

Waterman Group		Page 1
Pickfords Wharf Clink Street London, SE1 9DG	Trinity Academy Surface Water Network	
Date 03/03/2021	Designed by DB	
File TRINITY ACADEMY SW NETWORK.MDX	Checked by SS	
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	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	19.000	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.357	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	40	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm

« - 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
S1.000	34.633	0.346	100.1	0.142	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	22.491	0.225	100.0	0.121	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	53.188	1.465	36.3	0.054	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	21.923	0.219	100.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	52.844	0.970	54.5	0.063	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	18.608	0.186	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	27.642	0.473	58.4	0.042	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.000	25.298	0.433	58.4	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	41.760	0.422	99.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.002	31.036	0.816	38.0	0.171	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	17.085	1.171	14.6	0.127	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	15.920	0.159	100.1	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	5.44	144.582	0.142	0.0	0.0	7.7	1.31	52.0	27.0
S1.001	50.00	5.68	144.236	0.263	0.0	0.0	14.3	1.57	111.2	49.9
S2.000	50.00	5.53	146.650	0.054	0.0	0.0	2.9	1.68	29.6	10.2
S1.002	50.00	5.91	143.011	0.317	0.0	0.0	17.2	1.57	111.1	60.1
S3.000	50.00	5.64	146.750	0.063	0.0	0.0	3.4	1.37	24.1	11.9
S1.003	50.00	6.11	143.792	0.380	0.0	0.0	20.6	1.57	111.1	72.0
S4.000	50.00	5.35	147.750	0.042	0.0	0.0	2.3	1.32	23.3	7.9
S5.000	50.00	5.32	147.250	0.033	0.0	0.0	1.8	1.32	23.3	6.3
S4.001	50.00	6.04	146.817	0.075	0.0	0.0	4.1	1.01	17.9	14.2
S4.002	50.00	6.28	146.320	0.246	0.0	0.0	13.3	2.13	84.6	46.7
S1.004	50.00	6.34	143.531	0.753	0.0	0.0	40.8	4.76	526.2	142.8
S1.005	50.00	6.61	142.360	0.753	0.0	0.0	40.8	1.00	17.7«	142.8

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., I*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	148.000	3.418	Open Manhole	1200	S1.000	144.582	225				
S2	146.850	2.614	Open Manhole	1200	S1.001	144.236	300	S1.000	144.236	225	
SRE1	148.000	1.350	Open Manhole	1200	S2.000	146.650	150				
S3	146.610	3.599	Open Manhole	1200	S1.002	143.011	300	S1.001	144.011	300	1000
								S2.000	145.185	150	2024
SRE2	148.100	1.350	Open Manhole	1200	S3.000	146.750	150				
S4	147.130	4.338	Open Manhole	1200	S1.003	143.792	300	S1.002	142.792	300	
								S3.000	145.780	150	1838
S5	149.100	1.350	Open Manhole	1200	S4.000	147.750	150				
S6	148.600	1.350	Open Manhole	1200	S5.000	147.250	150				
S7	148.800	1.983	Open Manhole	1200	S4.001	146.817	150	S4.000	147.277	150	460
								S5.000	146.817	150	
S8	147.770	1.450	Open Manhole	1200	S4.002	146.320	225	S4.001	146.395	150	
S9	146.930	3.399	Open Manhole	1350	S1.004	143.531	375	S1.003	143.606	300	
								S4.002	145.504	225	1823
S10	146.730	4.370	Open Manhole	1350	S1.005	142.360	150	S1.004	142.360	375	
SMH147	144.000	1.799	Open Manhole	0		OUTFALL		S1.005	142.201	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	433371.832	405530.327	433371.832	405530.327	Required	
S2	433400.009	405550.463	433400.009	405550.463	Required	
SRE1	433343.806	405537.535	433343.806	405537.535	Required	
S3	433386.886	405568.729	433386.886	405568.729	Required	
SRE2	433330.879	405556.226	433330.879	405556.226	Required	
S4	433374.143	405586.569	433374.143	405586.569	Required	
S5	433320.341	405536.567	433320.341	405536.567	Required	
S6	433289.604	405579.670	433289.604	405579.670	Required	
S7	433304.292	405559.072	433304.292	405559.072	Required	
S8	433338.093	405583.596	433338.093	405583.596	Required	
S9	433363.305	405601.695	433363.305	405601.695	Required	
S10	433353.466	405615.663	433353.466	405615.663	Required	
SMH147	433350.400	405631.285			No Entry	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall C. Name	Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
S1.005	SMH147	144.000	142.201	0.000	0	0

