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58-62 Ock Street Abingdon Oxon OX14 5BZ	Former Purbrook School Waterlooville 40% CC	
Date 07.12.16 File 5444 Storm 22.12.16.mdx	Designed by mcshane Checked by	
Micro Drainage	Network 2016.1	

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)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.800	Minimum Backdrop Height (m)	0.000
Ratio R	0.325	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.190	4-8	0.132

Total Area Contributing (ha) = 0.322

Total Pipe Volume (m³) = 7.210

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
S1.000	25.807	0.086	300.1	0.122	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	23.220	0.153	151.8	0.095	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	43.242	0.096	450.4	0.023	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	17.297	0.085	203.5	0.067	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	5.48	51.370	0.122	0.0	0.0	0.0	0.90	63.8	16.5
S1.001	50.00	5.78	51.284	0.217	0.0	0.0	0.0	1.27	90.0	29.3
S1.002	50.00	6.76	51.131	0.239	0.0	0.0	0.0	0.73	51.9	32.4
S1.003	50.00	5.32	51.035	0.000	5.0	0.0	0.0	0.91	36.3	5.0

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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	-	-	95	0.128	0.122	0.122
1.001	-	-	95	0.100	0.095	0.095
1.002	-	-	95	0.024	0.023	0.023
1.003	-	-	95	0.070	0.067	0.067
				Total	Total	Total
				0.322	0.306	0.306

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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S1.003	S	53.330	50.950	0.000	1200	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 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	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.325		

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Online Controls for Storm

Complex Manhole: S4, DS/PN: S1.003, Volume (m³): 5.2

Hydro-Brake Optimum®

Unit Reference	MD-SHE-0102-5000-1250-5000
Design Head (m)	1.250
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	51.035
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	5.0
Flush-Flo™	0.370	5.0
Kick-Flo®	0.772	4.0
Mean Flow over Head Range	-	4.4

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	3.4	1.200	4.9	3.000	7.5	7.000	11.2
0.200	4.7	1.400	5.3	3.500	8.1	7.500	11.6
0.300	5.0	1.600	5.6	4.000	8.6	8.000	12.0
0.400	5.0	1.800	5.9	4.500	9.1	8.500	12.3
0.500	4.9	2.000	6.2	5.000	9.6	9.000	12.7
0.600	4.7	2.200	6.5	5.500	10.0	9.500	13.0
0.800	4.1	2.400	6.8	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.9		

Weir

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 52.285

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Storage Structures for Storm

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

Invert Level (m) 51.035

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	125.0	0.700	125.0	1.400	125.0	2.100	125.0
0.100	125.0	0.800	125.0	1.500	125.0	2.200	125.0
0.200	125.0	0.900	125.0	1.600	125.0	2.300	125.0
0.300	125.0	1.000	125.0	1.700	125.0	2.400	125.0
0.400	125.0	1.100	125.0	1.800	125.0	2.500	125.0
0.500	125.0	1.200	125.0	1.900	125.0		
0.600	125.0	1.300	125.0	2.000	125.0		

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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 0.325
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.800 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, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100, 200
 Climate Change (%) 0, 0, 40, 0

								Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act. Level (m)
S1.000	S1	15 Winter	100	+40%	100/15 Summer			52.307
S1.001	S2	240 Winter	100	+40%	30/15 Winter			52.219
S1.002	S3	240 Winter	100	+40%	30/15 Summer			52.215
S1.003	S4	240 Winter	100	+40%	30/15 Summer			52.209

		Surcharged		Flooded	Pipe		Level	
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded
S1.000	S1	0.637	0.000	1.10		62.8	FLOOD RISK	
S1.001	S2	0.635	0.000	0.32		25.2	SURCHARGED	
S1.002	S3	0.784	0.000	0.57		27.5	SURCHARGED	
S1.003	S4	0.949	0.000	0.15		5.0	SURCHARGED	

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200 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 0.325
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.800 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, 120, 180, 240, 360, 480, 600,
 720, 960, 1440
 Return Period(s) (years) 1, 30, 100, 200
 Climate Change (%) 0, 0, 40, 0

								Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act. Level (m)
S1.000	S1	15 Winter	200	+0%	100/15 Summer			52.017
S1.001	S2	180 Winter	200	+0%	30/15 Winter			51.977
S1.002	S3	180 Winter	200	+0%	30/15 Summer			51.973
S1.003	S4	180 Winter	200	+0%	30/15 Summer			51.967

		Surcharged		Flooded	Pipe		Level	
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded
S1.000	S1	0.347	0.000	0.92		52.7	SURCHARGED	
S1.001	S2	0.393	0.000	0.32		25.2	SURCHARGED	
S1.002	S3	0.542	0.000	0.56		27.4	SURCHARGED	
S1.003	S4	0.707	0.000	0.15		5.0	SURCHARGED	