STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.400	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.268	4-8	0.533	8-12	0.018

Total Area Contributing (ha) = 0.819

Total Pipe Volume (m³) = 42.519

Network Design Table for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

« - 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)	Auto Design
1.000	25.810	0.400	64.5	0.035	5.00	0.0	0.600	o	225	
1.001	45.832	0.360	127.3	0.063	0.00	0.0	0.600	o	225	
1.002	27.693	0.200	138.5	0.035	0.00	0.0	0.600	o	300	
1.003	26.099	0.253	103.2	0.019	0.00	0.0	0.600	o	300	
1.004	24.713	0.513	48.2	0.053	0.00	0.0	0.600	o	300	

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	5.26	76.900	0.035	0.0	0.0	0.0	1.63	64.8	4.7
1.001	50.00	5.92	76.500	0.098	0.0	0.0	0.0	1.16	46.0	13.3
1.002	49.32	6.27	76.065	0.133	0.0	0.0	0.0	1.33	94.3	17.8
1.003	48.29	6.55	75.865	0.152	0.0	0.0	0.0	1.55	109.4	19.9
1.004	47.65	6.73	75.612	0.205	0.0	0.0	0.0	2.27	160.5	26.5

20 Milton Park Abingdon Oxfordshire OX14 4SH	Land of Green Lane Chesterton
Date 14/04/2016 File JNY8140 SW Network Desi...	Designed by HSS Checked by SF
Causeway	Network 2014.1.1

Network Design Table for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
2.000	16.795	0.190	88.4	0.054	5.00	0.0	0.600	o	225	
2.001	34.270	0.300	114.2	0.039	0.00	0.0	0.600	o	300	
2.002	20.415	0.136	150.1	0.077	0.00	0.0	0.600	o	300	
2.003	26.416	0.200	132.1	0.053	0.00	0.0	0.600	o	450	
1.005	6.274	0.020	313.7	0.000	0.00	0.0	0.600	o	450	
1.006	4.311	0.015	287.4	0.000	0.00	0.0	0.600	o	450	
1.007	20.789	0.200	103.9	0.000	0.00	0.0	0.600	o	450	
1.008	22.627	0.100	226.3	0.085	0.00	0.0	0.600	o	450	
1.009	53.267	0.269	198.0	0.166	0.00	0.0	0.600	o	450	
3.000	17.110	0.355	48.2	0.063	5.00	0.0	0.600	o	225	
3.001	5.157	0.175	29.5	0.025	0.00	0.0	0.600	o	300	
1.010	15.860	0.050	317.2	0.052	0.00	0.0	0.600	o	450	
1.011	6.954	0.100	69.5	0.000	0.00	0.0	0.600	o	450	
1.012	8.064	0.020	403.2	0.000	0.00	0.0	0.600	o	450	
1.013	59.620	0.375	159.0	0.000	0.00	0.0	0.600	o	225	

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	5.20	76.000	0.054	0.0	0.0	0.0	1.39	55.3	7.3
2.001	50.00	5.59	75.735	0.093	0.0	0.0	0.0	1.47	103.9	12.6
2.002	50.00	5.86	75.435	0.170	0.0	0.0	0.0	1.28	90.5	23.0
2.003	49.96	6.10	75.149	0.223	0.0	0.0	0.0	1.77	281.1	30.2
1.005	47.33	6.82	74.949	0.428	0.0	0.0	0.0	1.14	181.7	54.9
1.006	47.13	6.88	74.929	0.428	0.0	0.0	0.0	1.19	189.9	54.9
1.007	46.55	7.06	74.914	0.428	0.0	0.0	0.0	1.99	317.1	54.9
1.008	45.64	7.34	74.714	0.513	0.0	0.0	0.0	1.35	214.3	63.4
1.009	43.79	7.95	74.614	0.679	0.0	0.0	0.0	1.44	229.2	80.5
3.000	50.00	5.15	74.950	0.063	0.0	0.0	0.0	1.89	75.1	8.5
3.001	50.00	5.18	74.520	0.088	0.0	0.0	0.0	2.91	205.5	11.9
1.010	43.13	8.19	74.195	0.819	0.0	0.0	0.0	1.14	180.7	95.7
1.011	43.00	8.23	74.145	0.819	0.0	0.0	0.0	2.44	388.2	95.7
1.012	42.64	8.37	74.045	0.819	0.0	0.0	0.0	1.01	160.0	95.7
1.013	40.28	9.33	74.025	0.819	0.0	0.0	0.0	1.03	41.1«	95.7

