

Bloor Homes		Page 0
Ashby Road Measham Swadlincote DE12 7JP		
Date 13/11/2025 10:50 File PH7A - FITCHETT STORM. ...	Designed by d_southa Checked by	
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 8

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	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 Surface Network 8

« - 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	30.932	0.327	94.6	0.167	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	17.048	0.253	67.4	0.081	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	24.461	0.315	77.7	0.032	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	16.291	0.265	61.5	0.011	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	30.319	0.590	51.4	0.257	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	14.528	0.258	56.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	15.635	0.284	55.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.007	30.561	0.110	277.8	0.066	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.008	19.656	0.160	122.8	0.023	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.000	42.890	0.416	103.1	0.184	5.00	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)
1.000	50.00	5.32	102.116	0.167	0.0	0.0	0.0	1.62	114.3	22.6
1.001	50.00	5.47	101.789	0.248	0.0	0.0	0.0	1.92	135.6	33.6
1.002	50.00	5.70	101.536	0.280	0.0	0.0	0.0	1.79	126.2	37.9
1.003	50.00	5.80	101.071	0.291	0.0	0.0	0.0	2.60	413.0	39.4
1.004	50.00	5.98	100.806	0.548	0.0	0.0	0.0	2.84	451.9	74.2
1.005	50.00	6.07	100.216	0.548	0.0	0.0	0.0	2.72	431.8	74.2
1.006	50.00	6.15	99.883	0.548	0.0	0.0	0.0	3.02	654.8	74.2
1.007	50.00	6.53	99.570	0.614	0.0	0.0	0.0	1.34	289.8	83.1
1.008	50.00	6.70	99.460	0.637	0.0	0.0	0.0	2.02	437.2	86.2
2.000	50.00	5.46	100.555	0.184	0.0	0.0	0.0	1.55	109.4	24.9

Bloor Homes		Page 1
Ashby Road Measham Swadlincote DE12 7JP		
Date 13/11/2025 10:50 File PH7A - FITCHETT STORM. ...	Designed by d_southa Checked by	
Innovyze	Network 2020.1.3	

Network Design Table for Surface Network 8

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
2.001	26.139	0.153	170.8	0.120	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	26.496	0.027	981.3	0.088	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	48.145	0.207	232.6	0.115	5.00	0.0	0.600	o	525	Pipe/Conduit	
3.001	25.530	0.084	303.9	0.083	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.003	15.475	0.209	74.0	0.007	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.004	17.159	0.072	238.3	0.142	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.005	13.568	0.027	502.5	0.138	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.006	17.264	0.126	137.0	0.148	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	41.865	0.075	556.0	0.047	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.010	34.997	0.110	319.0	0.211	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.011	32.331	0.546	59.2	0.074	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	58.453	0.246	237.7	0.106	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.012	6.746	0.124	54.4	0.164	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.013	21.383	0.350	61.1	0.035	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.014	13.269	0.160	82.9	0.030	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.015	37.757	0.380	99.4	0.058	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.016	47.054	1.100	42.8	0.112	0.00	0.0	0.600	o	600	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)
2.001	50.00	5.82	100.139	0.304	0.0	0.0	0.0	1.20	84.8	41.2
2.002	50.00	6.60	99.911	0.392	0.0	0.0	0.0	0.57	63.0	53.1
3.000	50.00	5.55	100.025	0.115	0.0	0.0	0.0	1.46	317.0	15.6
3.001	50.00	5.88	99.818	0.198	0.0	0.0	0.0	1.28	277.0	26.8
2.003	50.00	6.70	99.734	0.597	0.0	0.0	0.0	2.61	564.0	80.8
2.004	50.00	6.90	99.525	0.739	0.0	0.0	0.0	1.45	313.1	100.1
2.005	50.00	7.12	99.453	0.877	0.0	0.0	0.0	0.99	214.8	118.8
2.006	50.00	7.27	99.426	1.025	0.0	0.0	0.0	1.91	413.9	138.8
1.009	50.00	8.01	99.300	1.709	0.0	0.0	0.0	0.94	204.1	231.5
1.010	50.00	8.44	99.150	1.920	0.0	0.0	0.0	1.36	383.9	260.0
1.011	50.00	8.61	99.040	1.994	0.0	0.0	0.0	3.17	895.9	270.0
4.000	50.00	5.96	99.040	0.106	0.0	0.0	0.0	1.02	71.8	14.3
1.012	50.00	8.65	98.494	2.264	0.0	0.0	0.0	3.31	935.2	306.5
1.013	50.00	8.76	98.370	2.299	0.0	0.0	0.0	3.12	882.0	311.3
1.014	50.00	8.84	98.020	2.329	0.0	0.0	0.0	2.68	756.5	315.4
1.015	50.00	9.10	97.860	2.387	0.0	0.0	0.0	2.44	690.8	323.3
1.016	50.00	9.31	97.480	2.499	0.0	0.0	0.0	3.73	1054.8	338.4

