STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	107.578	1.345	80.0	0.009	5.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	140.698	1.759	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
3.000	107.578	1.345	80.0	0.003	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	139.204	1.740	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
3.002	34.646	0.433	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.002	41.939	0.524	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	7.08	9.000	0.009	0.0	0.0	0.0	0.86	6.8	1.2
2.001	50.00	9.81	7.655	0.009	0.0	0.0	0.0	0.86	6.8	1.2
3.000	50.00	7.08	9.000	0.003	0.0	0.0	0.0	0.86	6.8	0.4
3.001	50.00	9.78	7.655	0.003	0.0	0.0	0.0	0.86	6.8	0.4
3.002	50.00	10.45	5.915	0.003	0.0	0.0	0.0	0.86	6.8	0.4
2.002	50.00	11.26	5.482	0.012	0.0	0.0	0.0	0.86	6.8	1.6

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)
2.000	o	100	4	10.000	9.000	0.900	Open Manhole	1200
2.001	o	100	2	10.000	7.655	2.245	Open Manhole	1200
3.000	o	100	3	10.000	9.000	0.900	Open Manhole	1200
3.001	o	100	1	10.000	7.655	2.245	Open Manhole	1200
3.002	o	100	5	10.000	5.915	3.985	Open Manhole	1200
2.002	o	100	5	10.000	5.482	4.418	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)
2.000	107.578	80.0	2	10.000	7.655	2.245	Open Manhole	1200
2.001	140.698	80.0	5	10.000	5.897	4.003	Open Manhole	1200
3.000	107.578	80.0	1	10.000	7.655	2.245	Open Manhole	1200
3.001	139.204	80.0	5	10.000	5.915	3.985	Open Manhole	1200
3.002	34.646	80.0	5	10.000	5.482	4.418	Open Manhole	1200
2.002	41.939	80.0		10.000	4.958	4.942	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.000	-	-	100	0.009	0.009	0.009
2.001	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.003	0.003	0.003
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.012	0.012	0.012

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
2.002		10.000	4.958	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	5
FEH Rainfall Version	2013
Site Location	GB 529623 183745 TQ 29623 83745
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Orifice Manhole: 2, DS/PN: 2.001, Volume (m³): 3.5

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 7.655

Orifice Manhole: 1, DS/PN: 3.001, Volume (m³): 3.5

Diameter (m) 0.028 Discharge Coefficient 0.600 Invert Level (m) 7.655

Storage Structures for Storm

Cellular Storage Manhole: 2, DS/PN: 2.001

Invert Level (m) 7.655 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.5	0.0	0.196	0.0	0.0
0.195	28.5	0.0			

Cellular Storage Manhole: 1, DS/PN: 3.001

Invert Level (m) 7.655 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	21.1	0.0	0.061	0.0	0.0
0.060	21.1	0.0			

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 529623 183745 TQ 29623 83745
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	130.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.000	4	15 Winter	2	+0%	100/15 Winter				9.032
2.001	2	180 Winter	2	+0%	100/15 Winter				7.691
3.000	3	15 Winter	2	+0%					9.018
3.001	1	180 Winter	2	+0%					7.672
3.002	5	180 Winter	2	+0%					5.920
2.002	5	180 Winter	2	+0%					5.495

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	4	-0.068	0.000	0.22			1.4	OK	
2.001	2	-0.064	0.000	0.03		101	0.2	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	3	-0.082	0.000	0.07			0.5	OK	
3.001	1	-0.083	0.000	0.01		120	0.1	OK	
3.002	5	-0.095	0.000	0.01			0.1	OK	
2.002	5	-0.087	0.000	0.04			0.3	OK	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 529623 183745 TQ 29623 83745
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	130.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.000	4	15 Winter	30	+0%	100/15 Winter				9.055
2.001	2	120 Winter	30	+0%	100/15 Winter				7.737
3.000	3	15 Winter	30	+0%					9.030
3.001	1	120 Winter	30	+0%					7.688
3.002	5	120 Winter	30	+0%					5.926
2.002	5	120 Winter	30	+0%					5.501

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	4	-0.045	0.000	0.52			3.5	OK	
2.001	2	-0.018	0.000	0.06		86	0.4	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	3	-0.070	0.000	0.19			1.2	OK	
3.001	1	-0.067	0.000	0.03		72	0.2	OK	
3.002	5	-0.089	0.000	0.03			0.2	OK	
2.002	5	-0.081	0.000	0.08			0.6	OK	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 529623 183745 TQ 29623 83745
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	130.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.000	4	15 Winter	100	+40%	100/15 Winter				9.123
2.001	2	180 Winter	100	+40%	100/15 Winter				7.821
3.000	3	15 Winter	100	+40%					9.042
3.001	1	120 Winter	100	+40%					7.714
3.002	5	120 Winter	100	+40%					5.930
2.002	5	120 Winter	100	+40%					5.506

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	4	0.023	0.000	0.94			6.3	SURCHARGED	
2.001	2	0.066	0.000	0.08		116	0.6	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	3	-0.058	0.000	0.33			2.2	OK	
3.001	1	-0.041	0.000	0.05		61	0.3	OK	
3.002	5	-0.085	0.000	0.05			0.3	OK	
2.002	5	-0.076	0.000	0.13			0.9	OK	