Manhole Schedules for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

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)
1	77.500	0.600	Open Manhole	450	1.000	76.900	225				
2	77.251	0.751	Open Manhole	900	1.001	76.500	225	1.000	76.500	225	
3	77.793	1.728	Open Manhole	1200	1.002	76.065	300	1.001	76.140	225	
4	77.357	1.492	Open Manhole	1200	1.003	75.865	300	1.002	75.865	300	
5	77.108	1.496	Open Manhole	1200	1.004	75.612	300	1.003	75.612	300	
18	76.650	0.650	Open Manhole	450	2.000	76.000	225				
19	76.839	1.104	Open Manhole	1200	2.001	75.735	300	2.000	75.810	225	
20	76.521	1.086	Open Manhole	1200	2.002	75.435	300	2.001	75.435	300	
21	76.679	1.530	Open Manhole	1350	2.003	75.149	450	2.002	75.299	300	
6	77.203	2.254	Open Manhole	1350	1.005	74.949	450	1.004	75.099	300	
								2.003	74.949	450	
8	75.976	1.047	Open Manhole	2100	1.006	74.929	450	1.005	74.929	450	
9	76.590	1.676	Open Manhole	3660	1.007	74.914	450	1.006	74.914	450	
10	76.326	1.612	Open Manhole	1350	1.008	74.714	450	1.007	74.714	450	
11	76.132	1.518	Open Manhole	1350	1.009	74.614	450	1.008	74.614	450	
22	75.900	0.950	Open Manhole	450	3.000	74.950	225				
23	75.950	1.430	Open Manhole	900	3.001	74.520	300	3.000	74.595	225	
12	75.699	1.504	Open Manhole	1350	1.010	74.195	450	1.009	74.345	450	150
								3.001	74.345	300	
13	75.711	1.566	Open Manhole	1350	1.011	74.145	450	1.010	74.145	450	
15	75.200	1.155	Open Manhole	2100	1.012	74.045	450	1.011	74.045	450	
16	75.150	1.125	Open Manhole	3660	1.013	74.025	225	1.012	74.025	450	
17	75.600	1.950	Open Manhole	1200		OUTFALL		1.013	73.650	225	

PIPELINE SCHEDULES for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

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)
1.000	o	225	1	77.500	76.900	0.375	Open Manhole	450
1.001	o	225	2	77.251	76.500	0.526	Open Manhole	900
1.002	o	300	3	77.793	76.065	1.428	Open Manhole	1200
1.003	o	300	4	77.357	75.865	1.192	Open Manhole	1200
1.004	o	300	5	77.108	75.612	1.196	Open Manhole	1200
2.000	o	225	18	76.650	76.000	0.425	Open Manhole	450
2.001	o	300	19	76.839	75.735	0.804	Open Manhole	1200
2.002	o	300	20	76.521	75.435	0.786	Open Manhole	1200
2.003	o	450	21	76.679	75.149	1.080	Open Manhole	1350
1.005	o	450	6	77.203	74.949	1.804	Open Manhole	1350
1.006	o	450	8	75.976	74.929	0.597	Open Manhole	2100
1.007	o	450	9	76.590	74.914	1.226	Open Manhole	3660
1.008	o	450	10	76.326	74.714	1.162	Open Manhole	1350
1.009	o	450	11	76.132	74.614	1.068	Open Manhole	1350
3.000	o	225	22	75.900	74.950	0.725	Open Manhole	450
3.001	o	300	23	75.950	74.520	1.130	Open Manhole	900
1.010	o	450	12	75.699	74.195	1.054	Open Manhole	1350

