STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.200	Add Flow / Climate Change (%)	0
Ratio R	0.350	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 Surface Network 3

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.209	4-8	0.073

Total Area Contributing (ha) = 0.282

Total Pipe Volume (m³) = 6.911

Network Design Table for Surface Network 3

« - Indicates pipe capacity < flow

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
1.000	33.337	0.275	121.2	0.146	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	25.388	0.650	39.1	0.087	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	13.533	0.500	27.1	0.049	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	14.485	0.080	181.1	0.000	0.00	0.0	0.600	o	150	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)
1.000	50.00	5.39	116.900	0.146	0.0	0.0	0.0	1.43	100.9	19.8
1.001	50.00	5.53	116.550	0.233	0.0	0.0	0.0	2.91	321.1	31.6
1.002	50.00	5.60	115.900	0.282	0.0	0.0	0.0	3.49	386.0	38.2
1.003	50.00	5.92	115.400	0.282	0.0	0.0	0.0	0.74	13.1«	38.2

©1982-2020 Innovyze

Free Flowing Outfall Details for Surface Network 3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	OUTFALL 4	116.300	115.320	0.000	1200	0

Simulation Criteria for Surface Network 3

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

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Storm Duration (mins)	30
Ratio R	0.350		

©1982-2020 Innovyze

Online Controls for Surface Network 3

Hydro-Brake® Optimum Manhole: POND1, DS/PN: 1.003, Volume (m³): 3.3

Unit Reference	MD-SHE-0041-8000-1000-8000
Design Head (m)	1.000
Design Flow (l/s)	0.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	41
Invert Level (m)	115.400
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.8
Flush-Flo™	0.184	0.6
Kick-Flo®	0.369	0.5
Mean Flow over Head Range	-	0.6

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	0.6	1.200	0.9	3.000	1.3	7.000	1.9
0.200	0.6	1.400	0.9	3.500	1.4	7.500	2.0
0.300	0.6	1.600	1.0	4.000	1.5	8.000	2.0
0.400	0.5	1.800	1.0	4.500	1.6	8.500	2.1
0.500	0.6	2.000	1.1	5.000	1.6	9.000	2.2
0.600	0.6	2.200	1.1	5.500	1.7	9.500	2.2
0.800	0.7	2.400	1.2	6.000	1.8		
1.000	0.8	2.600	1.2	6.500	1.9		

©1982-2020 Innovyze

Storage Structures for Surface Network 3

Tank or Pond Manhole: POND1, DS/PN: 1.003

Invert Level (m) 115.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	108.0	1.400	338.7

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

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	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

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)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SNL-1	15 Winter	100	+40%				
1.001	SNL-2	15 Winter	100	+40%				
1.002	SNL-3	1440 Winter	100	+40%	100/120 Winter			
1.003	POND1	1440 Winter	100	+40%	100/15 Summer			

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
1.000	SNL-1	117.122	-0.078	0.000	0.87			80.6	OK
1.001	SNL-2	116.735	-0.190	0.000	0.47			131.6	OK
1.002	SNL-3	116.573	0.298	0.000	0.03			8.2	SURCHARGED
1.003	POND1	116.573	1.023	0.000	0.07			0.9	FLOOD RISK

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Level Exceeded
1.000	SNL-1	
1.001	SNL-2	
1.002	SNL-3	
1.003	POND1	

©1982-2020 Innovyze