


Woods Hardwick		Page 0
15-17 Goldington Road Bedford MK40 3NH		
Date 25/09/2015 16:05	Designed by a.tew	
File SW Trenchard existing 2...	Checked by	
Micro Drainage		Network 2014.1.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW EAST EXISTING 15.07.13.SWS






Pipe Sizes SW EAST EXISTING 15.07.13 Manhole Sizes SW EAST EXISTING 15.07.13

FEH Rainfall Model

Return Period (years)	2
Site Location GB 450500 225250 SP 50500 25250	
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292
F (1km)	2.461
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	0.75
Min Slope for Optimisation (1:X)	500


Designed with Level Soffits

Network Design Table for SW EAST EXISTING 15.07.13.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
1.000	35.951	0.629	57.2	0.031	5.00	0.0	0.600	o	225	
1.001	26.411	0.215	122.8	0.056	0.00	0.0	0.600	o	150	
2.000	14.225	0.225	63.2	0.090	5.00	0.0	0.600	o	150	
2.001	22.148	0.198	111.9	0.200	0.00	0.0	0.600	o	300	
1.002	10.321	0.104	99.2	0.100	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	0.00	5.35	120.021	0.031	0.0	0.0	0.0	1.73	68.9	0.0
1.001	0.00	5.83	119.392	0.087	0.0	0.0	0.0	0.91	16.0	0.0
2.000	0.00	5.19	119.600	0.090	0.0	0.0	0.0	1.27	22.4	0.0
2.001	0.00	5.44	119.225	0.290	0.0	0.0	0.0	1.49	105.0	0.0
1.002	0.00	5.94	119.027	0.477	0.0	0.0	0.0	1.58	111.6	0.0


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Network Design Table for SW EAST EXISTING 15.07.13.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
3.000	20.687	0.097	213.3	0.363	5.00	0.0	0.600	o	375	
4.000	30.988	0.327	94.8	0.293	5.00	0.0	0.600	o	225	
3.001	43.746	0.406	107.7	0.132	0.00	0.0	0.600	o	375	
5.000	25.387	0.211	120.3	0.099	5.00	0.0	0.600	o	100	
3.002	31.824	0.107	297.4	0.000	0.00	0.0	0.600	o	375	
3.003	10.659	0.040	266.5	0.029	0.00	0.0	0.600	o	375	
6.000	3.241	0.135	24.0	0.030	5.00	0.0	0.600	o	150	
1.003	5.982	0.017	351.9	0.000	0.00	0.0	0.600	o	525	
1.004	8.188	0.018	454.9	0.000	0.00	0.0	0.600	o	525	
7.000	8.461	0.042	201.5	0.159	5.00	0.0	0.600	o	225	
7.001	38.682	0.240	161.2	0.000	0.00	0.0	0.600	o	225	
7.002	7.950	0.001	7950.0	0.046	0.00	0.0	0.600	o	300	
8.000	20.838	0.169	123.3	0.515	5.00	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)
3.000	0.00	5.28	119.600	0.363	0.0	0.0	0.0	1.24	136.6	0.0
4.000	0.00	5.38	119.980	0.293	0.0	0.0	0.0	1.34	53.4	0.0
3.001	0.00	5.80	119.503	0.788	0.0	0.0	0.0	1.75	192.7	0.0
5.000	0.00	5.60	119.583	0.099	0.0	0.0	0.0	0.70	5.5	0.0
3.002	0.00	6.31	119.097	0.887	0.0	0.0	0.0	1.05	115.5	0.0
3.003	0.00	6.47	118.990	0.916	0.0	0.0	0.0	1.11	122.1	0.0
6.000	0.00	5.03	119.257	0.030	0.0	0.0	0.0	2.06	36.5	0.0
1.003	0.00	6.55	118.917	1.423	0.0	0.0	0.0	1.19	257.2	0.0
1.004	0.00	6.69	118.365	1.423	0.0	0.0	0.0	1.04	225.9	0.0
7.000	0.00	5.15	118.929	0.159	0.0	0.0	0.0	0.92	36.5	0.0
7.001	0.00	5.78	118.887	0.159	0.0	0.0	0.0	1.03	40.8	0.0
7.002	0.00	6.57	118.572	0.205	0.0	0.0	0.0	0.17	11.8	0.0
8.000	0.00	5.30	119.471	0.515	0.0	0.0	0.0	1.18	46.8	0.0


