

Renaissance Assoc.		Page 1
Carvers Warehouse 77 Dale Street Manchester M1 2HG		
Date 06/07/2022 09:56 File MC VICTORIA HOUSE.MDX	Designed by HenryWilkinson Checked by	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.359	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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.102	4-8	0.031

Total Area Contributing (ha) = 0.133

Total Pipe Volume (m³) = 2.409

Network Design Table for Storm

- Indicates pipe length does not match coordinates

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
S1.000	2.015	0.025	80.0	0.082	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	5.877	0.073	80.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	20.443	0.300	68.1	0.003	0.00	0.0	0.600	o	225	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)
S1.000	50.00	5.02	47.625	0.082	0.0	0.0	0.0	1.46	58.2	11.1
S2.000	50.00	5.09	47.748	0.000	0.0	0.0	0.0	1.12	19.9	0.0
S1.001	50.00	5.30	47.600	0.085	0.0	0.0	0.0	1.59	63.1	11.5

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Network 2020.1.3

Page 2



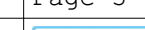
Network Design Table for Storm

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
S3.000	11.566	0.150	77.2	0.005	5.00	0.0	0.600	o	150	Pipe/Conduit	
S4.000	4.207	0.135	31.2	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	8.663	0.108	80.0	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	3.621	0.045	80.0	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	3.164#	0.032	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	4.781#	0.048	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	5.732	0.057	100.0	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	2.170	0.027	80.0	0.002	5.00	0.0	0.600	o	150	Pipe/Conduit	
S6.001	1.885	0.024	80.0	0.016	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	2.755	0.217	12.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.17	47.525	0.005	0.0	0.0	0.0	1.15	20.2	0.7
S4.000	50.00	5.04	47.510	0.007	0.0	0.0	0.0	1.81	32.0	0.9
S1.002	50.00	5.40	47.300	0.101	0.0	0.0	0.0	1.46	58.2	13.7
S5.000	50.00	5.05	47.312	0.007	0.0	0.0	0.0	1.12	19.9	0.9
S1.003	50.00	5.44	46.532	0.108	0.0	0.0	0.0	1.31	52.0	14.6
S1.004	50.00	5.50	46.500	0.108	0.0	0.0	0.0	1.31	52.0	14.6
S1.005	50.00	5.57	46.453	0.115	0.0	0.0	0.0	1.31	52.0	15.6
S6.000	50.00	5.03	46.521	0.002	0.0	0.0	0.0	1.12	19.9	0.3
S6.001	50.00	5.06	46.494	0.018	0.0	0.0	0.0	1.12	19.9	2.4
S1.006	50.00	5.59	46.395	0.133	0.0	0.0	0.0	3.69	146.8	18.0

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Renaissance Assoc.		Page 3
Carvers Warehouse 77 Dale Street Manchester M1 2HG		
Date 06/07/2022 09:56 File MC VICTORIA HOUSE.MDX	Designed by HenryWilkinson Checked by	
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Area Summary for Storm

Free Flowing Outfall Details for Storm

S1.006	S	47.765	46.178	0.000	0	0
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Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Renaissance Assoc.		Page 4
Carvers Warehouse 77 Dale Street Manchester M1 2HG		
Date 06/07/2022 09:56 File MC VICTORIA HOUSE.MDX	Designed by HenryWilkinson Checked by	
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S1.06, DS/PN: S1.006, Volume (m³): 1.9

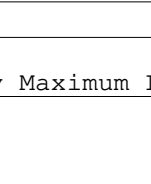
Unit Reference	MD-SFP-0142-1100-1390-1100
Design Head (m)	1.390
Design Flow (l/s)	11.0
Flush-Flo™	Calculated
Objective	Future Proof
Application	Surface
Sump Available	Yes
Diameter (mm)	142
Invert Level (m)	46.395
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.390	11.0
Flush-Flo™	0.350	11.0
Kick-Flo®	0.813	8.6
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	5.4	1.200	10.3	3.000	15.8	7.000	23.7
0.200	10.4	1.400	11.0	3.500	17.0	7.500	24.5
0.300	10.9	1.600	11.8	4.000	18.1	8.000	25.3
0.400	10.9	1.800	12.4	4.500	19.2	8.500	26.0
0.500	10.7	2.000	13.1	5.000	20.2	9.000	26.8
0.600	10.4	2.200	13.7	5.500	21.1	9.500	27.5
0.800	8.8	2.400	14.2	6.000	22.0		
1.000	9.4	2.600	14.8	6.500	22.9		

Renaissance Assoc.		Page 7							
Carvers Warehouse 77 Dale Street Manchester M1 2HG									
Date 06/07/2022 09:56 File MC VICTORIA HOUSE.MDX									
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<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>									

Renaissance Assoc.		Page 8
Carvers Warehouse 77 Dale Street Manchester M1 2HG		
Date 06/07/2022 09:56 File MC VICTORIA HOUSE.MDX		
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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	1
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	0.357
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	400.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1.00	15 Winter	2	+0%	100/15 Summer				47.728
S2.000	S13	15 Summer	2	+0%					47.748
S1.001	S1.01	15 Winter	2	+0%					47.673
S3.000	S2.00	15 Winter	2	+0%					47.545
S4.000	S3.00	15 Winter	2	+0%					47.531
S1.002	S1.02	15 Winter	2	+0%	100/15 Summer				47.390
S5.000	S4.00	15 Winter	2	+0%	100/30 Winter				47.341
S1.003	S1.03	15 Winter	2	+0%	30/15 Summer				46.653
S1.004	S1.04	15 Winter	2	+0%	30/15 Summer				46.644
S1.005	S1.05	15 Winter	2	+0%	30/15 Summer				46.640
S6.000	S5.00	15 Winter	2	+0%	30/15 Summer				46.634
S6.001	S5.01	15 Winter	2	+0%	30/15 Summer				46.634
S1.006	S1.06	15 Winter	2	+0%	2/15 Winter				46.633

