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Date 12/12/2022 15:31 File 104878 Phase 2B (GF).MDX	Designed by MFox 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

FEH Rainfall Model			
Return Period (years)	100	Maximum Time of Concentration (mins)	30
		Foul Sewage (l/s/ha)	0.000
FEH Rainfall Version	1999	Volumetric Runoff Coeff.	0.750
Site Location	GB 526100 184450 TQ 26100 84450	PIMP (%)	100
C (1km)	-0.025	Add Flow / Climate Change (%)	10
D1 (1km)	0.330	Minimum Backdrop Height (m)	1.500
D2 (1km)	0.277	Maximum Backdrop Height (m)	1.500
D3 (1km)	0.234	Min Design Depth for Optimisation (m)	1.200
E (1km)	0.332	Min Vel for Auto Design only (m/s)	1.00
F (1km)	2.519	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	50		

Designed with Level Soffits

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)
S1.003	S5	50.000	46.300	0.000	0	0

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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 * 10m <sup>3</sup> /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	FEH	E (1km)	0.332
Return Period (years)	100	F (1km)	2.519
FEH Rainfall Version	1999	Summer Storms	Yes
Site Location	GB 526100 184450 TQ 26100 84450	Winter Storms	No
C (1km)	-0.025	Cv (Summer)	0.750
D1 (1km)	0.330	Cv (Winter)	0.840
D2 (1km)	0.277	Storm Duration (mins)	30
D3 (1km)	0.234		

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Online Controls for Storm


Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.003, Volume (m³): 8.3

Unit Reference	MD-SHE-0055-1900-2000-1900	Sump Available	Yes
Design Head (m)	2.000	Diameter (mm)	55
Design Flow (l/s)	1.9	Invert Level (m)	46.372
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
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)	2.000	1.9	Kick-Flo®	0.493	1.0
Flush-Flo™	0.242	1.2	Mean Flow over Head Range	-	1.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.1	0.600	1.1	1.600	1.7	2.600	2.1	5.000	2.9	7.500	3.5
0.200	1.2	0.800	1.3	1.800	1.8	3.000	2.3	5.500	3.0	8.000	3.6
0.300	1.2	1.000	1.4	2.000	1.9	3.500	2.5	6.000	3.1	8.500	3.7
0.400	1.2	1.200	1.5	2.200	2.0	4.000	2.6	6.500	3.3	9.000	3.8
0.500	1.0	1.400	1.6	2.400	2.1	4.500	2.8	7.000	3.4	9.500	3.9


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Storage Structures for Storm

Tank or Pond Manhole: S4, DS/PN: S1.003

Invert Level (m) 46.372

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	171.0	2.000	171.0	2.001	0.0

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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	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m <sup>3</sup> /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	D3 (1km)	0.234
FEH Rainfall Version	1999	E (1km)	0.332
Site Location	GB 526100 184450 TQ 26100 84450	F (1km)	2.519
C (1km)		-0.025 Cv (Summer)	0.750
D1 (1km)		0.330 Cv (Winter)	0.840
D2 (1km)		0.277	

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	2.5 Second Increment (Extended)	Inertia Status	ON
DTS 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)		2, 30, 100
Climate Change (%)		0, 0, 40




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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume	Flow / Overflow	Half Drain
									(m)	(m)	(m <sup>3</sup> )	Cap. (l/s)	Time (mins)
S1.000	S1	15 Winter	2	+0%					51.558	-0.392	0.000	0.04	
S1.001	S2	15 Winter	2	+0%					49.654	-0.367	0.000	0.08	
S1.002	S3	15 Winter	2	+0%	100/15 Summer				48.228	-0.298	0.000	0.25	
S1.003	S4	720 Winter	2	+0%	2/60 Winter				46.729	0.132	0.000	0.04	

Pipe				
PN	US/MH Name	Flow (l/s)	Status	Level Exceeded
S1.000	S1	20.5	OK	
S1.001	S2	38.0	OK	
S1.002	S3	55.6	OK	
S1.003	S4	1.2	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	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m <sup>3</sup> /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	D3 (1km)	0.234
FEH Rainfall Version	1999	E (1km)	0.332
Site Location	GB 526100 184450 TQ 26100 84450	F (1km)	2.519
C (1km)		-0.025 Cv (Summer)	0.750
D1 (1km)		0.330 Cv (Winter)	0.840
D2 (1km)		0.277	

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	2.5 Second Increment (Extended)	Inertia Status	ON
DTS 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)		2, 30, 100
Climate Change (%)		0, 0, 40




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

US/MH	Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water Level	Surcharged Depth	Flooded Volume	Flow / Overflow	Half Drain Time	Pipe Flow	Status	
PN Name	Storm Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m <sup>3</sup> )	Cap. (1/s)	(mins)	(1/s)	


US/MH Level  
PN Name Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume	Flow / Overflow	Half Drain Time
									(m)	(m)	(m <sup>3</sup> )	Cap. (l/s)	(mins)
S1.000	S1	15 Winter	30	+0%					51.599	-0.351	0.000	0.11	
S1.001	S2	15 Winter	30	+0%					49.717	-0.304	0.000	0.23	
S1.002	S3	15 Winter	30	+0%	100/15 Summer				48.374	-0.152	0.000	0.76	
S1.003	S4	720 Winter	30	+0%	2/60 Winter				47.286	0.689	0.000	0.04	

Pipe			
PN	US/MH Name	Flow (l/s)	Level Exceeded Status
S1.000	S1	55.1	OK
S1.001	S2	113.5	OK
S1.002	S3	171.8	OK
S1.003	S4	1.3	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	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coefficient	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	D3 (1km)	0.234
FEH Rainfall Version	1999	E (1km)	0.332
Site Location	GB 526100 184450 TQ 26100 84450	F (1km)	2.519
C (1km)	-0.025	Cv (Summer)	0.750
D1 (1km)	0.330	Cv (Winter)	0.840
D2 (1km)	0.277		

Margin for Flood Risk Warning (mm) 300.0    DVD Status ON  
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON  
DTS 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)	2, 30, 100
Climate Change (%)	0, 0, 40



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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume	Flow / Overflow	Half Drain
									(m)	(m)	(m <sup>3</sup> )	Cap. (l/s)	Time (mins)
S1.000	S1	15 Winter	100	+40%					51.649	-0.301	0.000	0.24	
S1.001	S2	15 Winter	100	+40%					49.798	-0.223	0.000	0.50	
S1.002	S3	15 Winter	100	+40%	100/15 Summer				48.804	0.278	0.000	1.65	
S1.003	S4	720 Winter	100	+40%	2/60 Winter				48.296	1.699	0.000	0.06	

Pipe			
PN	US/MH Name	Flow (l/s)	Status
S1.000	S1	120.6	OK
S1.001	S2	248.1	OK
S1.002	S3	374.2	SURCHARGED
S1.003	S4	1.9	SURCHARGED