STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 526100 184450 TQ 26100 84450
C (1km)	-0.025
D1 (1km)	0.330
D2 (1km)	0.277
D3 (1km)	0.234
E (1km)	0.332
F (1km)	2.519
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	10
Minimum Backdrop Height (m)	1.500
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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)
S1.003	S	49.220	45.920	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Synthetic Rainfall Details

Rainfall Model	FEH
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Site Location	GB 526100 184450 TQ 26100 84450
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D1 (1km)	0.330
D2 (1km)	0.277
D3 (1km)	0.234
E (1km)	0.332
F (1km)	2.519
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.003, Volume (m³): 15.3

Unit Reference	MD-SHE-0068-2800-2000-2800
Design Head (m)	2.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	68
Invert Level (m)	45.958
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	2.8
Flush-Flo™	0.298	2.0
Kick-Flo®	0.606	1.6
Mean Flow over Head Range	-	2.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.7	1.200	2.2	3.000	3.4	7.000	5.0
0.200	2.0	1.400	2.4	3.500	3.6	7.500	5.2
0.300	2.0	1.600	2.5	4.000	3.9	8.000	5.3
0.400	2.0	1.800	2.7	4.500	4.1	8.500	5.5
0.500	1.9	2.000	2.8	5.000	4.3	9.000	5.6
0.600	1.6	2.200	2.9	5.500	4.5	9.500	5.8
0.800	1.8	2.400	3.0	6.000	4.7		
1.000	2.0	2.600	3.2	6.500	4.8		

Storage Structures for Storm

Tank or Pond Manhole: S4, DS/PN: S1.003

Invert Level (m) 45.958

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	260.5	2.000	260.5	2.001	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

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D3 (1km)	0.234
E (1km)	0.332
F (1km)	2.519
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
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	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S1	15 minute 2 year Winter I+0%	49.200	47.798	-0.202	0.000	0.23
S1.001	S2	15 minute 2 year Winter I+0%	49.500	47.652	-0.163	0.000	0.43
S1.002	S3	15 minute 2 year Winter I+0%	49.500	47.357	-0.304	0.000	0.23
S2.000	S4	15 minute 2 year Winter I+0%	49.500	47.998	-0.202	0.000	0.23
S2.001	S5	15 minute 2 year Winter I+0%	49.400	47.846	-0.160	0.000	0.45
S2.002	S6	15 minute 2 year Winter I+0%	49.300	47.600	-0.308	0.000	0.22
S1.003	S4	720 minute 2 year Winter I+0%	49.300	46.345	0.162	0.000	0.07

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

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1		16.4	OK
S1.001	S2		30.4	OK
S1.002	S3		43.8	OK
S2.000	S4		16.6	OK
S2.001	S5		30.5	OK
S2.002	S6		44.0	OK
S1.003	S4		2.0	SURCHARGED

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	1
Number of Online Controls	1	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	1999
Site Location	GB 526100 184450 TQ 26100 84450
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D1 (1km)	0.330
D2 (1km)	0.277
D3 (1km)	0.234
E (1km)	0.332
F (1km)	2.519
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
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	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S1	15 minute 30 year Winter I+0%	49.200	47.945	-0.055	0.000	0.60
S1.001	S2	15 minute 30 year Winter I+0%	49.500	47.877	0.062	0.000	1.19
S1.002	S3	15 minute 30 year Winter I+0%	49.500	47.481	-0.180	0.000	0.66
S2.000	S4	15 minute 30 year Winter I+0%	49.500	48.136	-0.064	0.000	0.61
S2.001	S5	15 minute 30 year Winter I+0%	49.400	48.061	0.055	0.000	1.28
S2.002	S6	15 minute 30 year Winter I+0%	49.300	47.724	-0.184	0.000	0.64
S1.003	S4	720 minute 30 year Winter I+0%	49.300	46.948	0.765	0.000	0.07

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

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1		43.2	OK
S1.001	S2		84.8	SURCHARGED
S1.002	S3		126.4	OK
S2.000	S4		44.0	OK
S2.001	S5		87.4	SURCHARGED
S2.002	S6		130.7	OK
S1.003	S4		2.0	SURCHARGED

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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

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D3 (1km)	0.234
E (1km)	0.332
F (1km)	2.519
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S1	15 minute 100 year Winter I+40%	49.200	49.138	1.138	0.000	1.30
S1.001	S2	15 minute 100 year Winter I+40%	49.500	48.846	1.031	0.000	2.55
S1.002	S3	960 minute 100 year Winter I+40%	49.500	48.017	0.356	0.000	0.08
S2.000	S4	15 minute 100 year Winter I+40%	49.500	49.180	0.980	0.000	1.31
S2.001	S5	15 minute 100 year Winter I+40%	49.400	48.856	0.850	0.000	2.73
S2.002	S6	15 minute 100 year Winter I+40%	49.300	48.100	0.192	0.000	1.39
S1.003	S4	960 minute 100 year Winter I+40%	49.300	48.017	1.834	0.000	0.10

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

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1		94.4	FLOOD RISK
S1.001	S2		182.1	SURCHARGED
S1.002	S3		14.6	SURCHARGED
S2.000	S4		95.5	SURCHARGED
S2.001	S5		186.2	SURCHARGED
S2.002	S6		282.8	SURCHARGED
S1.003	S4		2.8	SURCHARGED