1724	0.0000	SURCHARGED
15 minute winter	A	6	151.534	0.959	92.5	0.0000	0.0000	SURCHARGED
2880 minute winter	B	2160	150.902	0.353	3.7	163.5685	0.0000	SURCHARGED
30 minute summer	C	21	141.804	0.494	2.2	0.0000	0.0000	SURCHARGED
30 minute summer	D	21	141.804	0.529	4.9	0.0000	0.0000	SURCHARGED
30 minute summer	10	21	141.804	0.574	24.2	0.6487	0.0000	SURCHARGED
30 minute summer	5	21	141.789	0.714	21.5	1.9040	0.0000	SURCHARGED
960 minute winter	6	720	141.366	0.490	4.2	0.5547	0.0000	SURCHARGED
960 minute winter	7	720	141.365	1.465	4.5	47.0957	0.0000	SURCHARGED
960 minute winter	8	720	139.218	0.018	1.3	0.0206	0.0000	OK
960 minute winter	9	720	138.238	0.018	1.3	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.9	0.079	0.053	0.2130	
30 minute summer	2	Orifice	3	4.0				
30 minute summer	2	Infiltration		0.1				
60 minute summer	3	Orifice	4	4.1				
60 minute summer	3	Infiltration		0.1				
60 minute summer	4	Orifice	5	3.7				
60 minute summer	4	Infiltration		0.0				
15 minute summer	A	2.000	B	100.5	2.340	1.163	0.1665	
2880 minute winter	B	Orifice	C	1.0				
15 minute summer	C	2.002	D	-2.6	0.345	-0.060	0.1939	
15 minute summer	D	2.003	10	-5.6	0.357	-0.137	0.2848	
15 minute summer	10	2.004	5	19.3	0.667	0.398	0.7086	
30 minute summer	5	Orifice	6	17.0				
30 minute summer	5	Infiltration		0.1				
30 minute summer	6	1.005	7	17.7	1.020	0.398	0.2367	
960 minute winter	7	Hydro-Brake®	8	1.3				
960 minute winter	7	Infiltration		0.5				
960 minute winter	8	1.007	9	1.3	0.896	0.013	0.0383	74.2

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	5.00	141.750	1200	717617.532	725337.516	0.600
2		141.750	1200	717622.380	725338.738	1.779
3		141.000	1200	717650.632	725345.858	1.800
4		140.500	1200	717679.727	725348.213	1.500
5		139.200	1200	717722.282	725347.091	0.598

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	5.000	0.600	141.150	140.971	0.179	27.9	300	5.03	42.0
1.001	2	3	29.135	0.600	139.971	139.200	0.771	37.8	300	5.22	41.5
1.002	3	4	29.190	0.600	139.200	139.000	0.200	146.0	300	5.59	40.4
1.003	4	5	42.570	0.600	139.000	138.602	0.398	107.0	300	6.06	39.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.986	211.0	0.0	0.300	0.479	0.000	0.0	0	0.000
1.001	2.565	181.3	0.0	1.479	1.500	0.000	0.0	0	0.000
1.002	1.299	91.8	0.0	1.500	1.200	0.000	0.0	0	0.000
1.003	1.520	107.4	0.0	1.200	0.298	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.000	27.9	300	Circular	141.750	141.150	0.300	141.750	140.971	0.479
1.001	29.135	37.8	300	Circular	141.750	139.971	1.479	141.000	139.200	1.500
1.002	29.190	146.0	300	Circular	141.000	139.200	1.500	140.500	139.000	1.200
1.003	42.570	107.0	300	Circular	140.500	139.000	1.200	139.200	138.602	0.298

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Headwall	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Headwall

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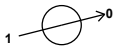
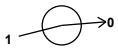
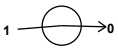
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	717617.532	725337.516	141.750	0.600	1200				
						0	1.000	141.150	300
2	717622.380	725338.738	141.750	1.779	1200	1	1.000	140.971	300
									
						0	1.001	139.971	300
3	717650.632	725345.858	141.000	1.800	1200	1	1.001	139.200	300
									
						0	1.002	139.200	300
4	717679.727	725348.213	140.500	1.500	1200	1	1.002	139.000	300
									
						0	1.003	139.000	300
5	717722.282	725347.091	139.200	0.598	1200	1	1.003	138.602	300
									

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	0.0
M5-60 (mm)	17.300	Check Discharge Rate(s)	✓
Ratio-R	0.270	1 year (l/s)	5.9
Summer CV	1.000	30 year (l/s)	11.7
Winter CV	1.000	100 year (l/s)	13.9
Analysis Speed	Detailed	Check Discharge Volume	✓
Skip Steady State	x	100 year +20% 360 minute (m³)	516

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	20	10	0
30	20	10	0
100	20	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	1.691	Betterment (%)	0
SAAR (mm)	965	QBar	7.1
Soil Index	3	Q 1 year (l/s)	5.9
SPR	0.37	Q 30 year (l/s)	11.7
Region	11	Q 100 year (l/s)	13.9
Growth Factor 1 year	0.83		

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Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	20
Positively Drained Area (ha)	1.691	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.37	PR	0.421
CWI	124.913	Runoff Volume (m^3)	516

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Appendix E **WASTEWATER DESIGN REPORT**

- As per Uisce Éireann Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03
- Generated by Causeway Flow (Causeway Technologies Ltd.)

Design Settings

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	1.0	Minimum Backdrop Height (m)	0.600
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
1	156.798	Adoptable	717524.169	725204.002	1.628
2	156.432	Adoptable	717530.341	725181.366	1.849
3	155.127	Adoptable	717537.592	725156.388	1.584
4	153.016	Adoptable	717582.608	725127.736	2.316
5	153.398	Adoptable	717557.894	725198.896	1.425
6	153.492	Adoptable	717564.305	725176.302	2.107
7	151.447	Adoptable	717608.735	725147.920	2.207
8	152.795	Adoptable	717583.857	725211.514	1.695
9	152.276	Adoptable	717588.406	725197.843	1.776
10	149.839	Adoptable	717634.890	725168.181	2.037
11	148.868	Adoptable	717647.969	725183.941	1.556
12	147.595	Adoptable	717648.649	725210.935	2.275
13	146.917	Adoptable	717655.651	725222.134	2.124
14	146.274	Adoptable	717668.192	725224.312	1.845
15	144.600	Adoptable	717685.694	725202.511	1.450
16	145.030	Adoptable	717691.770	725215.259	2.156
17	144.524	Adoptable	717701.661	725220.803	1.726
18	143.598	Adoptable	717705.537	725249.126	1.435
19	143.288	Adoptable	717697.747	725278.380	1.481
20	143.181	Adoptable	717691.020	725286.215	1.443
21	142.511	Adoptable	717687.468	725309.406	1.425
22	142.913	Adoptable	717657.374	725300.196	2.213
23	142.414	Adoptable	717657.370	725309.188	1.864
24	141.831	Adoptable	717673.883	725317.057	2.351
25	140.575	Adoptable	717630.720	725339.363	1.305
26	140.575	Adoptable	717654.506	725343.929	1.465
27	140.575	Adoptable	717709.021	725345.377	1.375
28	140.587	Adoptable	717671.055	725345.338	2.187
29	140.525	Adoptable	717670.405	725356.381	2.182

