Appendix A : SURFACE WATER DRAINAGE NETWORK CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	16.100	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.130	4-8	0.056

Total Area Contributing (ha) = 0.186

Total Pipe Volume (m³) = 4.487

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	72.148	0.361	199.9	0.093	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	12.775	0.064	199.6	0.093	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	11.639	0.058	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	16.284	0.651	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.31	54.746	0.093	0.0	0.0	2.5	0.92	36.6	15.1
S1.001	50.00	5.54	54.385	0.186	0.0	0.0	5.0	0.92	36.7	30.2
S1.002	50.00	5.75	54.321	0.186	0.0	0.0	5.0	0.92	36.6	30.2
S1.003	50.00	5.85	54.263	0.186	0.0	0.0	5.0	2.63	104.5	30.2

©1982-2020 Innovyze

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S17	55.697	0.951	Open Manhole	1200	S1.000	54.746	225				
S16	56.844	2.459	Open Manhole	1200	S1.001	54.385	225	S1.000	54.385	225	
S15	56.942	2.621	Open Manhole	1200	S1.002	54.321	225	S1.001	54.321	225	
S14	55.850	1.587	Open Manhole	1200	S1.003	54.263	225	S1.002	54.263	225	
S00	NaN	0.000	Open Manhole	0		OUTFALL		S1.003	53.611	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S17	667618.335	833664.287	667618.335	833664.287	Required	
S16	667676.909	833706.410	667676.909	833706.410	Required	
S15	667689.676	833706.867	667689.676	833706.867	Required	
S14	667695.894	833716.706	667695.894	833716.706	Required	
S00	667685.612	833729.333			No Entry	

©1982-2020 Innovyze

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S17	55.697	54.746	0.726	Open Manhole	1200
S1.001	o	225	S16	56.844	54.385	2.234	Open Manhole	1200
S1.002	o	225	S15	56.942	54.321	2.396	Open Manhole	1200
S1.003	o	225	S14	55.850	54.263	1.362	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	72.148	199.9	S16	56.844	54.385	2.234	Open Manhole	1200
S1.001	12.775	199.6	S15	56.942	54.321	2.396	Open Manhole	1200
S1.002	11.639	200.0	S14	55.850	54.263	1.362	Open Manhole	1200
S1.003	16.284	25.0	S00	NaN	53.611	NaN	Open Manhole	0

©1982-2020 Innovyze

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.093	0.093	0.093
1.001	-	-	100	0.093	0.093	0.093
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.186	0.186	0.186

©1982-2020 Innovyze