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Network Design Table for SW EAST EXISTING 15.07.13.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
8.001	45.406	0.311	146.0	0.120	0.00	0.0	0.600	o	225	
8.002	21.439	0.193	111.1	0.135	0.00	0.0	0.600	o	225	
8.003	14.461	0.152	95.1	0.100	0.00	0.0	0.600	o	225	
7.003	7.429	0.001	7429.0	0.000	0.00	0.0	0.600	o	300	
9.000	56.396	0.150	376.0	0.156	5.00	0.0	0.600	o	525	
9.001	8.750	0.030	291.7	0.000	0.00	0.0	0.600	o	525	
9.002	23.509	0.060	391.8	0.000	0.00	0.0	0.600	o	525	
1.005	37.754	0.097	389.2	0.000	0.00	0.0	0.600	o	825	
10.000	13.633	0.058	235.1	0.063	5.00	0.0	0.600	o	100	
10.001	17.441	0.070	250.0	0.000	0.00	0.0	0.600	o	100	
1.006	19.044	0.020	952.2	0.000	0.00	0.0	0.600	\	40	
11.000	12.426	0.039	318.6	0.070	5.00	0.0	0.600	o	100	
11.001	9.076	0.010	907.6	0.006	0.00	0.0	0.600	o	100	
12.000	8.298	0.065	127.7	0.006	5.00	0.0	0.600	o	150	

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)
8.001	0.00	6.00	119.302	0.635	0.0	0.0	0.0	1.08	42.9	0.0
8.002	0.00	6.28	118.991	0.770	0.0	0.0	0.0	1.24	49.3	0.0
8.003	0.00	6.46	118.798	0.870	0.0	0.0	0.0	1.34	53.3	0.0
7.003	0.00	7.29	118.571	1.075	0.0	0.0	0.0	0.17	12.2	0.0
9.000	0.00	5.82	118.570	0.156	0.0	0.0	0.0	1.15	248.8	0.0
9.001	0.00	5.93	118.420	0.156	0.0	0.0	0.0	1.31	282.8	0.0
9.002	0.00	6.28	118.390	0.156	0.0	0.0	0.0	1.13	243.6	0.0
1.005	0.00	7.71	118.297	2.654	0.0	0.0	0.0	1.50	801.2	0.0
10.000	0.00	5.46	118.268	0.063	0.0	0.0	0.0	0.50	3.9	0.0
10.001	0.00	6.06	118.210	0.063	0.0	0.0	0.0	0.48	3.8	0.0
1.006	0.00	7.88	117.700	2.717	0.0	0.0	0.0	1.91	7493.7	0.0
11.000	0.00	5.49	118.143	0.070	0.0	0.0	0.0	0.43	3.3	0.0
11.001	0.00	6.10	118.104	0.076	0.0	0.0	0.0	0.25	1.9	0.0
12.000	0.00	5.16	118.017	0.006	0.0	0.0	0.0	0.89	15.7	0.0

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Network Design Table for SW EAST EXISTING 15.07.13.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
1.007	31.260	0.035	893.1	0.000	0.00	0.0	0.600	\	40	
13.000	33.909	0.096	353.2	0.107	5.00	0.0	0.600	o	100	
1.008	4.365	0.005	873.0	0.000	0.00	0.0	0.600	\	40	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	0.00	8.14	117.680	2.799	0.0	0.0	0.0	1.97	7739.1	0.0
13.000	0.00	6.40	117.753	0.107	0.0	0.0	0.0	0.40	3.2	0.0
1.008	0.00	8.18	117.645	2.906	0.0	0.0	0.0	1.99	7828.5	0.0

Free Flowing Outfall Details for SW EAST EXISTING 15.07.13.SWS


Outfall Pipe Number	Outfall C. Level Name	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.008		0.000	117.640	0.000	0 0

Simulation Criteria for SW EAST EXISTING 15.07.13.SWS

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	1.000
Hot Start (mins)	0	Inlet Coefficient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 450500 225250 SP 50500
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292

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Synthetic Rainfall Details

F (1km) 2.461
 Summer Storms No
 Winter Storms Yes
 Cv (Summer) 0.750
 Cv (Winter) 0.840
 Storm Duration (mins) 15

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Summary of Critical Results by Maximum Level (Rank 1) for SW EAST EXISTING
15.07.13.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	1.000
Hot Start Level (mm)	0	Inlet Coefficient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FEH
Site Location	GB 450500 225250 SP 50500 25250
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292
F (1km)	2.461
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	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	100
Climate Change (%)	0


PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow Act.	O/F	Lvl Exc.
1.000	15 Winter	100	0%					
1.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			5
2.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
2.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			3
1.002	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
3.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			5
4.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			6
3.001	15 Summer	100	0%	100/15 Summer	100/15 Summer			2
5.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			9
3.002	15 Winter	100	0%	100/15 Summer	100/15 Summer			1
3.003	15 Winter	100	0%	100/15 Summer				
6.000	15 Winter	100	0%	100/15 Summer				
1.003	15 Winter	100	0%	100/15 Summer				
1.004	15 Winter	100	0%	100/15 Summer				

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Summary of Critical Results by Maximum Level (Rank 1) for SW EAST EXISTING
15.07.13.SWS