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	1	2	23.462	1.500	155.170	154.583	0.587	40.0	225
1.001	2	3	26.009	1.500	154.583	153.543	1.040	25.0	225
1.002	3	4	53.361	1.500	153.543	151.409	2.134	25.0	225
1.003	4	7	33.015	1.500	150.700	149.240	1.460	22.6	225
2.000	5	6	23.486	1.500	151.973	151.385	0.588	39.9	225
2.001	6	7	52.722	1.500	151.385	150.066	1.319	40.0	225
1.004	7	10	33.085	1.500	149.240	147.802	1.438	23.0	225
3.000	8	9	14.408	1.500	151.100	150.500	0.600	24.0	225
3.001	9	10	55.142	1.500	150.500	148.400	2.100	26.3	225
1.005	10	11	20.480	1.500	147.802	147.312	0.490	41.8	225
1.006	11	12	27.003	1.500	147.312	146.320	0.992	27.2	225
1.007	12	13	13.208	1.500	145.320	144.793	0.527	25.1	225
1.008	13	14	12.729	1.500	144.793	144.429	0.364	35.0	225
1.009	14	16	25.256	1.500	144.429	143.707	0.722	35.0	225
4.000	15	16	21.933	1.500	143.150	142.874	0.276	79.5	225
1.010	16	17	11.339	1.500	142.874	142.798	0.076	149.2	225
1.011	17	18	28.587	1.500	142.798	142.163	0.635	45.0	225
1.012	18	19	30.273	1.500	142.163	141.807	0.356	85.0	225
1.013	19	20	10.327	1.500	141.807	141.738	0.069	149.7	225
1.014	20	21	23.461	1.500	141.738	141.086	0.652	36.0	225
1.015	21	24	15.591	1.500	141.086	140.350	0.736	21.2	225
5.000	22	23	8.992	1.500	140.700	140.550	0.150	59.9	225
5.001	23	24	18.292	1.500	140.550	140.350	0.200	91.5	225
1.016	24	28	28.422	1.500	139.480	139.000	0.480	59.2	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.000	1.818	72.3	0.0	1.403	1.624	0.000	0	0.0	0.0	0	0.000
1.001	0.000	2.300	91.5	0.0	1.624	1.359	0.000	0	0.0	0.0	0	0.000
1.002	0.000	2.300	91.5	0.0	1.359	1.382	0.000	0	0.0	0.0	0	0.000
1.003	0.000	2.419	96.2	0.0	2.091	1.982	0.000	0	0.0	0.0	0	0.000
2.000	0.000	1.819	72.3	0.0	1.200	1.882	0.000	0	0.0	0.0	0	0.000
2.001	0.000	1.818	72.3	0.0	1.882	1.156	0.000	0	0.0	0.0	0	0.000
1.004	0.000	2.398	95.4	0.0	1.982	1.812	0.000	0	0.0	0.0	0	0.000
3.000	0.000	2.348	93.3	0.0	1.470	1.551	0.000	0	0.0	0.0	0	0.000
3.001	0.000	2.245	89.3	0.0	1.551	1.214	0.000	0	0.0	0.0	0	0.000
1.005	0.000	1.778	70.7	0.0	1.812	1.331	0.000	0	0.0	0.0	0	0.000
1.006	0.000	2.205	87.7	0.0	1.331	1.050	0.000	0	0.0	0.0	0	0.000
1.007	0.000	2.298	91.4	0.0	2.050	1.899	0.000	0	0.0	0.0	0	0.000
1.008	0.000	1.944	77.3	0.0	1.899	1.620	0.000	0	0.0	0.0	0	0.000
1.009	0.000	1.944	77.3	0.0	1.620	1.098	0.000	0	0.0	0.0	0	0.000
4.000	0.000	1.288	51.2	0.0	1.225	1.931	0.000	0	0.0	0.0	0	0.000
1.010	0.000	0.939	37.3	0.0	1.931	1.501	0.000	0	0.0	0.0	0	0.000
1.011	0.000	1.713	68.1	0.0	1.501	1.210	0.000	0	0.0	0.0	0	0.000
1.012	0.000	1.245	49.5	0.0	1.210	1.256	0.000	0	0.0	0.0	0	0.000
1.013	0.000	0.937	37.3	0.0	1.256	1.218	0.000	0	0.0	0.0	0	0.000
1.014	0.000	1.917	76.2	0.0	1.218	1.200	0.000	0	0.0	0.0	0	0.000
1.015	0.000	2.500	99.4	0.0	1.200	1.256	0.000	0	0.0	0.0	0	0.000
5.000	0.000	1.484	59.0	0.0	1.988	1.639	0.000	0	0.0	0.0	0	0.000
5.001	0.000	1.200	47.7	0.0	1.639	1.256	0.000	0	0.0	0.0	0	0.000
1.016	0.000	1.493	59.4	0.0	2.126	1.362	0.000	0	0.0	0.0	0	0.000

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
6.000	25	26	24.220	1.500	139.270	139.110	0.160	151.4	225
6.001	26	28	16.609	1.500	139.110	139.000	0.110	151.0	225
7.000	27	28	37.966	1.500	139.200	139.000	0.200	189.8	225
1.017	28	29	11.062	1.500	138.400	138.343	0.057	194.1	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
6.000	0.000	0.932	37.1	0.0	1.080	1.240	0.000	0	0.0	0.0	0	0.000
6.001	0.000	0.933	37.1	0.0	1.240	1.362	0.000	0	0.0	0.0	0	0.000
7.000	0.000	0.832	33.1	0.0	1.150	1.362	0.000	0	0.0	0.0	0	0.000
1.017	0.000	0.822	32.7	0.0	1.962	1.957	0.000	0	0.0	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	23.462	40.0	225	Circular	156.798	155.170	1.403	156.432	154.583	1.624
1.001	26.009	25.0	225	Circular	156.432	154.583	1.624	155.127	153.543	1.359
1.002	53.361	25.0	225	Circular	155.127	153.543	1.359	153.016	151.409	1.382
1.003	33.015	22.6	225	Circular	153.016	150.700	2.091	151.447	149.240	1.982
2.000	23.486	39.9	225	Circular	153.398	151.973	1.200	153.492	151.385	1.882
2.001	52.722	40.0	225	Circular	153.492	151.385	1.882	151.447	150.066	1.156
1.004	33.085	23.0	225	Circular	151.447	149.240	1.982	149.839	147.802	1.812
3.000	14.408	24.0	225	Circular	152.795	151.100	1.470	152.276	150.500	1.551
3.001	55.142	26.3	225	Circular	152.276	150.500	1.551	149.839	148.400	1.214
1.005	20.480	41.8	225	Circular	149.839	147.802	1.812	148.868	147.312	1.331
1.006	27.003	27.2	225	Circular	148.868	147.312	1.331	147.595	146.320	1.050
1.007	13.208	25.1	225	Circular	147.595	145.320	2.050	146.917	144.793	1.899
1.008	12.729	35.0	225	Circular	146.917	144.793	1.899	146.274	144.429	1.620
1.009	25.256	35.0	225	Circular	146.274	144.429	1.620	145.030	143.707	1.098
4.000	21.933	79.5	225	Circular	144.600	143.150	1.225	145.030	142.874	1.931
1.010	11.339	149.2	225	Circular	145.030	142.874	1.931	144.524	142.798	1.501

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
2.000	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.001	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.004	7	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
3.000	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
3.001	9	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
1.005	10	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
1.006	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
1.007	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
1.008	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
1.009	14	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
4.000	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
1.010	16	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable

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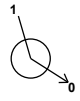
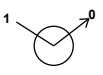
Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.011	28.587	45.0	225	Circular	144.524	142.798	1.501	143.598	142.163	1.210
1.012	30.273	85.0	225	Circular	143.598	142.163	1.210	143.288	141.807	1.256
1.013	10.327	149.7	225	Circular	143.288	141.807	1.256	143.181	141.738	1.218
1.014	23.461	36.0	225	Circular	143.181	141.738	1.218	142.511	141.086	1.200
1.015	15.591	21.2	225	Circular	142.511	141.086	1.200	141.831	140.350	1.256
5.000	8.992	59.9	225	Circular	142.913	140.700	1.988	142.414	140.550	1.639
5.001	18.292	91.5	225	Circular	142.414	140.550	1.639	141.831	140.350	1.256
1.016	28.422	59.2	225	Circular	141.831	139.480	2.126	140.587	139.000	1.362
6.000	24.220	151.4	225	Circular	140.575	139.270	1.080	140.575	139.110	1.240
6.001	16.609	151.0	225	Circular	140.575	139.110	1.240	140.587	139.000	1.362
7.000	37.966	189.8	225	Circular	140.575	139.200	1.150	140.587	139.000	1.362
1.017	11.062	194.1	225	Circular	140.587	138.400	1.962	140.525	138.343	1.957

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.011	17	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
1.012	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
1.013	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
1.014	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
1.015	21	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
5.000	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
5.001	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
1.016	24	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
6.000	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
6.001	26	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
7.000	27	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
1.017	28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	717524.169	725204.002	156.798	1.628	1200	 0	1.000	155.170	225
2	717530.341	725181.366	156.432	1.849	1200	 1 0	1.000 1.001	154.583 154.583	225 225
3	717537.592	725156.388	155.127	1.584	1200	 1 0	1.001 1.002	153.543 153.543	225 225
4	717582.608	725127.736	153.016	2.316	1200	 1 0	1.002 1.003	151.409 150.700	225 225
5	717557.894	725198.896	153.398	1.425	1200	 0	2.000	151.973	225

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	717564.305	725176.302	153.492	2.107	1200	1	2.000	151.385	225
						0	2.001	151.385	225
7	717608.735	725147.920	151.447	2.207	1200	1	2.001	150.066	225
						2	1.003	149.240	225
						0	1.004	149.240	225
8	717583.857	725211.514	152.795	1.695	1200	0	3.000	151.100	225
9	717588.406	725197.843	152.276	1.776	1200	1	3.000	150.500	225
						0	3.001	150.500	225
10	717634.890	725168.181	149.839	2.037	1200	1	3.001	148.400	225
						2	1.004	147.802	225
						0	1.005	147.802	225
11	717647.969	725183.941	148.868	1.556	1200	1	1.005	147.312	225
						0	1.006	147.312	225
12	717648.649	725210.935	147.595	2.275	1200	1	1.006	146.320	225
						0	1.007	145.320	225
13	717655.651	725222.134	146.917	2.124	1200	1	1.007	144.793	225
						0	1.008	144.793	225
14	717668.192	725224.312	146.274	1.845	1200	1	1.008	144.429	225
						0	1.009	144.429	225
15	717685.694	725202.511	144.600	1.450	1200	0	4.000	143.150	225
16	717691.770	725215.259	145.030	2.156	1200	1	4.000	142.874	225
						2	1.009	143.707	225
						0	1.010	142.874	225
17	717701.661	725220.803	144.524	1.726	1200	1	1.010	142.798	225
						0	1.011	142.798	225
18	717705.537	725249.126	143.598	1.435	1200	1	1.011	142.163	225
						0	1.012	142.163	225

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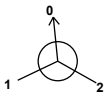
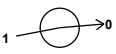
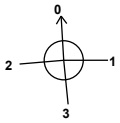
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
19	717697.747	725278.380	143.288	1.481	1200		1	1.012	141.807	225
							0	1.013	141.807	225
20	717691.020	725286.215	143.181	1.443	1200		1	1.013	141.738	225
							0	1.014	141.738	225
21	717687.468	725309.406	142.511	1.425	1200		1	1.014	141.086	225
							0	1.015	141.086	225
22	717657.374	725300.196	142.913	2.213	1200		0	5.000	140.700	225
23	717657.370	725309.188	142.414	1.864	1200		1	5.000	140.550	225
							0	5.001	140.550	225
24	717673.883	725317.057	141.831	2.351	1200		1	5.001	140.350	225
							2	1.015	140.350	225
							0	1.016	139.480	225
25	717630.720	725339.363	140.575	1.305	1200		0	6.000	139.270	225
26	717654.506	725343.929	140.575	1.465	1200		1	6.000	139.110	225
							0	6.001	139.110	225
27	717709.021	725345.377	140.575	1.375	1200		0	7.000	139.200	225
28	717671.055	725345.338	140.587	2.187	1200		1	7.000	139.000	225
							2	6.001	139.000	225
							3	1.016	139.000	225
							0	1.017	138.400	225
29	717670.405	725356.381	140.525	2.182	1200		1	1.017	138.343	225

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Appendix F STAGE 1 STORMWATER AUDIT

STORMWATER AUDIT (STAGE 1)

JBA Project Code	2024s1699
Contract	Blackglen LRD Stage 1 SWA
Client	Zolbury Ltd, Unit 9, Ardcavan Business Park, Ardcavan, Co Wexford
Prepared by	Dania Thomas & Michael O'Donoghue
Subject	Stage 1 Stormwater Audit Report

Revision History

Issue	Date	Status	Issued to
S3-P01	12/12/2024	First Issue	OCSC
S3-P02	20/12/2024	Final Issue	OCSC

1 Introduction

JBA Consulting have been contracted by O'Connor Sutton Cronin & Associates (OCSC) to undertake a Stage 1 SW Audit of the surface water drainage design for the proposed residential development at Blackglen Road, Sandyford, Dublin 18. O'Connor Sutton Cronin & Associates (OCSC) are the Design Engineers for the project.

The subject of this Stage 1 stormwater audit is to review the proposed surface water drainage design and sustainable urban drainage system (SuDS) proposals for the proposed development.

This audit has been carried out in accordance with the Dún Laoghaire-Rathdown County Council's (DLRCC) Stormwater Audit Procedure as set out in Appendix 7 of the Development Plan 2022-28, where applicable as set out below.

***Stage 1 – Pre-Planning Stage**: A Stage 1 Audit shall be carried out of the applicant's proposed Stormwater drainage proposals based on the drawings submitted for planning approval.*

The Stage 1 Audit report must be submitted to Municipal Services for approval prior to lodging the planning application. All recommendations shall be complied with, unless otherwise agreed in writing with DLRCC.

1.1 Report Structure

The Feedback Form in Appendix A identifies queries raised in this report which are to be answered by the Design Engineers. Once an 'Acceptable' status is achieved for each query the audit is deemed to be completed and requires sign off from both Auditor and Designer, prior to submission to the council for approval.

The Audit is not considered complete until the council have been given an opportunity to review and approve the Audit report.

The results of the audit are set out hereunder, where items raised in the feedback form are shown in bold within this report.

