STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW 06

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.423	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

Network Design Table for SW 06

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	41.426	0.001	41426.3	0.000	4.00	0.0	0.600		-1	Pipe/Conduit	
3.000	4.269	0.094	45.4	0.095	3.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	4.148	0.160	25.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	27.771	0.001	27771.0	0.000	0.00	0.0	0.600		-1	Pipe/Conduit	
4.000	5.753	0.044	130.7	0.625	3.00	0.0	0.600	o	450	Pipe/Conduit	
4.001	4.089	0.087	47.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.002	4.754	0.280	17.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.003	3.000	0.319	9.4	0.000	0.00	0.0	0.600	o	300	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	5.88	90.077	0.000	0.0	0.0	0.0	0.37	3847.0	0.0
3.000	50.00	3.04	90.644	0.095	0.0	0.0	0.0	1.95	77.4	12.9
3.001	50.00	3.06	90.550	0.095	0.0	0.0	0.0	2.58	102.6	12.9
2.001	50.00	6.91	90.076	0.095	0.0	0.0	0.0	0.45	4722.1	12.9
4.000	50.00	3.05	90.206	0.625	0.0	0.0	0.0	1.78	282.5	84.6
4.001	50.00	3.08	90.162	0.625	0.0	0.0	0.0	2.97	472.6	84.6
2.002	50.00	6.93	90.075	0.720	0.0	0.0	0.0	3.83	271.0	97.5
2.003	50.00	6.94	89.795	0.720	0.0	0.0	0.0	5.16	364.5	97.5

Manhole Schedules for SW 06

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)
S6.01	92.499	2.422	Junction		2.000	90.077	-1				
S6.02	91.835	1.191	Open Manhole	1240 x 675	3.000	90.644	225				
S6.03	91.650	1.100	Junction		3.001	90.550	225	3.000	90.550	225	
S6.04	91.600	1.524	Junction		2.001	90.076	-1	2.000	90.076	-1	
								3.001	90.390	225	
S6.05	91.300	1.094	Open Manhole	1240 x 675	4.000	90.206	450				
S6.06	91.600	1.438	Junction		4.001	90.162	450	4.000	90.162	450	
S6.07	91.600	1.525	Open Manhole	1240 x 675	2.002	90.075	300	2.001	90.075	-1	
								4.001	90.075	450	
S6.07 FC	91.600	1.805	Open Manhole	1200	2.003	89.795	300	2.002	89.795	300	
S6.O1	91.550	2.074	Open Manhole	0		OUTFALL		2.003	89.476	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S6.01	568392.580	245822.437			No Entry	
S6.02	568420.822	245792.205	568420.822	245792.205	Required	
S6.03	568423.586	245795.459			No Entry	
S6.04	568426.397	245798.510			No Entry	
S6.05	568450.756	245775.148	568450.756	245775.148	Required	
S6.06	568446.854	245779.374			No Entry	
S6.07	568449.230	245782.702	568449.230	245782.702	Required	
S6.07 FC	568453.189	245780.070	568453.189	245780.070	Required	
S6.O1	568456.189	245780.070			No Entry	

PIPELINE SCHEDULES for SW 06

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		-1	S6.01	92.499	90.077	0.922	Junction	
3.000	o	225	S6.02	91.835	90.644	0.966	Open Manhole	1240 x 675
3.001	o	225	S6.03	91.650	90.550	0.875	Junction	
2.001		-1	S6.04	91.600	90.076	0.024	Junction	
4.000	o	450	S6.05	91.300	90.206	0.644	Open Manhole	1240 x 675
4.001	o	450	S6.06	91.600	90.162	0.988	Junction	
2.002	o	300	S6.07	91.600	90.075	1.225	Open Manhole	1240 x 675
2.003	o	300	S6.07 FC	91.600	89.795	1.505	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	41.426	41426.3	S6.04	91.600	90.076	0.024	Junction	
3.000	4.269	45.4	S6.03	91.650	90.550	0.875	Junction	
3.001	4.148	25.9	S6.04	91.600	90.390	0.985	Junction	
2.001	27.771	27771.0	S6.07	91.600	90.075	0.025	Open Manhole	1240 x 675
4.000	5.753	130.7	S6.06	91.600	90.162	0.988	Junction	
4.001	4.089	47.0	S6.07	91.600	90.075	1.075	Open Manhole	1240 x 675
2.002	4.754	17.0	S6.07 FC	91.600	89.795	1.505	Open Manhole	1200
2.003	3.000	9.4	S6.01	91.550	89.476	1.774	Open Manhole	0

Area Summary for SW 06

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.000	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.095	0.095	0.095
3.001	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.625	0.625	0.625
4.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.720	0.720	0.720

Simulation Criteria for SW 06

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	1.000
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)	10080
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	2

Number of Input Hydrographs	0	Number of Storage Structures	0
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)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Storm Duration (mins)	15
Ratio R	0.430		

Online Controls for SW 06

Complex Manhole: S6.07, DS/PN: 2.002, Volume (m³): 286.9

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0061-1200-0300-1200
Design Head (m)	0.300
Design Flow (l/s)	1.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	61
Invert Level (m)	90.075
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	1.2
Flush-Flo™	0.094	1.2
Kick-Flo®	0.218	1.0
Mean Flow over Head Range	-	1.0

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	1.2	1.200	2.2	3.000	3.4	7.000	5.2
0.200	1.1	1.400	2.4	3.500	3.7	7.500	5.4
0.300	1.2	1.600	2.6	4.000	3.9	8.000	5.6
0.400	1.4	1.800	2.7	4.500	4.2	8.500	5.8
0.500	1.5	2.000	2.8	5.000	4.4	9.000	5.9
0.600	1.6	2.200	3.0	5.500	4.6	9.500	6.1
0.800	1.9	2.400	3.1	6.000	4.8		
1.000	2.1	2.600	3.2	6.500	5.0		

Orifice

Diameter (m) 0.055 Discharge Coefficient 0.600 Invert Level (m) 90.875