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Sheppard Lockton House Cafferata Way Newark NG24 2TN	Parkside Crescent Spalding FSR Calculations	
Date 23/04/2018 File Parkside Crescent 18.04...	Designed by CM Checked by AG	
Micro Drainage	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	1999
Site Location GB 524000 323550 TF 24000 23550	
C (1km)	-0.023
D1 (1km)	0.300
D2 (1km)	0.303
D3 (1km)	0.229
E (1km)	0.314
F (1km)	2.490
Maximum Rainfall (mm/hr)	100
Maximum Time of Concentration (mins)	100
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
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	0.087	4-8	0.015
Total Area Contributing (ha) = 0.103			
Total Pipe Volume (m³) = 1.169			

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length	Fall	Slope	I.Area	T.E.	Base	k	HYD	DIA	Section	Type	Auto
(m)	(m)	(1:X)	(ha)	(mins)	Flow	(l/s)	(mm)	SECT	(mm)			Design

Network Results Table

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Network Design Table for Storm

PN	Rain	T.C.	US/IL	Σ I.Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow
	(mm/hr)	(mins)	(m)	(ha)	Flow (l/s)	(l/s)	(l/s)	(m/s)	(l/s)	(l/s)

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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
1.000	6.321#	0.080	79.0	0.030	4.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	10.160	0.127	80.0	0.009	4.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	6.700#	0.113	59.3	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	10.662	0.134	79.6	0.013	4.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	3.400#	0.122	27.9	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	6.503#	0.082	79.3	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	21.426	0.166	129.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	1.000#	0.008	125.0	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)
1.000	100.00	4.09	2.840	0.030	0.0	0.0	0.0	1.13	20.0	8.1
2.000	100.00	4.15	3.000	0.009	0.0	0.0	0.0	1.12	19.9	2.4
2.001	100.00	4.24	2.823	0.017	0.0	0.0	0.0	1.31	23.1	4.6
3.000	100.00	4.16	3.450	0.013	0.0	0.0	0.0	1.13	19.9	3.5
3.001	100.00	4.19	3.316	0.026	0.0	0.0	0.0	1.91	33.8	7.1
1.001	98.44	4.33	2.110	0.103	0.0	0.0	0.0	1.13	20.0«	27.4
1.002	92.34	4.74	2.028	0.103	0.0	0.0	0.0	0.88	15.6«	27.4
1.003	92.08	4.75	1.862	0.103	0.0	0.0	0.0	0.90	15.9«	27.4

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out PN	Invert Level (m)	Diameter (mm)	Pipes In PN	Invert Level (m)	Diameter (mm)	Backdrop (mm)
3	3.700	0.860	Open Manhole	1200	1.000	2.840	150				
1	3.600	0.600	Open Manhole	1200	2.000	3.000	150				
2	3.600	0.777	Open Manhole	1200	2.001	2.823	150	2.000	2.873	150	50
4	4.050	0.600	Open Manhole	1200	3.000	3.450	150				
5	4.050	0.734	Open Manhole	1200	3.001	3.316	150	3.000	3.316	150	
TANK	3.750	1.640	Open Manhole	1200	1.001	2.110	150	1.000	2.760	150	650
								2.001	2.710	150	600
								3.001	3.194	150	1084
6	3.800	1.772	Open Manhole	1200	1.002	2.028	150	1.001	2.028	150	
7	3.880	2.018	Open Manhole	1200	1.003	1.862	150	1.002	1.862	150	
	3.887	2.033	Open Manhole	0		OUTFALL		1.003	1.854	150	

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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)
1.000	o	150	3	3.700	2.840	0.710	Open Manhole	1200
2.000	o	150	1	3.600	3.000	0.450	Open Manhole	1200
2.001	o	150	2	3.600	2.823	0.627	Open Manhole	1200
3.000	o	150	4	4.050	3.450	0.450	Open Manhole	1200
3.001	o	150	5	4.050	3.316	0.584	Open Manhole	1200
1.001	o	150	TANK	3.750	2.110	1.490	Open Manhole	1200
1.002	o	150	6	3.800	2.028	1.622	Open Manhole	1200
1.003	o	150	7	3.880	1.862	1.868	Open Manhole	1200

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)
1.000	6.321#	79.0	TANK	3.750	2.760	0.840	Open Manhole	1200
2.000	10.160	80.0	2	3.600	2.873	0.577	Open Manhole	1200
2.001	6.700#	59.3	TANK	3.750	2.710	0.890	Open Manhole	1200
3.000	10.662	79.6	5	4.050	3.316	0.584	Open Manhole	1200
3.001	3.400#	27.9	TANK	3.750	3.194	0.406	Open Manhole	1200
1.001	6.503#	79.3	6	3.800	2.028	1.622	Open Manhole	1200
1.002	21.426	129.1	7	3.880	1.862	1.868	Open Manhole	1200
1.003	1.000#	125.0		3.887	1.854	1.883	Open Manhole	0

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)
1.003		3.887	1.854	1.854	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 * 10m ³ /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 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	FEH
Return Period (years)	2
FEH Rainfall Version	1999
Site Location	GB 524000 323550 TF 24000 23550
C (1km)	-0.023
D1 (1km)	0.300
D2 (1km)	0.303
D3 (1km)	0.229
E (1km)	0.314
F (1km)	2.490
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.002, Volume (m³): 2.1