Waterman Group		Page 3
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Simulation Criteria for Storm

Volumetric Runoff Coeff 0.750 Manhole Headloss Coeff (Global) 0.500 Inlet Coeffiecient 0.800
Areal Reduction Factor 1.000 Foul Sewage per hectare (l/s) 0.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Additional Flow - % of Total Flow 0.000 Run Time (mins) 60
Hot Start Level (mm) 0 MADD Factor * 10m³/ha Storage 2.000 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 M5-60 (mm) 19.000 Cv (Summer) 0.750
Return Period (years) 100 Ratio R 0.357 Cv (Winter) 0.840
Region England and Wales Profile Type Summer Storm Duration (mins) 30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S10, DS/PN: S1.005, Volume (m³): 8.0

Unit Reference	MD-SHE-0085-5000-2700-5000	Sump Available	Yes
Design Head (m)	2.700	Diameter (mm)	85
Design Flow (l/s)	5.0	Invert Level (m)	142.360
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.700	5.0	Kick-Flo®	0.760	2.8
Flush-Flo™	0.369	3.5	Mean Flow over Head Range	-	3.7

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)	Depth (m)	Flow (l/s)
0.100	2.6	0.600	3.3	1.600	3.9	2.600	4.9	5.000	6.7	7.500	8.1
0.200	3.3	0.800	2.8	1.800	4.1	3.000	5.2	5.500	7.0	8.000	8.3
0.300	3.5	1.000	3.2	2.000	4.3	3.500	5.6	6.000	7.3	8.500	8.6
0.400	3.5	1.200	3.4	2.200	4.5	4.000	6.0	6.500	7.5	9.000	8.8
0.500	3.4	1.400	3.7	2.400	4.7	4.500	6.3	7.000	7.8	9.500	9.0

Waterman Group		Page 5
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Storage Structures for Storm

Tank or Pond Manhole: S2, DS/PN: S1.001

Invert Level (m) 144.236

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	410.0	1.000	410.0	1.001	0.0

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

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 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 FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 433390 405576 SE 33390 05576 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880,
4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 0

PN	US/MH		Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
	Name	Storm							(m)	(m)	(m³)			
S1.000	S1	2160 Winter	100	+0%	100/15 Summer				145.205	0.398	0.000	0.05		2.4
S1.001	S2	2160 Winter	100	+0%	100/15 Summer				145.202	0.666	0.000	0.12		12.2
S2.000	SRE1	15 Winter	100	+0%					146.759	-0.041	0.000	0.85		24.5
S1.002	S3	1440 Winter	100	+0%	100/15 Summer	100/2160 Winter			146.128	2.817	0.000	0.09		9.2
S3.000	SRE2	15 Winter	100	+0%	100/15 Summer				147.130	0.230	0.000	1.10		26.0
S1.003	S4	2160 Winter	100	+0%	100/15 Summer	100/7200 Winter			146.664	2.572	0.000	0.10		9.9
S4.000	S5	15 Winter	100	+0%	100/15 Summer				148.048	0.148	0.000	0.84		18.7
S5.000	S6	15 Winter	100	+0%	100/15 Summer				147.968	0.568	0.000	0.53		11.8
S4.001	S7	15 Winter	100	+0%	100/15 Summer				147.858	0.891	0.000	1.60		27.6
S4.002	S8	15 Winter	100	+0%	100/15 Summer				147.217	0.672	0.000	1.10		87.0
S1.004	S9	1440 Winter	100	+0%	100/15 Summer	100/2160 Winter			146.771	2.865	0.000	0.02		10.1
S1.005	S10	2160 Winter	100	+0%	100/15 Summer	100/480 Summer			146.731	4.221	9.474	0.30		5.0

US/MH		Level	
PN	Name	Status	Exceeded
S1.000	S1	SURCHARGED	
S1.001	S2	SURCHARGED	
S2.000	SRE1	OK	
S1.002	S3	SURCHARGED	
S3.000	SRE2	SURCHARGED	
S1.003	S4	SURCHARGED	
S4.000	S5	SURCHARGED	
S5.000	S6	SURCHARGED	
S4.001	S7	SURCHARGED	
S4.002	S8	SURCHARGED	
S1.004	S9	FLOOD RISK	
S1.005	S10	FLOOD	14