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26-29 Saint Cross St London EC1N 8UH	Student Centre Surface Water Calculations	
Date 18/01/2016 11:10 File SURFACE WATER.MDX	Designed by leake_t Checked by	
Micro Drainage	Network 2015.1	

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	Add Flow / Climate Change (%)	30
M5-60 (mm)	20.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.437	Maximum Backdrop Height (m)	1.500
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 Soffits

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PIPELINE SCHEDULES for Storm

Upstream Manhole

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	225	1	23.900	22.720	0.955	Open Manhole	1050
1.001	o	700	2	24.000	21.120	2.180	Open Manhole	1500
2.000	o	150	3	24.000	21.120	2.730	Open Manhole	1200
2.001	o	150	4	24.000	21.119	2.731	Open Manhole	1200
2.002	o	150	5	24.000	21.118	2.732	Open Manhole	1200
1.002	o	700	6	27.000	20.567	5.733	Open Manhole	1500

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	23.900	100.8	2	24.000	22.483	1.292	Open Manhole	1500
1.001	31.500	168.4	6	27.000	20.933	5.367	Open Manhole	1500
2.000	5.000	9900.0	4	24.000	21.119	2.731	Open Manhole	1200
2.001	5.000	9900.0	5	24.000	21.119	2.731	Open Manhole	1200
2.002	5.000	9900.0	6	27.000	21.117	5.733	Open Manhole	1500
1.002	5.000	714.3		27.000	20.560	5.740	Open Manhole	150

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	30.000
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 0
 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)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Storm Duration (mins)	30
Ratio R	0.437		

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 6, DS/PN: 1.002, Volume (m³): 23.0

Unit Reference	MD-SHE-0161-1510-2000-1510
Design Head (m)	2.000
Design Flow (l/s)	15.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	161
Invert Level (m)	20.568
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.1
Flush-Flo™	0.587	15.1
Kick-Flo®	1.224	12.0
Mean Flow over Head Range	-	13.2

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	5.8	1.200	12.3	3.000	18.3	7.000	27.5
0.200	12.6	1.400	12.7	3.500	19.7	7.500	28.4
0.300	14.0	1.600	13.6	4.000	21.0	8.000	29.3
0.400	14.7	1.800	14.4	4.500	22.2	8.500	30.2
0.500	15.0	2.000	15.1	5.000	23.4	9.000	31.0
0.600	15.1	2.200	15.8	5.500	24.5	9.500	31.8
0.800	14.8	2.400	16.5	6.000	25.5		
1.000	14.1	2.600	17.1	6.500	26.5		

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 30.000
 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 0
 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 0.436
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 20.500 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, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

US/MH		Return Storm	Climate Period	Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level
PN	Name								(m)
1.000	1 15 Winter	100	+30%	100/15 Summer					23.118
1.001	2 30 Winter	100	+30%	100/15 Summer					22.791
2.000	3 30 Winter	100	+30%	30/15 Summer					22.787
2.001	4 30 Winter	100	+30%	30/15 Summer					22.787
2.002	5 30 Winter	100	+30%	30/15 Summer					22.787
1.002	6 30 Winter	100	+30%	30/15 Summer					22.788

US/MH		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow		Level Exceeded
PN	Name					(l/s)	Status	
1.000	1	0.173	0.000	1.31	62.5		SURCHARGED	
1.001	2	0.971	0.000	0.10	56.6		SURCHARGED	
2.000	3	1.517	0.000	0.25	2.2		SURCHARGED	
2.001	4	1.517	0.000	0.49	4.5		SURCHARGED	
2.002	5	1.519	0.000	0.74	6.7		SURCHARGED	
1.002	6	1.521	0.000	0.05	15.6		SURCHARGED	