1.2 Relevant Studies and Documents

The following guidance documents were considered as part of this surface water audit, or equivalent current at the time of the Stage 1 audit:

- Greater Dublin Strategic Drainage Strategy (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works;
- The SUDs Manual (CIRIA C753).
- DLRCC Development Plan 2022-2028 (where applicable)
- DLRCC Stormwater Management Policy
- BRE Digest 365

The documentation provided by OCSC on 08/11/2024, 22/11/2024 and 26/11/2024 are listed below:

- 2 Z040-OCSC-XX-XX-DR-C-0500-S4-P01
- Z040-OCSC-XX-XX-DR-C-0501-S4-P01
- Z040-OCSC-XX-XX-DR-C-0502-S4-P01
- Z040-OCSC-XX-XX-DR-C-0503-S4-P01
- Z040-OCSC-XX-XX-DR-C-0504-S4-P01
- Z040-OCSC-XX-XX-DR-C-0504-S4-P01
- Z040-OCSC-XX-XX-DR-C-0511-S4-P01
- Z040-OCSC-XX-XX-DR-C-0512-S4-P01
- Z040-OCSC-XX-XX-DR-C-0515-S4-P01
- Z040-OCSC-XX-XX-DR-C-0516-S4-P01
- Z040-OCSC-XX-XX-RP-C-0103-S4-P03 - Engineering Services Report
- Z040-OCSC-XX-XX-DR-C-0500 (DRAINAGE LAYOUT - Masterplan)
- Z040-OCSC-XX-XX-DR-C-0501 (DRAINAGE LAYOUT - sheet 1)
- Z040-OCSC-XX-XX-DR-C-0502 (DRAINAGE LAYOUT - Sheet 2)
- Z040-OCSC-XX-XX-DR-C-0507-(Proposed Dr. System Overlaid with Ex. Contours)
- Z040-OCSC-XX-XX-DR-C-0506-(Attenuation System Cross Sections)

Updated layout and design calculations received on 11/12/2024

- Z040-OCSC-XX-XX-DR-C-0500-S4-P01
  Z040-OCSC-XX-XX-DR-C-0501-S4-P01
  Z040-OCSC-XX-XX-DR-C-0502-S4-P01
  Z040-OCSC-XX-XX-DR-C-0503-S4-P01
  Z040-OCSC-XX-XX-DR-C-0504-S4-P01
- Appendix D-a - Stormwater design calculations report - Main System

1.3 Key Considerations and Benefits of SuDS

The key benefits and objectives of SuDS considered as part of this audit and listed below include:

- Water Quantity
- Water Quality
- Amenity
- Biodiversity

Which can be achieved by;

- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

1.3.1 Recommendations from GDSDS

Table 6.3 of the GDSDS recommends the following criteria for Development Drainage;

Criterion		Design Objective
Criterion 1 River water quality protection	1.1 1.2	Interception storage of 5mm Treatment storage if 1.1 not provided
Criterion 2 River regime protection	2.1 2.2	Discharge rate equal 1-year greenfield run-off Discharge rate equal 100-year greenfield run-off
Criterion 3 Level of Service	3.1 3.2 3.3 3.4	No site flooding for 30-year storm No internal property flooding for 100-year storm Floor levels +500mm above 100-year TWL in river or tanks No flooding in 100-year storm of adjacent urban areas
Criterion 4 River Flood Protection	4.1 4.2 4.3	Long term flooding provided by 4.1 & 4.2 for the 100-year 6-hour storm in excess of greenfield runoff. Alternatively, if long term flooding not provided discharge rate Qbar or 2 l/s/ha for ALL storage.

1.3.2 SuDS Management Train

A SuDS Management Train is a robust pollutant removal strategy. The treatment train can comprise four stages:

1. *Prevention*
2. *Source Control*
3. *Site Control*
4. *Regional control*

2 Proposed Development

The subject site is located at Blackglen Road, Sandyford, Dublin 18. The development is immediately bound by residential properties to the east & west, Blackglen Road to the north and Woodside Road to the south.

The proposed Large Scale Residential development will consist of 192 no. residential units ranging from 2-5 storeys in height, associated resident amenity facilities, a childcare facility, all boundary treatment and landscaping works, site services connections and all site development works.

The site location is shown below.



Figure 1 | Site Location (Source: Google Earth)

2.1 Review of SW Drainage Proposals

2.1.1 Site Characteristics

The subject site is 3.83 hectares and is currently greenfield in nature. A topographic survey of the area indicated that the site generally graded towards north of the site highest point of the site being located at the south-west boundary and lowest point being located at the north-east boundary of the site. This gives a typical gradient of approximately 8.2% across the site.

Using the ICPSuDS Input, FSR (Flood Studies Report) Method, the rainfall runoff discharging from the total greenfield site area to be developed (i.e. 3.83 ha), in its existing condition, is estimated at QBAR (RURAL) = 4.2 l/s/ha.

Due to the topography of the site and the proposed layout, the surface water network is split into two main catchment areas. Where, Catchment 1 has a positively drained area of 1.691ha with a runoff rate of 7.1 l/s and Catchment 2 has a positively drained area of 0.318ha, which yields a runoff rate of 1.3 l/s., with some infiltration expected into the ground at the soakaway prior to outfalling to the stream.

The soil at the site has been indicated as being Soil Type 3 (SPR 0.37) in accordance with HR Wallingford procedures and Ground Investigation report. A site investigation was carried out by GII Ltd. between April and May 2021. The following works were carried out:

- 14 no. Trial Pits & 2 No Trenches to a maximum depth of 2.3m BGL
- 6 No. In-situ Plate Bearing Tests within each trial pit
- 40 no. dynamic probes
- 3 No. Soakaways to determine a soil infiltration value to BRE digest 365
- 4 No. Rotary Core Boreholes to a maximum depth of 8.50m BGLA further
- 8 No additional trial pits to verify bedrock/shallow DPH refusal
- Installation of 4 No. Groundwater monitoring wells

The strata encountered were variable across the site, with topsoil present in all exploratory holes. Made ground deposits were observed beneath the topsoil at locations TP01 and TP03 underlain with cohesive deposits and contained occasional fragments of concrete, wire and glass.

The cohesive deposits were described typically as soft or soft to firm reddish brown/brown sandy gravelly Clay, with occasional angular to sub angular cobbles and some boulders. This is consistent with Soil Type 3.

In some of the exploratory holes weathered rock was encountered typically as fine to coarse angular to subangular gravel and cobbles of Granite. And with bedrock of Medium strong to strong massive grey coarsely crystalline GRANITE, partially to distinctly weathered.

Soakaway testing carried out on site resulted in good infiltration rates across the site.

Given the good infiltration observed during the testing, the QBAR calculation based on Soil Type 3 seems prudent.

The groundwater monitoring installation tests indicated ground water levels to be at 1.97m, 1.54m, 2.43m and 2.96m BGL at 4 borehole locations respectively.

Also, the site is not in vicinity of any tidally influenced area of groundwater flood and is therefore not considered at Risk from Groundwater flooding.

2.1.2 Design Parameters

Rainfall parameters	Designer values	JBA Comment
M5_60	17.3mm	17.4mm – Met Éireann (2023 DDF values)
Ratio R	0.270	0.2693 – Met Éireann (2023 DDF values)
SAAR	965mm	988 mm - Met Éireann (2024)
Soil Index	0.37	OK - representative for the CLAY encountered on site
Limiting discharge	QBAR or to 2 l/s/Ha, whichever is greater	OK
Qbar (l/s)	7.1l/s – for main system area 1.691 ha 1.3l/s – SE system area 0.318 ha	OK -16.47l/s from UK_SuDS for soil type 3
Climate Change	20% applied to rainfall	OK – DLRCC's County Development Plan 2022-2028
Urban Creep	10% applied	OK – DLRCC's County Development Plan 2022-2028

OCSC to provide sketch of area not contributing to the drained system and thus not included in the QBar calculation.