Unit Reference	MD-SHE-0107-5000-0882-5000
Design Head (m)	0.882
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	107
Invert Level (m)	2.028
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.882	5.0
Flush-Flo™	0.261	5.0
Kick-Flo®	0.577	4.1
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)
0.100	3.7	1.200	5.8	3.000	8.9	7.000	13.3
0.200	4.9	1.400	6.2	3.500	9.5	7.500	13.7
0.300	5.0	1.600	6.6	4.000	10.2	8.000	14.1
0.400	4.9	1.800	7.0	4.500	10.7	8.500	14.6
0.500	4.6	2.000	7.3	5.000	11.3	9.000	14.9
0.600	4.2	2.200	7.7	5.500	11.8	9.500	15.3
0.800	4.8	2.400	8.0	6.000	12.3		
1.000	5.3	2.600	8.3	6.500	12.8		

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Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.001

Invert Level (m) 2.110 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	56.0	50.0	0.801	0.0	74.0
0.800	56.0	74.0			

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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 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 0.400
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

US/MH		Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name Storm						
		Period Change	Surcharge	Flood	Overflow	Act.	Level (m)
1.000	3 15 Winter	1 +0%	100/15 Summer				2.891
2.000	1 15 Winter	1 +0%					3.026
2.001	2 15 Winter	1 +0%					2.856
3.000	4 15 Summer	1 +0%					3.482
3.001	5 15 Winter	1 +0%					3.355
1.001	TANK 30 Winter	1 +0%	30/15 Summer				2.186
1.002	6 30 Winter	1 +0%	30/15 Summer				2.175
1.003	7 30 Winter	1 +0%					1.931

US/MH		Surcharged Flooded		Pipe		Level
PN	Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	
						Exceeded
1.000	3	-0.099	0.000	0.25	4.2	OK
2.000	1	-0.124	0.000	0.07	1.2	OK
2.001	2	-0.117	0.000	0.11	2.2	OK
3.000	4	-0.118	0.000	0.10	1.8	OK
3.001	5	-0.111	0.000	0.15	3.3	OK
1.001	TANK	-0.074	0.000	0.29	4.9	OK
1.002	6	-0.003	0.000	0.32	4.7	OK

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

			Surcharged	Flooded		Pipe		
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
1.003	7	-0.081	0.000	0.44		4.7	OK	

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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 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 0.400
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

									Water
	US/MH			Return Climate	First (X)	First (Y)	First (Z)	Overflow	Level
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)
1.000	3	15 Summer	30	+0%	100/15 Summer				2.926
2.000	1	15 Summer	30	+0%					3.042
2.001	2	15 Summer	30	+0%					2.879
3.000	4	15 Summer	30	+0%					3.501
3.001	5	15 Summer	30	+0%					3.384
1.001	TANK	30 Winter	30	+0%	30/15 Summer				2.358
1.002		6 30 Winter	30	+0%	30/15 Summer				2.394
1.003	7	60 Winter	30	+0%					1.933

US/MH		Surcharged Flooded		Pipe		Level	
PN	Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	3	-0.064	0.000	0.62		10.4	OK
2.000	1	-0.108	0.000	0.17		3.0	OK
2.001	2	-0.094	0.000	0.30		5.9	OK
3.000	4	-0.099	0.000	0.25		4.5	OK
3.001	5	-0.082	0.000	0.42		9.1	OK
1.001	TANK	0.098	0.000	0.33		5.5	SURCHARGED
1.002	6	0.216	0.000	0.34		5.0	SURCHARGED

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

			Surcharged	Flooded		Pipe		
	US/MH	Depth	Volume	Flow /	Overflow	Flow		Level
PN	Name	(m)	(m³)	Cap.	(l/s)	(l/s)	Status	Exceeded
1.003	7	-0.079	0.000	0.46		5.0	OK	

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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 0.400
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	3	15 Winter	100	+30%	100/15 Summer				2.990
2.000	1	15 Summer	100	+30%					3.055
2.001	2	15 Summer	100	+30%					2.899
3.000	4	15 Summer	100	+30%					3.518
3.001	5	15 Summer	100	+30%					3.409
1.001	TANK	60 Winter	100	+30%	30/15 Summer				2.645
1.002	6	60 Winter	100	+30%	30/15 Summer				2.654
1.003	7	60 Summer	100	+30%					1.933

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.000	3	0.000	0.000	1.01		17.0		SURCHARGED	
2.000	1	-0.095	0.000	0.29		5.1		OK	
2.001	2	-0.074	0.000	0.51		10.0		OK	
3.000	4	-0.082	0.000	0.42		7.6		OK	
3.001	5	-0.057	0.000	0.70		15.3		OK	
1.001	TANK	0.385	0.000	0.32		5.4		SURCHARGED	
1.002	6	0.476	0.000	0.34		5.0		SURCHARGED	

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

			Surcharged	Flooded		Pipe		
	US/MH	Depth	Volume	Flow /	Overflow	Flow		Level
PN	Name	(m)	(m³)	Cap.	(l/s)	(l/s)	Status	Exceeded
1.003	7	-0.079	0.000	0.46		5.0	OK	