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Page 10								
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Date 06/07/2022 09:56 Designed by HenryWilkinson								
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm								
Simulation Criteria Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coeffiecient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (1/per/day) 0.000 Foul Sewage per hectare (1/s) 0.000								
Number of Input Hydrographs 0 Number of Storage Structures 1 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 0.357 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 18.000 Cv (Winter) 0.840								
Margin for Flood Risk Warning (mm) 400.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status OFF DVD Status ON Inertia Status ON								
Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360 Return Period(s) (years) 1, 2, 30, 100 Climate Change (%) 0, 0, 0, 40								
Water Level (m)								
PN	US/MH	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1.00	15 Winter	30	+0%	100/15 Summer			47.780
S2.000	S13	15 Summer	30	+0%				47.748
S1.001	S1.01	15 Winter	30	+0%				47.705
S3.000	S2.00	15 Winter	30	+0%				47.553
S4.000	S3.00	15 Winter	30	+0%				47.540
S1.002	S1.02	15 Winter	30	+0%	100/15 Summer			47.433
S5.000	S4.00	15 Winter	30	+0%	100/30 Winter			47.351
S1.003	S1.03	30 Winter	30	+0%	30/15 Summer			46.925
S1.004	S1.04	30 Winter	30	+0%	30/15 Summer			46.922
S1.005	S1.05	30 Winter	30	+0%	30/15 Summer			46.920
S6.000	S5.00	30 Winter	30	+0%	30/15 Summer			46.913
S6.001	S5.01	30 Winter	30	+0%	30/15 Summer			46.913
S1.006	S1.06	30 Winter	30	+0%	2/15 Winter			46.913

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Network 2020.1.3

Page 11



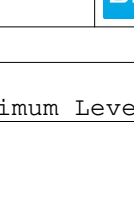
30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)

for Storm

PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1.00	-0.070	0.000	0.80			24.0	OK	
S2.000	S13	-0.150	0.000	0.00			0.0	OK	
S1.001	S1.01	-0.120	0.000	0.43			24.7	OK	
S3.000	S2.00	-0.122	0.000	0.08			1.5	OK	
S4.000	S3.00	-0.120	0.000	0.09			2.1	OK	
S1.002	S1.02	-0.092	0.000	0.64			29.5	OK	
S5.000	S4.00	-0.111	0.000	0.15			2.1	OK	
S1.003	S1.03	0.168	0.000	0.80			24.1	SURCHARGED	
S1.004	S1.04	0.196	0.000	0.33		15	10.0	SURCHARGED*	
S1.005	S1.05	0.242	0.000	0.31			10.4	SURCHARGED	
S6.000	S5.00	0.242	0.000	0.03			0.3	SURCHARGED	
S6.001	S5.01	0.269	0.000	0.35			3.8	SURCHARGED	
S1.006	S1.06	0.292	0.000	0.17			10.9	SURCHARGED	

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Renaissance Assoc.		Page 12
Carvers Warehouse 77 Dale Street Manchester M1 2HG		
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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	1
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	0.357
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	400.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1.00	15 Winter	100	+40%	100/15 Summer				47.912
S2.000	S13	15 Winter	100	+40%					47.749
S1.001	S1.01	15 Winter	100	+40%					47.754
S3.000	S2.00	30 Winter	100	+40%					47.575
S4.000	S3.00	30 Winter	100	+40%					47.573
S1.002	S1.02	30 Winter	100	+40%	100/15 Summer				47.571
S5.000	S4.00	60 Winter	100	+40%	100/30 Winter				47.561
S1.003	S1.03	60 Winter	100	+40%	30/15 Summer				47.560
S1.004	S1.04	60 Winter	100	+40%	30/15 Summer				47.556
S1.005	S1.05	60 Winter	100	+40%	30/15 Summer				47.551
S6.000	S5.00	60 Winter	100	+40%	30/15 Summer				47.545
S6.001	S5.01	60 Winter	100	+40%	30/15 Summer				47.545
S1.006	S1.06	60 Winter	100	+40%	2/15 Winter				47.544

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Page 13



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

PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1.00	0.062	0.000	1.45			43.4	SURCHARGED	
S2.000	S13	-0.149	0.000	0.00			0.0	OK	
S1.001	S1.01	-0.071	0.000	0.78			44.7	OK	
S3.000	S2.00	-0.100	0.000	0.12			2.1	OK	
S4.000	S3.00	-0.087	0.000	0.13			3.0	OK	
S1.002	S1.02	0.046	0.000	0.93			43.3	SURCHARGED	
S5.000	S4.00	0.099	0.000	0.15			2.0	SURCHARGED	
S1.003	S1.03	0.803	0.000	1.01			30.1	SURCHARGED	
S1.004	S1.04	0.830	0.000	0.32		38	9.8	SURCHARGED*	
S1.005	S1.05	0.874	0.000	0.30			10.2	SURCHARGED	
S6.000	S5.00	0.874	0.000	0.03			0.4	SURCHARGED	
S6.001	S5.01	0.901	0.000	0.42			4.6	SURCHARGED	
S1.006	S1.06	0.924	0.000	0.17			10.9	FLOOD RISK	

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