2.2 Surface Water Drainage Strategy

2.2.1 Site Drainage Strategy

A 20% climate change factor and 10% urban creep factor have been included in the design of the surface water network in accordance with the requirements DLRCC's County Development Plan 2022-2028.

The proposed surface water drainage network is spilt into two main surface water drainage catchments- Catchment 1 and 2. Attenuated runoff from Catchment 1 is to be discharge via a flow control device to the new surface water sewer which bounds the site to the north. Catchment 2 is to discharge to an infiltration soakaway and outfall at less than greenfield runoff rate to the existing stream on the southeastern boundary. Each sub-catchment area will aim to provide interception and treatment of the rainfall runoff, either at source or through site.

2.2.2 SuDS Measures Considered

SuDS Technology	Comments
Green/Blue Roofs	Green roof and blue roofs are proposed. As this development includes roof areas greater than 300m2 on apartment buildings, It is proposed that block B1/B2 and block B3/B4 will each provide a minimum of 50% green roof coverage using an intensive buildup. The green roofs on these blocks will also be blue roofs. Blocks A1 and A2 both have sloped roofs which are not practical for green roof construction. However, as both buildings exceed the 300m2 threshold, green roof coverage has been provided as an extensive buildup on 20 of the individual housing units. Even with a 700mm setback on each of these roofs almost 80% coverage for Blocks A1 and A2 is provided, thus exceeding the 70% requirement. The drawings indicating the locations of Green & blue roofs are provided **Section details of green roofs not provided.**
Swale, Filter Drain, Infiltration Trench	It is proposed to use filter drains along roads where possible to intercept and treat polluted water. The drawing indicating the filter drain locations are provided. Figure 3.11 in the Engineering Report shows liner around filter drain. **Filter drain detail drawing not provided**
Tree Pits, Bioretention Areas, Rain Gardens	Bio-retention areas incl. tree pits and raingardens are proposed throughout the site to provide treatment and interception for minor storm events. Locations are marked in the drainage masterplan. **Section drawing through bio-retention areas, rain gardens and tree pits not provided**
Permeable Surfacing	Type B Pervious paving with a 300mm (typical) depth of open graded crushed rock as base course, is proposed to be provided in the driveways/ car parking for the individual units within the proposed development and a number of additional areas. An overflow pipe, from the base-course, will be provided to the drainage network, which will allow for interception of initial rainfall, groundwater discharge, with an attenuated outflow to the main network in extreme rainfall events. Grasscrete paving proposed for remaining car parking spaces.

	Locations marked in the drainage masterplan and proposed SW layout. Figure 3.5 in the engineering report shows detail of Type B pervious paving and Figure 3.6 shows Grasscrete typical section. **Section drawing for pervious and grasscrete paving not provided**
Soakaways	A stone infiltration soakaway of 46.5m3 is proposed in Catchment 2 to treat rainfall runoff from Blocks B3 and B4, before discharging to the existing stream on the south-east boundary line. Location marked in drainage masterplan and SW layouts. Soakaway section detail is provided in DR-C-0506.
Detention Basins, Retention Ponds, Stormwater Wetlands	None proposed.
Rainwater Harvesting	None proposed.
Petrol Interceptor	A Class 1 bypass fuel separator is proposed immediately upstream of the final attenuation structure in each system, as an additional and final mitigation measure, prior to surface water discharge from each unit sub-catchment to the public surface water network. A similar separator is proposed immediately upstream of the infiltration soakaway as well. Fuel separators are located so as to provide easy vehicular access for inspection and maintenance. Locations of the oil separators are indicated in the SW layouts
Attenuation	Unlined proprietary geocellular storage units (ESS Eco Cell) are proposed for the attenuation of rainfall runoff for the developed catchment area. The attenuation tanks are proposed in Catchment 1 with volumes 359.8m3, 441.2m3, 170.6m3, 238.7m3, 126.8m3 which satisfies the required storage volumes from the drainage calculations – 364m3, 444m3, 174m3, 241m3, 128.8m3. Hydro-brake optimum vortex flow control unit (or similar approved by DLRCC) is proposed in the manhole downstream of each of the final attenuation systems to achieve required rate of flow. Access chambers for inspection and maintenance to be provided. **DR-C-0506 drawing showed previous attenuation tank details and needs to be updated.**

2.2.3 Review of drainage design and drawings

Drawing C- 0500 shows the proposed drainage masterplan through the site including SuDS elements, existing storm water and foul water line, proposed foul and storm water drainage arrangement.

Drawing C-0501 and 0502 shows the proposed storm water layout wherein, SuDS elements such as pervious paving, green and blue roofs, grasscrete paving, bio-retention areas, tree pits, rain gardens attenuation tanks, and infiltration soakaway are marked. The locations for fuel separator and flow control devices, along with design head and design flow for hydrobrake/ flow control device indicated in the drawing.

DR- C- 0503 and 0504 shows proposed foul water layout.

The surface water and foul water long sections are provided in DR- C 0510 to DR- C- 0516.

Drawing C-0506 shows the section details of attenuation tanks and stone infiltration soakaway.

The ES report provides an attenuation storage summary for each sub-catchment, taking into account SuDs features and traditional drainage systems. The following are some queries following this review:

OCSC to provide section drawings for all SuDS elements- pervious pavers, green roofs, bio-retention areas etc.

OCSC to provide outlet manhole detail drawing.

2.2.4 Review of Drainage Design Calculations

The proposed network calculations designed using Causeway Flow were provided in the Engineering Report (Appendix D)

A factor of 20% Climate Change to rainfall and 10% urban creep were applied.

As per the GDSDS, for the surface water network design simulation, all external paved roads were considered 100% impermeable and has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each periods.

For areas of permeable pavement, a factor of 0.7 is applied for the portion of contribution to the surface water system. Areas of grasscrete and grass (in reasonable proximity to the SW system), a factor of 0.3 is applied. And volumetric runoff coefficient CV, 1.00 both winter and summer is considered in accordance with Appendix 7.1.3 (DLR County Development Plan 2022-2028).

Catchment 1 has a positively drained area of 1.691ha, while Catchment 2 has a positively drained area of 0.318ha. A sketch of these hasn't been provided.

OCSC to provide drained area sketch.

For the most part, orifice diameters have been held at 50mm minimum. However, Node B in the south-east catchment has a diameter of 28mm.

OCSC to comment on reduced diameter at Node B.

There are a number of nodes identified as at "Flood Risk". It isnt stated in the calculations as to what depth below the cover level is deemed acceptable as part of the design.

OCSC to provide comment.

2.2.5 Interception/treatment of Flow

Interception of runoff is intended to prevent any runoff for small rainfall events which are less than 5mm (and up to 10mm if possible). Treatment of 15mm is required if interception is not provided.

Table 24.6 of the CIRIA manual provides indication of deemed to satisfy criteria and it is considered that this should be complied with. All sources of runoff should also be intercepted where possible. Compliance is required for the entire site, or at least for road/paved areas, for it to be considered effective. Interception mechanisms are based on runoff retention. This can be achieved using rainwater harvesting or using soil storage and evaporation. Either infiltration or transpiration rates can dispose of the runoff from minor events to enable the next event to be captured.

