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The Arup Campus Blyth Gate Solihull B90 8AE		
Date 16/05/2019 08:33 File Phase 2 Checked.MDX	Designed by Emma.Cecil Checked by	
XP Solutions	Network 2018.1.1	

STORM SEWER DESIGN by the Modified Rational Method

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	27.568	0.184	150.0	0.056	4.00	0.0	0.600	o	150	Pipe/Conduit		🔧
1.001	6.931	0.693	10.0	0.073	0.00	0.0	0.600	o	150	Pipe/Conduit		🔧
1.002	13.147	0.131	100.4	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit		🔧
1.003	11.500	0.077	150.0	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit		🔧
1.004	14.005	0.093	150.0	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit		🔧
2.000	9.101	0.091	100.0	0.076	4.00	0.0	0.600	o	150	Pipe/Conduit		🔧
3.000	5.230	0.105	50.0	0.021	4.00	0.0	0.600	o	150	Pipe/Conduit		🔒
1.005	7.406	0.049	150.0	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit		🔧
1.006	5.875	0.039	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		🔧
1.007	1.612	0.011	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		🔧
4.000	15.398	0.154	100.0	0.007	4.00	0.0	0.600	o	150	Pipe/Conduit		🔒
4.001	22.566	0.150	150.0	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit		🔧
4.002	11.471	0.076	150.0	0.096	0.00	0.0	0.600	o	225	Pipe/Conduit		🔧
4.003	6.711	0.045	150.0	0.075	0.00	0.0	0.600	o	225	Pipe/Conduit		🔧
4.004	6.028	0.040	150.0	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit		🔧
5.000	23.993	0.480	50.0	0.010	4.00	0.0	0.600	o	150	Pipe/Conduit		🔒

Network Results Table

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

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
6.000	8.036	0.161	50.0	0.029	4.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	10.951	0.219	50.0	0.019	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.002	19.634	1.309	15.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.005	11.007	0.073	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	16.812	0.168	100.0	0.037	4.00	0.0	0.600	o	150	Pipe/Conduit	
7.001	28.537	0.190	150.0	0.062	0.00	0.0	0.600	o	225	Pipe/Conduit	
7.002	18.287	0.122	150.0	0.043	0.00	0.0	0.600	o	225	Pipe/Conduit	
8.000	23.945	0.160	150.0	0.045	4.00	0.0	0.600	o	150	Pipe/Conduit	
4.006	5.408	0.027	200.0	0.048	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.007	18.214	0.091	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.008	4.367	0.022	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.009	17.246	0.086	200.0	0.000	0.00	0.0	0.600	o	450	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)
6.000	50.00	4.09	34.061	0.029	0.0	0.0	0.0	1.43	25.2	5.2
5.001	50.00	4.41	33.900	0.058	0.0	0.0	0.0	1.43	25.2	10.4
5.002	50.00	4.53	33.681	0.058	0.0	0.0	0.0	2.61	46.2	10.4
4.005	50.00	5.22	29.990	0.298	0.0	0.0	0.0	1.28	90.6	53.8
7.000	50.00	4.28	30.700	0.037	0.0	0.0	0.0	1.00	17.8	6.7
7.001	50.00	4.73	30.457	0.099	0.0	0.0	0.0	1.07	42.4	17.8
7.002	50.00	5.01	30.267	0.142	0.0	0.0	0.0	1.07	42.4	25.6
8.000	50.00	4.49	32.150	0.045	0.0	0.0	0.0	0.82	14.5	8.2
4.006	50.00	5.29	29.842	0.533	0.0	0.0	0.0	1.28	141.1	96.3
4.007	50.00	5.53	29.250	0.533	0.0	0.0	0.0	1.28	141.1	96.3
4.008	50.00	5.59	29.159	0.533	0.0	0.0	0.0	1.28	141.1	96.3
4.009	50.00	5.79	29.062	0.533	0.0	0.0	0.0	1.43	228.1	96.3