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
7.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
7.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			2
7.002	15 Winter	100	0%	100/15 Summer				
8.000	30 Winter	100	0%	100/15 Summer	100/15 Summer			11
8.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			6
8.002	15 Winter	100	0%	100/15 Summer	100/15 Summer			3
8.003	15 Winter	100	0%	100/15 Summer				
7.003	15 Winter	100	0%	100/15 Summer				
9.000	15 Winter	100	0%					
9.001	15 Winter	100	0%	100/15 Summer				
9.002	15 Winter	100	0%	100/15 Summer				
1.005	15 Winter	100	0%					
10.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			8
10.001	15 Winter	100	0%	100/15 Summer				
1.006	15 Winter	100	0%					
11.000	15 Winter	100	0%	100/15 Summer	100/15 Summer			8
11.001	15 Winter	100	0%	100/15 Summer				
12.000	15 Winter	100	0%	100/15 Summer				
1.007	15 Winter	100	0%					
13.000	30 Winter	100	0%	100/15 Summer	100/15 Summer			10
1.008	15 Winter	100	0%					

PN	US/MH Name	Water	Flooded			Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
1.000	0759	120.134	-0.112	0.000	0.28	0.0	18.0	OK
1.001	0761	120.088	0.546	11.059	1.62	0.0	24.7	FLOOD
2.000	1212	120.544	0.794	6.980	1.89	0.0	38.9	FLOOD
2.001	1211	120.237	0.712	6.547	1.21	0.0	112.4	FLOOD
1.002	0764	119.947	0.620	9.787	1.83	0.0	147.7	FLOOD
3.000	Ex MH	120.731	0.756	31.471	0.95	0.0	109.3	FLOOD
4.000	1257	120.812	0.607	41.742	1.58	0.0	78.8	FLOOD
3.001	0760	120.673	0.795	0.449	1.05	0.0	185.5	FLOOD
5.000	0763	120.412	0.729	19.104	2.11	0.0	11.3	FLOOD
3.002	0762	120.257	0.785	0.017	1.82	0.0	186.6	FLOOD
3.003	Ex MH	119.902	0.537	0.000	2.24	0.0	204.2	SURCHARGED
6.000	0767	119.707	0.300	0.000	0.76	0.0	17.6	FLOOD RISK
1.003	0766	119.624	0.182	0.000	2.31	0.0	362.7	FLOOD RISK
1.004	PI	119.109	0.219	0.000	2.81	0.0	357.5	SURCHARGED
7.000	0745	120.106	0.952	7.480	2.04	0.0	60.3	FLOOD
7.001	0746	119.952	0.840	0.145	1.53	0.0	59.3	FLOOD
7.002	1208	119.495	0.623	0.000	2.30	0.0	82.3	SURCHARGED
8.000	0711	120.165	0.469	123.952	1.20	0.0	50.8	FLOOD
8.001	0952	120.113	0.586	35.474	1.43	0.0	58.4	FLOOD
8.002	0953	120.190	0.974	6.280	1.39	0.0	62.4	FLOOD
8.003	1206	120.074	1.051	0.000	2.16	0.0	100.8	FLOOD RISK
7.003	Ex MH	119.385	0.514	0.000	4.80	0.0	181.4	SURCHARGED
9.000	0768	119.095	0.000	0.000	0.37	0.0	82.8	OK
9.001	0765	118.987	0.042	0.000	0.49	0.0	88.6	SURCHARGED

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Summary of Critical Results by Maximum Level (Rank 1) for SW EAST EXISTING
15.07.13.SWS

PN	US/MH Name	Water	Flooded		Pipe		Status	
		Level (m)	Surch'ed Depth (m)	Volume (m ³)	Flow / O'flow Cap. (l/s)	Flow (l/s)		
9.002	Ex MH	118.948	0.033	0.000	0.42	0.0	82.8	SURCHARGED
1.005	0769	118.911	-0.211	0.000	0.91	0.0	574.6	OK
10.000	1226	118.907	0.539	9.196	2.37	0.0	8.8	FLOOD
10.001	1285	118.611	0.301	0.000	2.31	0.0	8.4	FLOOD RISK
1.006	Ditch	118.238	-0.733	0.000	0.29	0.0	579.6	OK
11.000	1267	118.561	0.318	12.673	2.32	0.0	7.3	FLOOD
11.001	1288	118.441	0.237	0.000	3.58	0.0	9.2	FLOOD RISK
12.000	1287	118.207	0.040	0.000	0.25	0.0	3.5	SURCHARGED
1.007	Ditch	118.204	-0.747	0.000	0.18	0.0	577.9	OK
13.000	1225	118.450	0.597	21.987	2.57	0.0	8.0	FLOOD
1.008	Ditch	118.144	-0.772	0.000	0.17	0.0	581.8	OK