Overcompensation in one area cannot be considered acceptable for lack of interception in another area. However, SuDS measures appear to be proposed throughout.

Interception of stormwater is proposed through various SuDS measures and a clear effort to include suds measures has been made. There is no specific mention of whether an intercepted volume has been achieved as per GDSDS, however. It is likely It is not clear how runoff from all impermeable areas will be intercepted.

OCSC to provide table showing breakdown of all applicable SuDS features and corresponding interception areas utilising the guidance from CIRIA C753 Table 24.6. OCSC to assess interception on an area by area basis as per DLRCC procedure and provide a completed Table 7.1.5 of the DLR Stormwater audit procedure.

2.2.6 Exceedance Flows

No mention of exceedance flow considered.

2.3 Health & Safety and Maintenance Issues

The proposed drainage system comprises SuDS devices, trapped road gullies, manholes, filter drain, green & blue roofs, attenuation systems, pervious and grasscrete parking, bio-retention areas, infiltration soakaway. These elements are considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction, and operation.

Optimum performance of the SuDS treatment train is subject to the frequency of maintenance provided. It is recommended that a maintenance regime be adopted.

It is recommended that the petrol interceptor be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular inspection and maintenance are recommended for the petrol interceptor.

Please note that silt and debris removed from the petrol interceptor during maintenance will be classified as contaminated material and should only be handled and transported by a suitably licensed contractor and haulier and disposed of at a suitably licensed landfill only.

OCSC to provide maintenance plan

2.4 Items to be considered at Detailed Design Stage

This report outlines the review of the initial submission by the designer. JBA comments are also included in the Audit Feedback Form in Appendix A. This feedback form shows the audit trail and the responses from the designer. The audit will be deemed closed out once an "Acceptable" status has been achieved for each query. Some queries may be considered acceptable subject to Local Authority agreement.

The following has resulted from the audit process:

- Exceedance flows have been considered for Catchment 1 and Catchment 2.
- DR-C-0505 -Storm water catchment zone, showing major and sub catchments contributing to the system have been provided.
- Interception calculations were updated based on impermeable areas draining to suds measures, in accordance with table 24.6 of SuDS manual-CIRIA C753.
- The model and all associated drawings have been updated to reflect any changes in the design.

Recommendations for the Detailed Design Stage:

- Ensure DLRCC design parameters are met for green/ blue roof systems.
- DR-0508 notes exceedance flow from catchment 1 to exit onto Blackglen Road, subject to DLRCC decision.

Audit Report Prepared by:

Dania Thomas BEng MEng (Hons)
Assistant Engineer

Approved by:

Michael O'Donoghue BEng CEng MIEI
Director

Audit Report Findings are accepted by the Design Engineer

Representative:	
Name of Company:	
Date:	

Note:

JBA Consulting Engineers & Scientists Ltd. role on this project is as an independent reviewer/auditor. JBA Consulting Engineers & Scientists hold no design responsibility on this project. All issues raised and comments made by JBA are for the consideration of the Design Engineer. Final design, construction supervision, with sign-off and/or commissioning of the surface water system so that the final product is fit for purpose with a suitable design, capacity and lifespan, remains the responsibility of the Design Engineers.

Appendix A – Audit Feedback Form

JBA Consulting Stormwater Audit - Stage 1 Feedback Form

Project:	Blackglen LRD Stage 1 SWA
Date:	20/12/2024 (P03)
JBA Reviewers	Dania Thomas & Michael O'Donoghue
Project Number:	2024s1699

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
	12/12/2024	12/12/2024	19/12/2024	
	Reference Documents **•2 Z040-OCSC-XX-XX-DR-C-0500-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0501-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0502-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0503-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0504-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0504-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0511-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0512-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0515-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0516-S4-P01** **•Z040-OCSC-XX-XX-RP-C-0103-S4-P03 - Engineering Services Report** **•Z040-OCSC-XX-XX-DR-C-0500 (DRAINAGE LAYOUT - Masterplan)** **•Z040-OCSC-XX-XX-DR-C-0501 (DRAINAGE LAYOUT - sheet 1)** **•Z040-OCSC-XX-XX-DR-C-0502 (DRAINAGE LAYOUT - Sheet 2)** **•Z040-OCSC-XX-XX-DR-C-0507-(Proposed Dr. System Overlaid with Ex. Contours)** **•Z040-OCSC-XX-XX-DR-C-0506-(Attenuation System Cross Sections)** **11.12.2024 -UPDATED LAYOUT DRAWINGS AND DESIGN CALCULATIONS** **•Z040-OCSC-XX-XX-DR-C-0500-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0501-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0502-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0503-S4-P01** **•Z040-OCSC-XX-XX-DR-C-0504-S4-P01** **Appendix D-a - Stormwater design calculations report - Main System**			
1	Green roof is proposed in accordance with Appendix 16 of DLRCC County Development Plan. The section detail of green roof build up is not provided	OCSC to provide green roof build-up. OCSC to provide run-off coefficients for green roofs.	Drawing C-0524 (SuDS Details - Sheet 2) with Green and Blue Roof Buildups has been provided Runoff Coefficient used for the green roofs on the individual units was 0.917 (per DLRCC Development Plan - Appendix 7, p. 260). For Blocks B1/B2 and B3/B4 and their adjoining podiums we used a coefficient of 0.834 as we proposed an intensive buildup there.	**Acceptable**
2	Interception of stormwater is proposed through various SuDS measures and a clear effort to include suds measures has been made. There is no specific mention of whether an intercepted volume has been achieved as per GDSDS, however. It is likely It is not clear how runoff from all impermeable areas will be intercepted.	OCSC to provide table showing breakdown of all applicable SuDS features and corresponding interception areas utilising the guidance from CIRIA C753 Table 24.6. OCSC to assess interception on an area by area basis as per DLRCC procedure and to complete Table 7.1.5 of the DLR Stormwater audit procedure.	Storm Water Interception of Runoff Calculations have been tabulated and will be inserted into the Engineering Services Report as Appendix L	**See Note 10**
3	Exceedance flow not considered.	OCSC to comment	This has been provided in Sheet C-0508 (Exceedance Flow Plan)	**Acceptable**
4	Whilst some standard details are provided in the report, section drawings for pervious & grasscrete pavers, blue roofs, bio-retention areas, tree pits, rain gardens, and filter drains not provided. In additon recent changes to the attenuation means that these drawings also need to be updated	OCSC To provide	Sheet C-0523 is provided with the SuDS Detail (except green roofs - to follow) Sheet C-0521, C-0522 are provide with the updated Attenuation system cross sections	**Acceptable**
5	DR-C-0501 & 0502 indicate locations of flow control devices with design head and design flow	OCSC to provide section details for outlet manhole	Detail has been included on Storm Water Details sheet C-0520	**Acceptable**
6	The use of the positively drained area for Qbar calculation is correct. A drawing clarifying the undrained area within the development red line boundary would be useful for clarity.	OCSC to provide.	We have provided sheet C-0505 - Storm Water Catchment Zone Plan, showing major and sub-catchments contributing to systems.	**Acceptable**
7	Node B on the south-east catchment has an orifice diameter of 28mm. This is at high risk of blockage and contradicts DLR's requirement of 50mm.	OCSC to advise.	Node B is for modelling purposes only and will not be a literal 28mm oriface. It was chosen to represent a flow which will consequentlly be maintained by a proprietary green/blue roof system of flow controls. An updated Design Calculations Report, marked up to show nodes/links used for modelling only, will be provided	**Acceptable**
8	A number of nodes are at flood risk, with water levels within 100mm of the cover level. It is unclear as to what permissible water level was used in the model.	OCSCS to advise on what depth below cover level of manholes they have accepted in their design.	The model has been designed to ensure no flooding from the network for all design events up to and including the 1% AEP. Several factors of safety will mitigate the levels shown even further. Storage provided in the Tree pits, Bio-retention areas and rain gardens has not been considered in the calculations. No infiltration is considered in the unlined cellular attenuation structures. Also a factor of safety of 2 is used for the infiltration applied to the sides of the filter drains. We believe these factors will significantly reduce the node water levels in the model.	**Acceptable**
9	No O & M Manual has been provided.	OCSC to provide.	A SuDS Operation and Maintenance Manual has been compiled for the relevant measures incorporated in the development and will be inserted into the Engineering Services Report as Appendix J	**Acceptable**
	19/12/2024	19/12/2024	19/12/2024	
10	The interception calc provided in based on volume. DLR's procedure requires an assessment based on area. (Table 24.6 of C753). Please provide assessment of interception of impermeable areas based on the suds measures they drain to	OCSC to provide	Interception calculations have been revised (based on Table 24.6 of the SuDS Manual - CIRIA C753) to be based on area rather than volume (per DLRCC requirements)	**Acceptable**
11				
12				
13				
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16				
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18				
19				