Bloor Homes		Page 2
Ashby Road Measham Swadlincote DE12 7JP		
Date 13/11/2025 10:50 File PH7A - FITCHETT STORM. ...	Designed by d_southa Checked by	
Innovyze	Network 2020.1.3	

Network Design Table for Surface Network 8

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
1.017	17.396	0.046	378.2	0.097	0.00	0.0	0.600	o	1000	Pipe/Conduit	
1.018	33.391	0.015	2226.1	0.092	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.019	4.123	0.100	41.2	0.024	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.020	20.322	0.300	67.7	0.000	0.00	0.0	0.600	o	600	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)
1.017	50.00	9.48	96.380	2.596	0.0	0.0	0.0	1.71	1345.8	351.5
1.018	48.78	10.58	96.315	2.688	0.0	0.0	0.0	0.51	143.3	355.1
1.019	48.74	10.60	96.300	2.712	0.0	0.0	0.0	3.80	1074.4	358.0
1.020	48.46	10.71	96.200	2.712	0.0	0.0	0.0	2.96	837.4	358.0

Free Flowing Outfall Details for Surface Network 8

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,I (mm)	W (mm)
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1.020	S8053 - Headwall	97.000	95.900	0.000	0	0
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Simulation Criteria for Surface Network 8

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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	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)	2	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		

Bloor Homes		Page 3
Ashby Road Measham Swadlincote DE12 7JP		
Date 13/11/2025 10:50 File PH7A - FITCHETT STORM. ...	Designed by d_southa Checked by	
Innovyze Network 2020.1.3		

Online Controls for Surface Network 8

Hydro-Brake® Optimum Manhole: S8052 Control Chamber, DS/PN: 1.020, Volume (m³): 15.0

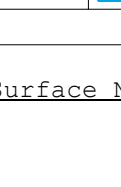
Unit Reference	MD-SHE-0145-1080-1400-1080
Design Head (m)	1.400
Design Flow (l/s)	10.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	145
Invert Level (m)	96.200
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	10.8
Flush-Flo™	0.412	10.7
Kick-Flo®	0.882	8.7
Mean Flow over Head Range	-	9.4

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	5.2	1.200	10.0	3.000	15.5	7.000	23.2
0.200	9.9	1.400	10.8	3.500	16.7	7.500	24.0
0.300	10.6	1.600	11.5	4.000	17.8	8.000	24.8
0.400	10.7	1.800	12.1	4.500	18.8	8.500	25.5
0.500	10.7	2.000	12.8	5.000	19.8	9.000	26.2
0.600	10.5	2.200	13.4	5.500	20.7	9.500	26.9
0.800	9.6	2.400	13.9	6.000	21.6		
1.000	9.2	2.600	14.5	6.500	22.4		

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Bloor Homes		Page 5
Ashby Road Measham Swadlincote DE12 7JP		
Date 13/11/2025 10:50 File PH7A - FITCHETT STORM. ...		
Designed by d_southa Checked by		
Innovyze		Network 2020.1.3

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 8

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
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	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	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood
1.000	S8104 Jelson	15 Winter	100	+40%	100/15 Summer	
1.001	S8172 Jelson	15 Winter	100	+40%	100/15 Summer	
1.002	S8105 Jelson	15 Winter	100	+40%	100/15 Summer	
1.003	S8107 Jelson	15 Winter	100	+40%	100/15 Summer	
1.004	S8171 Jelson	15 Winter	100	+40%	100/15 Summer	
1.005	S8170 Jelson	15 Winter	100	+40%	100/15 Summer	
1.006	S8009 - Jelson Connection	15 Winter	100	+40%	30/15 Winter	100/15 Winter
1.007	S8010	15 Winter	100	+40%	30/15 Summer	100/15 Winter
1.008	S8011	15 Winter	100	+40%	30/15 Summer	
2.000	S8108 Jelson	15 Winter	100	+40%	30/15 Winter	100/15 Summer
2.001	S8109 Jelson	15 Winter	100	+40%	30/15 Summer	100/15 Summer
2.002	S8110 Jelson	15 Winter	100	+40%	30/15 Summer	
3.000	S8115 Jelson	15 Winter	100	+40%	100/15 Summer	
3.001	S8116 Jelson	15 Winter	100	+40%	30/15 Summer	
2.003	S8111 Jelson	15 Winter	100	+40%	30/15 Summer	
2.004	S8112 Jelson	15 Winter	100	+40%	30/15 Summer	
2.005	S8113 Jelson	15 Winter	100	+40%	30/15 Summer	
2.006	S8022 Jelson Connection	15 Winter	100	+40%	30/15 Summer	
1.009	S8023	15 Winter	100	+40%	30/15 Summer	
1.010	S8025	15 Winter	100	+40%	30/15 Summer	
1.011	S8026	15 Winter	100	+40%	100/15 Summer	

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Bloor Homes		Page 6
Ashby Road Measham Swadlincote DE12 7JP		
Date 13/11/2025 10:50 File PH7A - FITCHETT STORM. ...	Designed by d_southa Checked by	
Innovyze	Network 2020.1.3	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 8