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Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
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	3
Number of Online Controls	2	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)	2	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.362		

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000		1	32.541	-0.059	0.000	0.66		9.1
1.001		2	32.332	-0.085	0.000	0.39		18.7
1.002		3	31.602	-0.122	0.000	0.43		19.3
1.003		4	31.490	-0.103	0.000	0.57		20.7
1.004		5	31.422	-0.094	0.000	0.64		23.6
2.000		6	31.504	-0.046	0.000	0.82		12.8
3.000		7	31.442	-0.108	0.000	0.18		3.6
1.005	Att Tank 1		30.836	0.036	0.000	0.09		5.2
1.006		8	30.510	-0.241	0.000	0.09		5.2
1.007	Existing NR MH01		26.662	-0.238	0.000	0.09		5.2
4.000		9	32.177	-0.123	0.000	0.07		1.2
4.001		10	32.062	-0.084	0.000	0.39		5.4
4.002		11	31.884	-0.111	0.000	0.50		18.0
4.003	Att Tank 2		30.315	-0.060	0.000	0.89		26.5
4.004		12	30.179	-0.151	0.000	0.49		30.1
5.000		16	34.406	-0.124	0.000	0.07		1.6
6.000		17	34.109	-0.102	0.000	0.22		4.8
5.001		18	33.966	-0.084	0.000	0.40		9.0
5.002		19	33.727	-0.104	0.000	0.21		8.9
4.005		13	30.151	-0.139	0.000	0.56		38.0

PN	US/MH Name	Status	Level Exceeded
1.000		OK	
1.001		OK	
1.002		OK	
1.003		OK	
1.004		OK	
2.000		OK	
3.000		OK	
1.005	Att Tank 1	SURCHARGED	
1.006		OK	
1.007	Existing NR MH01	OK	
4.000		OK	
4.001		OK	
4.002		OK	
4.003	Att Tank 2	OK	
4.004		OK	
5.000		OK	
6.000		OK	
5.001		OK	
5.002		OK	
4.005		OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000		1	32.675	0.075	0.000	1.18		16.2
1.001		2	32.369	-0.047	0.000	0.79		38.1
1.002		3	31.758	0.034	0.000	0.85		38.2
1.003		4	31.660	0.068	0.000	1.13		40.8
1.004		5	31.565	0.049	0.000	1.27		46.9
2.000		6	31.666	0.116	0.000	1.51		23.7
3.000		7	31.459	-0.091	0.000	0.33		6.7
1.005	Att Tank 1		31.275	0.475	0.000	0.09		5.3
1.006		8	30.510	-0.241	0.000	0.09		5.3
1.007	Existing NR MH01		26.662	-0.238	0.000	0.10		5.3
4.000		9	32.187	-0.113	0.000	0.14		2.3
4.001		10	32.124	-0.022	0.000	0.87		11.9
4.002		11	32.012	0.016	0.000	1.14		41.0
4.003	Att Tank 2		30.638	0.263	0.000	1.44		43.2
4.004		12	30.622	0.292	0.000	0.81		49.7
5.000		16	34.416	-0.114	0.000	0.13		3.1
6.000		17	34.128	-0.083	0.000	0.42		9.1
5.001		18	34.003	-0.047	0.000	0.81		18.3
5.002		19	33.749	-0.082	0.000	0.42		18.2
4.005		13	30.614	0.324	0.000	0.93		63.1

