STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes Alex003

FSR Rainfall Model - England and Wales

Return Period (years)	3	PIMP (%)	100
M5-60 (mm)	18.500	Add Flow / Climate Change (%)	40
Ratio R	0.334	Minimum Backdrop Height (m)	4.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	4.000
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)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.264	8-12	0.340	12-16	0.001

Total Area Contributing (ha) = 0.604

Total Pipe Volume (m³) = 34.511

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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)	1920
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	16

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	FSR	Profile Type	Winter
Return Period (years)	1000	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.500	Storm Duration (mins)	960
Ratio R	0.334		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S10, DS/PN: S1.005, Volume (m³): 5.8

Unit Reference	MD-SHE-0072-3000-1800-3000
Design Head (m)	1.800
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	103.682
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	3.0
Flush-Flo™	0.319	2.3
Kick-Flo®	0.646	1.9
Mean Flow over Head Range	-	2.3

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	1.9	1.200	2.5	3.000	3.8	7.000	5.6
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.8
0.300	2.3	1.600	2.8	4.000	4.3	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.1	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.0	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Storage Structures for Storm

Tank or Pond Manhole: S10, DS/PN: S1.005

Invert Level (m) 103.682

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	140.0	1.700	444.0	2.118	533.3

Summary of Results for 960 minute 1000 year Winter (Storm)

Margin for Flood Risk Warning (mm) 0.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S01	105.861	0.945	0.000	0.06			5.2	SURCHARGED
S1.001	S02	105.861	1.255	0.000	0.11			9.3	SURCHARGED
S1.002	S03	105.859	1.571	0.000	0.17			12.7	SURCHARGED
S2.000	S04	105.861	0.945	0.000	0.08			6.8	SURCHARGED
S2.001	S05	105.860	1.253	0.000	0.14			13.0	SURCHARGED
S1.003	S06	105.857	1.679	0.000	0.31			28.3	SURCHARGED
S3.000	S07	105.857	0.941	0.000	0.05			4.3	SURCHARGED
S3.001	S08	105.857	1.251	0.000	0.08			8.1	SURCHARGED
S1.004	S09	105.855	1.734	0.000	0.39			36.2	SURCHARGED
S1.005	S10	105.853	1.796	28.465	0.03			3.1	FLOOD
S1.006	S11	103.686	-0.092	0.000	0.32			3.1	OK
S1.007	S12	103.581	-0.106	0.000	0.19			3.1	OK
S1.008	S13	102.582	-0.109	0.000	0.17			3.1	OK*
S1.009	S14	102.376	-0.115	0.000	0.12			3.1	OK*