PN	US/MH Name	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S8104 Jelson			103.545	1.129	0.000	0.88
1.001	S8172 Jelson			103.301	1.212	0.000	1.15
1.002	S8105 Jelson			102.989	1.153	0.000	1.26
1.003	S8107 Jelson			102.495	0.974	0.000	0.51
1.004	S8171 Jelson			102.443	1.187	0.000	0.69
1.005	S8170 Jelson			102.130	1.464	0.000	0.92
1.006	S8009 - Jelson Connection			101.886	1.478	2.461	0.63
1.007	S8010			101.817	1.722	4.518	1.29
1.008	S8011			101.774	1.789	0.000	1.07
2.000	S8108 Jelson			102.563	1.708	3.484	0.98
2.001	S8109 Jelson			102.302	1.863	2.289	1.96
2.002	S8110 Jelson			101.936	1.650	0.000	4.65
3.000	S8115 Jelson			101.288	0.738	0.000	0.81
3.001	S8116 Jelson			101.468	1.125	0.000	1.02
2.003	S8111 Jelson			101.670	1.411	0.000	0.74
2.004	S8112 Jelson			101.738	1.688	0.000	1.11
2.005	S8113 Jelson			101.765	1.787	0.000	2.24
2.006	S8022 Jelson Connection			101.757	1.806	0.000	1.10
1.009	S8023			101.725	1.900	0.000	2.83
1.010	S8025			101.374	1.624	0.000	1.86
1.011	S8026			101.051	1.411	0.000	0.85

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S8104 Jelson			91.9	FLOOD RISK	
1.001	S8172 Jelson			132.9	FLOOD RISK	
1.002	S8105 Jelson			142.2	SURCHARGED	
1.003	S8107 Jelson			147.8	SURCHARGED	
1.004	S8171 Jelson			267.2	SURCHARGED	
1.005	S8170 Jelson			264.9	FLOOD RISK	
1.006	S8009 - Jelson Connection			256.3	FLOOD	1
1.007	S8010			313.3	FLOOD	1
1.008	S8011			328.7	FLOOD RISK	
2.000	S8108 Jelson			100.1	FLOOD	3
2.001	S8109 Jelson			149.3	FLOOD	2
2.002	S8110 Jelson			187.9	SURCHARGED	
3.000	S8115 Jelson			7 228.9	FLOOD RISK	
3.001	S8116 Jelson			231.2	SURCHARGED	
2.003	S8111 Jelson			260.7	SURCHARGED	
2.004	S8112 Jelson			263.7	SURCHARGED	
2.005	S8113 Jelson			266.6	SURCHARGED	
2.006	S8022 Jelson Connection			298.2	FLOOD RISK	
1.009	S8023			505.4	FLOOD RISK	
1.010	S8025			597.0	SURCHARGED	
1.011	S8026			624.2	SURCHARGED	

Bloor Homes

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DE12 7JP

Date 13/11/2025 10:50
File PH7A - FITCHETT STORM. ...

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Network 2020.1.3

Page 7



Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 8

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood
4.000	S8068	15 Winter	100	+40%	100/15 Summer	100/15 Winter
1.012	S8028	15 Winter	100	+40%	30/15 Summer	
1.013	S8029	15 Winter	100	+40%	100/15 Summer	
1.014	S8030	15 Winter	100	+40%	30/15 Summer	
1.015	S8031	15 Winter	100	+40%	100/15 Summer	
1.016	S8034	15 Winter	100	+40%	100/15 Summer	
1.017	S8037	600 Summer	100	+40%	100/15 Summer	100/240 Winter
1.018	S8039 - Headwall	1440 Summer	100	+40%	1/15 Winter	
1.019	S8051 - Headwall	1440 Summer	100	+40%		
1.020	S8052 Control Chamber	720 Winter	100	+40%	30/30 Summer	

PN	US/MH Name	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)
4.000	S8068			100.792	1.452	1.856	0.88
1.012	S8028			100.744	1.650	0.000	2.08
1.013	S8029			100.341	1.371	0.000	1.23
1.014	S8030			99.903	1.283	0.000	1.80
1.015	S8031			99.435	0.975	0.000	1.26
1.016	S8034			98.860	0.780	0.000	0.84
1.017	S8037			98.200	0.820	0.958	0.25
1.018	S8039 - Headwall			97.334	0.419	0.000	0.57
1.019	S8051 - Headwall			96.900	0.000	0.000	0.29
1.020	S8052 Control Chamber			97.912	1.112	0.000	0.02

PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S8068		60.2	FLOOD	1
1.012	S8028		733.3	SURCHARGED	
1.013	S8029		731.8	SURCHARGED	
1.014	S8030		721.6	SURCHARGED	
1.015	S8031		736.7	SURCHARGED	
1.016	S8034		771.2	SURCHARGED	
1.017	S8037		196.5	FLOOD	1
1.018	S8039 - Headwall		100.1	SURCHARGED*	
1.019	S8051 - Headwall		100.9	SURCHARGED*	
1.020	S8052 Control Chamber		11.9	SURCHARGED	

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