PN	US/MH Name	Status	Level Exceeded
1.000		1 SURCHARGED	
1.001		2 OK	
1.002		3 SURCHARGED	
1.003		4 SURCHARGED	
1.004		5 SURCHARGED	
2.000		6 SURCHARGED	
3.000		7 OK	
1.005	Att Tank 1	SURCHARGED	
1.006		8 OK	
1.007	Existing NR MH01	OK	
4.000		9 OK	
4.001		10 OK	
4.002		11 SURCHARGED	
4.003	Att Tank 2	SURCHARGED	
4.004		12 SURCHARGED	
5.000		16 OK	
6.000		17 OK	
5.001		18 OK	
5.002		19 OK	
4.005		13 SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH	Storm	Return Climate		First (X)	First (Y)	First (Z)
	Name		Period	Change	Surcharge	Flood	Overflow
7.000		21 15 Winter	30	+0%	100/15 Summer		
7.001		21a 30 Winter	30	+0%	100/15 Summer		
7.002		22 30 Winter	30	+0%	30/15 Summer		
8.000		20 15 Winter	30	+0%	100/15 Summer		
4.006		14 30 Winter	30	+0%	30/15 Summer		
4.007	Att Tank 3	30 Winter	30	+0%	2/15 Summer		
4.008		15 15 Winter	30	+0%			
4.009	Saddle Connection	15 Winter	30	+0%			

PN	US/MH Name	Overflow Act.	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe
			Level (m)	Depth (m)	Volume (m³)			Flow (l/s)
7.000		21	30.794	-0.056	0.000	0.71		11.7
7.001		21a	30.638	-0.044	0.000	0.60		23.5
7.002		22	30.619	0.128	0.000	0.88		33.6
8.000		20	32.294	-0.006	0.000	1.00		13.7
4.006		14	30.597	0.380	0.000	1.34		117.7
4.007	Att Tank 3		30.587	0.962	0.000	0.36		42.0
4.008		15	29.349	-0.185	0.000	0.51		42.0
4.009	Saddle Connection		29.213	-0.299	0.000	0.25		42.0

PN	US/MH Name	Status	Level Exceeded
7.000		21	OK
7.001		21a	OK
7.002		22	SURCHARGED
8.000		20	OK
4.006		14	SURCHARGED
4.007	Att Tank 3		SURCHARGED
4.008		15	OK
4.009	Saddle Connection		OK

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000		1	33.106	0.506	0.000	1.49		20.7
1.001		2	32.704	0.287	0.000	0.99		47.9
1.002		3	32.450	0.727	0.000	0.46		20.6
1.003		4	32.462	0.870	0.000	0.46		16.7
1.004		5	32.453	0.938	0.000	0.53		19.5
2.000		6	32.448	0.898	0.000	0.57		9.0
3.000		7	32.449	0.899	0.000	0.12		2.5
1.005	Att Tank 1		32.449	1.649	0.000	0.10		6.0
1.006		8	30.514	-0.237	0.000	0.10		6.0
1.007	Existing NR MH01		26.666	-0.234	0.000	0.11		6.0
4.000		9	32.357	0.057	0.000	0.24		3.9
4.001		10	32.347	0.201	0.000	1.24		17.0
4.002		11	32.134	0.139	0.000	1.67		60.3
4.003	Att Tank 2		31.825	1.450	0.000	1.56		46.5
4.004		12	31.808	1.478	0.000	0.89		54.9
5.000		16	34.425	-0.105	0.000	0.20		4.8
6.000		17	34.194	-0.017	0.000	0.61		13.4
5.001		18	34.132	0.082	0.000	1.17		26.5
5.002		19	33.766	-0.065	0.000	0.61		26.6
4.005		13	31.799	1.509	0.000	1.06		72.2

PN	US/MH Name	Status	Level Exceeded
1.000		1 FLOOD RISK	
1.001		2 SURCHARGED	
1.002		3 FLOOD RISK	
1.003		4 FLOOD RISK	
1.004		5 SURCHARGED	
2.000		6 SURCHARGED	
3.000		7 SURCHARGED	
1.005	Att Tank 1	SURCHARGED	
1.006		8 OK	
1.007	Existing NR MH01	OK	
4.000		9 SURCHARGED	
4.001		10 SURCHARGED	
4.002		11 SURCHARGED	
4.003	Att Tank 2	SURCHARGED	
4.004		12 SURCHARGED	
5.000		16 OK	
6.000		17 OK	
5.001		18 SURCHARGED	
5.002		19 OK	
4.005		13 SURCHARGED	

