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11 Bridgewater Road Worsley Manchester, M28 3JE	12851 CHAIN ROAD HYDRAULIC CALCULATIONS FOR SW/ S104 DRAINAGE	
Date 20/01/2022 File 12851 - Chain Road MicroDraia...	Designed by A MULLIGAN Checked by D MIDDLETON	
Innovyze	Network 2019.1	

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	0.360	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 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	2.000#	0.001	2000.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	12.500#	0.050	250.0	0.030	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.002	19.800#	0.080	247.5	0.061	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	9.000#	0.040	225.0	0.097	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.004	2.000#	0.070	28.6	0.000	0.00	0.0	0.600	o	150	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	5.12	96.200	0.000	0.0	0.0	0.0	0.28	11.3	0.0
S1.001	50.00	5.25	95.450	0.030	0.0	0.0	0.0	1.54	434.2	4.1
S1.002	50.00	5.47	95.400	0.091	0.0	0.0	0.0	1.54	436.4	12.3
S1.003	50.00	5.56	95.320	0.188	0.0	0.0	0.0	1.62	457.9	25.5
S1.004	50.00	5.58	95.280	0.188	0.0	0.0	0.0	1.89	33.4	25.5

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
STANK	97.100	0.900	Open Manhole	1200	S1.000	96.200	225				
SMH100	97.340	1.890	Open Manhole	1800	S1.001	95.450	600	S1.000	96.199	225	374
SMH101	97.760	2.360	Open Manhole	1800	S1.002	95.400	600	S1.001	95.400	600	
SMH102	97.920	2.600	Open Manhole	1800	S1.003	95.320	600	S1.002	95.320	600	
SMH103 HB	97.650	2.370	Open Manhole	1800	S1.004	95.280	150	S1.003	95.280	600	
SEXG MH	97.550	2.340	Open Manhole	0		OUTFALL		S1.004	95.210	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SMH100	96.270	63.281	96.270	63.281	Required	
SMH101	118.848	63.281	118.848	63.281	Required	
SMH102	155.213	64.066	155.213	64.066	Required	
SMH103 HB	171.247	63.543	171.247	63.543	Required	
SEXG MH	176.649	68.771			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	STANK	97.100	96.200	0.675	Open Manhole	1200
S1.001	o	600	SMH100	97.340	95.450	1.290	Open Manhole	1800
S1.002	o	600	SMH101	97.760	95.400	1.760	Open Manhole	1800
S1.003	o	600	SMH102	97.920	95.320	2.000	Open Manhole	1800
S1.004	o	150	SMH103 HB	97.650	95.280	2.220	Open Manhole	1800

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)
S1.000	2.000#	2000.0	SMH100	97.340	96.199	0.916	Open Manhole	1800
S1.001	12.500#	250.0	SMH101	97.760	95.400	1.760	Open Manhole	1800
S1.002	19.800#	247.5	SMH102	97.920	95.320	2.000	Open Manhole	1800
S1.003	9.000#	225.0	SMH103 HB	97.650	95.280	1.770	Open Manhole	1800
S1.004	2.000#	28.6	SEXX MH	97.550	95.210	2.190	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.030	0.030	0.030
1.002	-	-	100	0.061	0.061	0.061
1.003	-	-	100	0.097	0.097	0.097
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.188	0.188	0.188

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.004	SEXG MH	97.550	95.210	0.000	0	0
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Simulation Criteria for Storm

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 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 Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SMH103 HB, DS/PN: S1.004, Volume (m³): 8.1

Unit Reference	MD-SHE-0098-5000-1500-5000
Design Head (m)	1.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	95.280
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.0	Kick-Flo®	0.878	3.9
Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3

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)	Depth (m)	Flow (l/s)
0.100	3.2	0.800	4.3	2.000	5.7	4.000	7.9	7.000	10.3
0.200	4.4	1.000	4.1	2.200	6.0	4.500	8.4	7.500	10.7
0.300	4.8	1.200	4.5	2.400	6.2	5.000	8.8	8.000	11.0
0.400	4.9	1.400	4.8	2.600	6.5	5.500	9.2	8.500	11.3
0.500	4.9	1.600	5.1	3.000	6.9	6.000	9.6	9.000	11.6
0.600	4.8	1.800	5.4	3.500	7.4	6.500	10.0	9.500	11.9