Appendix G UISCE ÉIREANN CONFIRMATION OF FEASIBILITY & STATEMENT OF DESIGN ACCEPTANCE

CONFIRMATION OF FEASIBILITY

Mark Killian

OCSC
9 Prussia Street
Stoneybatter
Dublin 7
D07KT57

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

31 May 2024

Our Ref: CDS24000835 Pre-Connection Enquiry
Blackglen, Road, Sandyford, Dublin 18

Dear Applicant/Agent,

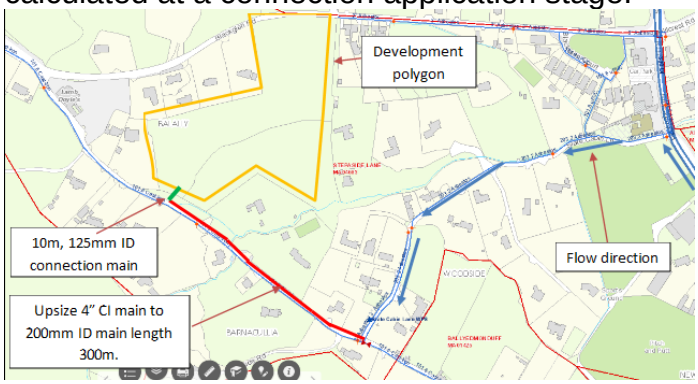
We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Multi/Mixed Use Development of 192 unit(s) at Blackglen, Road, Sandyford, Dublin 18, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible Subject to upgrades

- In order to accommodate the proposed connection, upsize of the 4'' CI main to 200mm ID main by approximately 300m is required. The Developer will be required to fund the upgrade works. The fee will be calculated at a connection application stage.

- 

Stiúrthóirí / Directors: Tony Keohane (Cathaoirleach / Chairman), Niall Gleeson (POF / CEO), Christopher Banks, Fred Barry, Gerard Britchfield, Liz Joyce, Patricia King, Eileen Maher, Cathy Mannion, Michael Walsh.
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin, Ireland D01NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Uisce Éireann is a design activity company, limited by shares. Cláraithe in Éirinn Uimh.: 530363 / Registered in Ireland No.: 530363.

- **Wastewater Connection** - Feasible Subject to upgrades

- In order to accommodate the proposed connection, wastewater network upgrade works are required downstream of the site. Uisce Éireann currently has a project on our current investment plan which will provide the necessary network upgrade and capacity. Estimated completion date for the project is Q3 2028 (subject to change).
- Additionally, the existing 300mm gravity sewer adjacent to the site, has to be connected to the proposed downstream infrastructure.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

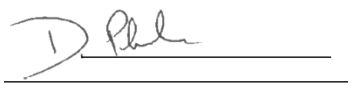
Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

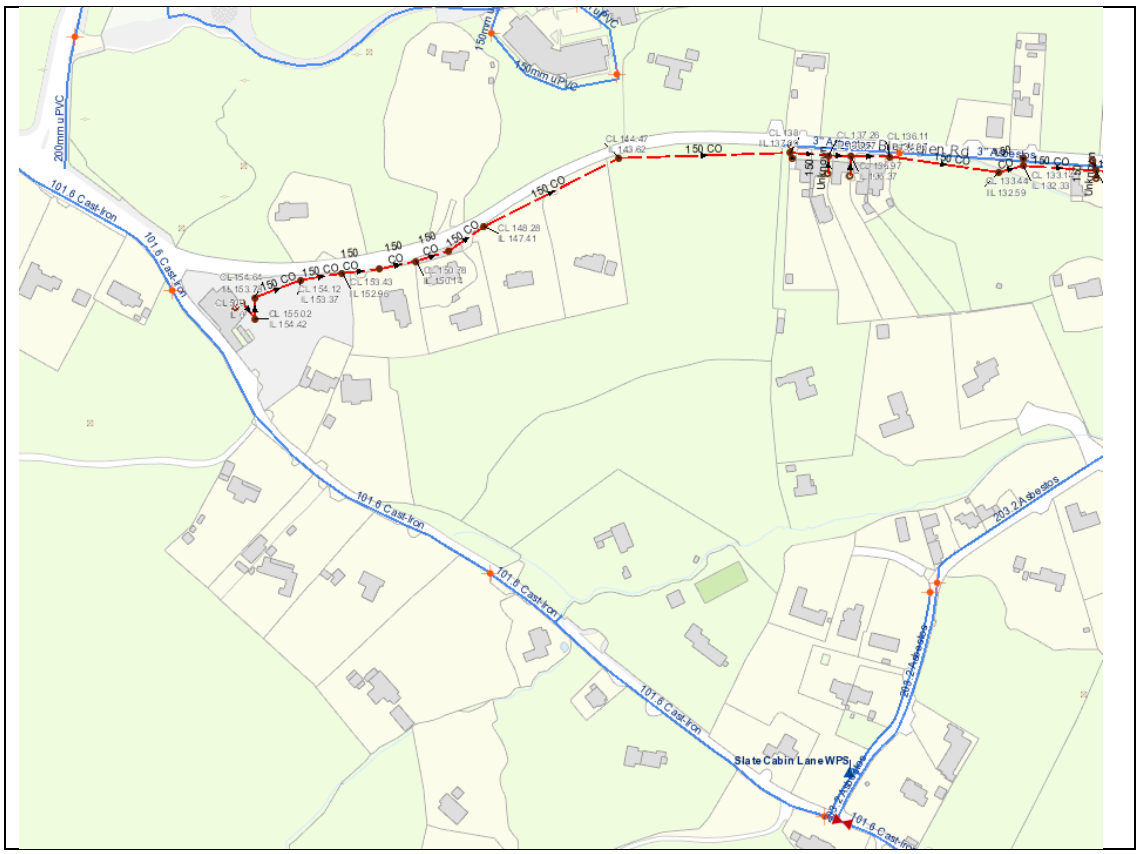
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie



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Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann's underground network(s) 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.