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)
1.000	25.810	64.5	2	77.251	76.500	0.526	Open Manhole	900
1.001	45.832	127.3	3	77.793	76.140	1.428	Open Manhole	1200
1.002	27.693	138.5	4	77.357	75.865	1.192	Open Manhole	1200
1.003	26.099	103.2	5	77.108	75.612	1.196	Open Manhole	1200
1.004	24.713	48.2	6	77.203	75.099	1.804	Open Manhole	1350
2.000	16.795	88.4	19	76.839	75.810	0.804	Open Manhole	1200
2.001	34.270	114.2	20	76.521	75.435	0.786	Open Manhole	1200
2.002	20.415	150.1	21	76.679	75.299	1.080	Open Manhole	1350
2.003	26.416	132.1	6	77.203	74.949	1.804	Open Manhole	1350
1.005	6.274	313.7	8	75.976	74.929	0.597	Open Manhole	2100
1.006	4.311	287.4	9	76.590	74.914	1.226	Open Manhole	3660
1.007	20.789	103.9	10	76.326	74.714	1.162	Open Manhole	1350
1.008	22.627	226.3	11	76.132	74.614	1.068	Open Manhole	1350
1.009	53.267	198.0	12	75.699	74.345	0.904	Open Manhole	1350
3.000	17.110	48.2	23	75.950	74.595	1.130	Open Manhole	900
3.001	5.157	29.5	12	75.699	74.345	1.054	Open Manhole	1350
1.010	15.860	317.2	13	75.711	74.145	1.116	Open Manhole	1350

PIPELINE SCHEDULES for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

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)
1.011	o	450	13	75.711	74.145	1.116	Open Manhole	1350
1.012	o	450	15	75.200	74.045	0.705	Open Manhole	2100
1.013	o	225	16	75.150	74.025	0.900	Open Manhole	3660

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)
1.011	6.954	69.5	15	75.200	74.045	0.705	Open Manhole	2100
1.012	8.064	403.2	16	75.150	74.025	0.675	Open Manhole	3660
1.013	59.620	159.0	17	75.600	73.650	1.725	Open Manhole	1200

Free Flowing Outfall Details for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013	17	75.600	73.650	73.615	1200	0

Simulation Criteria for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

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	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)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

Hydro-Brake Optimum® Manhole: 9, DS/PN: 1.007, Volume (m³): 17.9

Unit Reference	MD-SHE-0089-3000-0515-3000
Design Head (m)	0.515
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	89
Invert Level (m)	74.914
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.515	3.0
Flush-Flo™	0.159	3.0
Kick-Flo®	0.361	2.5
Mean Flow over Head Range	-	2.5

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	2.8	1.200	4.4	3.000	6.7	7.000	10.1
0.200	2.9	1.400	4.7	3.500	7.3	7.500	10.5
0.300	2.8	1.600	5.0	4.000	7.7	8.000	10.8
0.400	2.7	1.800	5.3	4.500	8.2	8.500	11.2
0.500	2.9	2.000	5.6	5.000	8.6	9.000	11.5
0.600	3.2	2.200	5.8	5.500	9.0	9.500	11.8
0.800	3.6	2.400	6.1	6.000	9.4		
1.000	4.0	2.600	6.3	6.500	9.8		

Storage Structures for JNY8140 SW NETWORK DESIGN 2015 09 25.SWS

Infiltration Basin Manhole: 8, DS/PN: 1.006

Invert Level (m) 74.929 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.54720

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	243.0	0.382	415.0	0.764	602.0	1.146	803.0

Tank or Pond Manhole: 15, DS/PN: 1.012

Invert Level (m) 74.045

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	392.0	0.350	507.0	0.700	634.0