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Storage Structures for Storm

Tank or Pond Manhole: STANK, DS/PN: S1.000

Invert Level (m) 96.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	90.0	0.400	90.0	0.401	0.0

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1 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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.360 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, 1440
 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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	STANK	120 Winter	1	+0%	100/30 Summer				96.200	-0.225
S1.001	SMH100	30 Winter	1	+0%	30/15 Summer				95.654	-0.396
S1.002	SMH101	30 Winter	1	+0%	30/15 Summer				95.654	-0.346
S1.003	SMH102	30 Winter	1	+0%	30/15 Summer				95.653	-0.267
S1.004	SMH103 HB	30 Winter	1	+0%	1/15 Summer				95.653	0.223

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
S1.000	STANK	0.000	0.00		0.0	OK	
S1.001	SMH100	0.000	0.01		1.6	OK	
S1.002	SMH101	0.000	0.01		4.7	OK	
S1.003	SMH102	0.000	0.03		7.4	OK	
S1.004	SMH103 HB	0.000	0.29		4.9	SURCHARGED	

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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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.360 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, 1440
 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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	STANK	120 Winter	2	+0%	100/30 Summer				96.200	-0.225
S1.001	SMH100	30 Winter	2	+0%	30/15 Summer				95.759	-0.291
S1.002	SMH101	30 Winter	2	+0%	30/15 Summer				95.759	-0.241
S1.003	SMH102	30 Winter	2	+0%	30/15 Summer				95.759	-0.161
S1.004	SMH103 HB	30 Winter	2	+0%	1/15 Summer				95.758	0.328

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
S1.000	STANK	0.000	0.00		0.0	OK	
S1.001	SMH100	0.000	0.01		1.9	OK	
S1.002	SMH101	0.000	0.01		4.9	OK	
S1.003	SMH102	0.000	0.03		8.4	OK	
S1.004	SMH103 HB	0.000	0.29		4.9	SURCHARGED	

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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 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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.360 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, 1440
 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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	STANK	60 Winter	30	+0%	100/30 Summer				96.287	-0.138
S1.001	SMH100	30 Winter	30	+0%	30/15 Summer				96.437	0.387
S1.002	SMH101	30 Winter	30	+0%	30/15 Summer				96.441	0.441
S1.003	SMH102	30 Winter	30	+0%	30/15 Summer				96.444	0.524
S1.004	SMH103 HB	30 Winter	30	+0%	1/15 Summer				96.443	1.013

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
S1.000	STANK	0.000	0.13		3.8	OK	
S1.001	SMH100	0.000	0.01		4.3	SURCHARGED	
S1.002	SMH101	0.000	0.02		6.4	SURCHARGED	
S1.003	SMH102	0.000	0.05		12.6	SURCHARGED	
S1.004	SMH103 HB	0.000	0.29		4.9	SURCHARGED	

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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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.360 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, 1440
 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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	STANK	120 Winter	100	+40%	100/30	Summer			97.010	0.585
S1.001	SMH100	120 Winter	100	+40%	30/15	Summer			97.010	0.960
S1.002	SMH101	120 Winter	100	+40%	30/15	Summer			97.010	1.010
S1.003	SMH102	120 Winter	100	+40%	30/15	Summer			97.010	1.090
S1.004	SMH103 HB	120 Winter	100	+40%	1/15	Summer			97.009	1.579

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
S1.000	STANK	0.000	0.39		11.2	FLOOD RISK	
S1.001	SMH100	0.000	0.03		9.2	SURCHARGED	
S1.002	SMH101	0.000	0.03		8.6	SURCHARGED	
S1.003	SMH102	0.000	0.03		8.7	SURCHARGED	
S1.004	SMH103 HB	0.000	0.32		5.3	SURCHARGED	