Appendix H PLUVIAL FLOOD RISK MAP

309000 312000 315000 318000 321000

234000

231000

228000

225000

PHOENIX PARK
Páirc an Fhionnuisce

DUBLIN HARBO

Baile Átha

Sandymount Strand

South Bull

Merrion Strand

Clondalkin
Cluain Dolcáin

Ballyfermot
Baile Formaid

Palmerston
Baile Pháma

Drumcondra
Cluain Tarbh

Ballsbridge

Ringsend
Rinn

Irishtown

Donnybrook
Domhnach Mór

Rathfarnham
Ráth Fearnáin

Churchtown
Baile an Teampaill

Windy Arbour

Mount Merrion
Cnoc Mhuirfean

Goatstown
Baile na nGabhar

Dundrum
Dún Droma

Kilmacud
Cill Mochuda

Stillorgan
Stigh Lorgan

Ballinteer
Baile an tSaoir

Sandyford
Áth an Ghairmín

Leopardstown

Foxrock
Carraig an tSi

Stepaside

Carrickmines
Carraig Mhai

Ballyogan

Kilmashogue Mountain
Sliabh Cuilinn Mochoig

Three Rock Mountain

Tallaght
Tamhlacht

Templeogue
Teach Mealóg

Terenure

Greenhills
Na Glaschnoic

Kilnamanagh
Cill na Manach

Tymon North
Tigh Mothain Thuaidh

Willbrook

Rathfarnham

Ballyboden
Baile Bodáin

Firhouse
Teach na Giúise

Oldbawn
Scanbhabhán

Jobstown
Bóthar Montain

Edmondstown

Whitechurch

Marley Park

Clarkstown

Taylorsgrange

Newtown

Rockbrook

Orlagh

Oldcourt

Killinardan

Killipper

Ballymana

Ballymaice

Knockanvinidee

Ballinascorney Lower

Corragreen

Bolgard Door

Friarstown

Jamestown

Kingswood

Newlands Cross Rds

Newlands

Quarryvale

Fonthill

River Liffey

Belgard

Bull Wall

North Bank Lighthouse

Martello Tower

Merrion Gates

Blackrock

Carysfort

Deansgrange

Galloping Green

Race Course

Reservoir

Castle

Megalithic Tomb

Standing Stone

Holy Well

Megalithic Standing Stone

Megalithic Stone Circle

Larch Hill

Barnacullia

Timock

Slackstown

Mountpelier

Ballyroan

Ballycullen

Kiltalown

Grand Canal

Dublin Mountains Way

Wicklow Way

M50

N81

N4

N7

N11

N31

R112

R113

R114

R115

R116

R117

R118

R119

R120

R121

R131

R132

R133

R134

R136

R137

R138

R139

R811

R812

1000 0 1000 2000 3000 4000 Meters

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Location Plan:



LEGEND

- 10% AEP Pluvial
- 1% AEP Pluvial
- 0.5% AEP Pluvial

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

The Office Of Public Works
Jonathan Swift Street
Trim
Co. Meath

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

Dublin City Council
Civic Offices
Wood Quay
Dublin 8

Project:

DUBLIN PLUVIAL STUDY (FloodResilienCity)

Map: **DUBLIN CITY - PLUVIAL FLOOD EXTENT MAP**

Map Type:	EXTENT - 180min Rainfall		
Source:	PLUVIAL		
Map Area:	URBAN		
Scenario:	CURRENT		
Drawn by:	IH	Date:	Aug - 2016
Checked by:	MC	Date:	Aug - 2016
Approved by:	JM	Date:	Aug - 2016
Map No.:	E09DCC_EXPCD_F0_03		
Revision: F0			
Map Scale: 1:50,000		Plot Scale: 1:1 @ A3	

Appendix I CELLULAR ATTENUATION SYSTEM

- E.S.S. Eco Cell with Access and Inspection Chamber

Modular Geo-Void Systems

Total Water Management

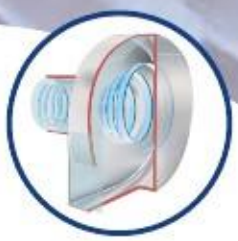
ESS EcoCell

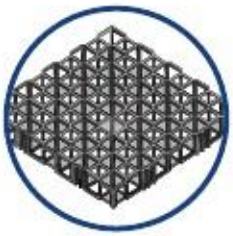
Ecological Tank Systems











ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Environmental Sustainable Solutions

Welcome to Environmental Sustainable Solutions; specialist suppliers and designers of geocomposites and water re-use systems. Environmental Sustainable Solutions can help you achieve innovative results for all your requirements:-

- Stormwater Management
- Gas Barrier Protection
- Stormwater Attenuation
- Contaminated Land Development
- Stormwater Drainage
- Ground Stabilisation
- Rainwater Recycling Management
- Structural Waterproofing
- Gas Venting Systems
- Damp-proofing projects

Over the last 12 years Environmental Sustainable Solutions, and associated companies, have designed and installed thousands of water recycling, drainage and attenuation tank systems for schools, car parks, retail parks, offices and sports arenas throughout Ireland, UK, Europe and the Middle East.

Our wide range of environmental protection products, surface water drainage modules and modular water storage tank systems provides maximum design flexibility for engineers and architects working on even the most demanding of storm water storage and recycling projects.

Stormwater Management And Design

Stormwater is the phrase used to describe the excess rainwater that flows from rooftops, roads, car parks and other buildings. This water can contain many pollutants picked up from roofs and highways. In extreme weather conditions sudden heavy downpours of rain can cause major environmental disasters. Using our Rainmanager products; stormwater can not only safely be removed, but it can be stored and recycled for commercial and domestic use.

How it works - ESS Attenuation Tank

Stormwater enters the attenuation tank via the inlet manhole, which incorporates a silt collection sump and a galvanised leaf collection basket. Water passes through the tank and exits through the outlet manhole, which contains an AquaBrake flow control device.
This flow control device regulates the release rate of water from the tank, and in so doing, enables the tank to fill. As a result of water entering the tank at a greater rate than it can exit, the void space then fills with water. While the tank fills, air is vented from the tank.
The Inlet/Outlet pipe will act as a flushing channel. This perforated pipe is wrapped completely in High Flow Filtering Geotextile, which prevents silt entering the block area. As the tank continues to empty at a pre-determined rate, air re-enters the tank via the same air vent system. The roof of the completed tank must be lower than the lowest gully trap on site.

Benefits

- 100% sealed tank
- Full installation service provided
- 12 years experience as market leader
- Quick installation – reduce site access delays
- Increased land usage – tanks are sub surface
- Economical – generally more cost efficient than any other equivalent sealed tank
- Cost effective – reduced costs for excavation and disposal of material
- Modular – easy to create any shape
- Strong – designed to support shear loading
- Lightweight – no cranes required
- Determinate volume – one cubic metre of matrix tank modules contain 950 litres of water, whereas stone fill will only provide 300 litres of storage per cubic metre.

Soakaway

The soakaway is normally best built as a long narrow structure.
The inlet pipe comes in at roof level and faces downwards so that the water can percolate into the tank.
The blocks are wrapped in Geotextile, to protect them and also to keep clay from filling up the void.
An air vent pipe is installed on the highest point with a cowl on top or vented back to an inlet manhole.
There is no outlet from a soakaway, therefore no flow control unit is required.