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575- 599 Maxted Road Hemel Hempstead Herts HP2 7ED	McDonald`s Buxton Proposed Surface Water GC4210567	
Date 2/29/2024 3:43 PM File proposed.MDX	Designed by FG Checked by	
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for New Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	2013
Site Location GB 406150 373600 SK 06150 73600	
Data Type	Catchment
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
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 New Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.158	4-8	0.175	8-12	0.013

Total Area Contributing (ha) = 0.346

Total Pipe Volume (m³) = 220.578

Network Design Table for New Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	11.633	0.116	100.3	0.019	5.00	0.0	0.600		o	225	Pipe/Conduit	
S3.001	24.364	0.244	100.0	0.020	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.002	26.961	0.270	100.0	0.070	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.003	3.349	0.033	100.0	0.034	0.00	0.0	0.600		o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.15	291.577	0.019	0.0	0.0	0.0	1.31	51.9	2.6
S3.001	50.00	5.46	291.461	0.039	0.0	0.0	0.0	1.31	52.0	5.3
S3.002	50.00	5.80	291.217	0.109	0.0	0.0	0.0	1.31	52.0	14.8
S3.003	50.00	5.85	290.948	0.143	0.0	0.0	0.0	1.31	52.0	19.3

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Network Design Table for New Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.004	18.119	0.001	18119.1	0.000	0.00	0.0		0.050	→[↓]		Cellular Storage	
S3.005	1.377	0.014	100.0	0.066	0.00	0.0	0.600		o	225	Pipe/Conduit	
S4.000	10.324	0.103	100.2	0.015	5.00	0.0	0.600		o	225	Pipe/Conduit	
S5.000	22.603	0.226	100.0	0.014	5.00	0.0	0.600		o	225	Pipe/Conduit	
S5.001	21.572	0.216	99.9	0.098	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.006	8.352	0.084	99.4	0.009	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.007	8.123	0.088	92.8	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.008	40.419	0.794	50.9	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.009	4.758	0.049	97.1	0.000	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)
S3.004	43.10	9.03	290.914	0.143	0.0	0.0	0.0	0.09	1117.6	19.3
S3.005	43.06	9.04	290.913	0.209	0.0	0.0	0.0	1.31	52.0	24.4
S4.000	50.00	5.13	291.002	0.015	0.0	0.0	0.0	1.31	51.9	2.1
S5.000	50.00	5.29	291.341	0.014	0.0	0.0	0.0	1.31	52.0	1.9
S5.001	50.00	5.56	291.115	0.112	0.0	0.0	0.0	1.31	52.0	15.1
S3.006	42.82	9.15	290.899	0.346	0.0	0.0	0.0	1.31	52.1	40.1
S3.007	42.59	9.25	290.815	0.346	0.0	0.0	0.0	1.36	54.0	40.1
S3.008	41.80	9.62	290.504	0.346	0.0	0.0	0.0	1.84	73.1	40.1
S3.009	41.67	9.68	289.710	0.346	0.0	0.0	0.0	1.33	52.8	40.1

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PIPELINE SCHEDULES for New 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)
S3.000	o		S1	293.000	291.577	1.198	Open Manhole	450
S3.001	o	225	S2	293.100	291.461	1.414	Open Manhole	600
S3.002	o	225	S3	292.680	291.217	1.237	Open Manhole	600
S3.003	o	225	S4	292.794	290.948	1.621	Open Manhole	600
S3.004 →[↓]			S5	292.781	290.914	0.666	Open Manhole	600
S3.005	o	225	S6	292.877	290.913	1.739	Open Manhole	600
S4.000	o	225	S7	292.807	291.002	1.580	Open Manhole	600
S5.000	o	225	S8	292.933	291.341	1.367	Open Manhole	600
S5.001	o	225	S9	292.942	291.115	1.602	Open Manhole	600
S3.006	o	225	S10	292.898	290.899	1.774	Open Manhole	1200
S3.007	o	225	SHB	292.724	290.815	1.684	Open Manhole	600
S3.008	o	225	SESR25/C1	292.722	290.504	1.993	Open Manhole	3540 x 1900
S3.009	o	225	S11	291.993	289.710	2.058	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)
S3.000	11.633	100.3	S2	293.100	291.461	1.414	Open Manhole	600
S3.001	24.364	100.0	S3	292.680	291.217	1.237	Open Manhole	600
S3.002	26.961	100.0	S4	292.794	290.948	1.621	Open Manhole	600
S3.003	3.349	100.0	S5	292.781	290.914	1.642	Open Manhole	600
S3.004	18.119	18119.1	S6	292.877	290.913	0.763	Open Manhole	600
S3.005	1.377	100.0	S10	292.898	290.899	1.773	Open Manhole	1200
S4.000	10.324	100.2	S10	292.898	290.899	1.774	Open Manhole	1200
S5.000	22.603	100.0	S9	292.942	291.115	1.602	Open Manhole	600
S5.001	21.572	99.9	S10	292.898	290.899	1.774	Open Manhole	1200
S3.006	8.352	99.4	SHB	292.724	290.815	1.684	Open Manhole	600
S3.007	8.123	92.8	SESR25/C1	292.722	290.727	1.770	Open Manhole	3540 x 1900
S3.008	40.419	50.9	S11	291.993	289.710	2.058	Open Manhole	1200
S3.009	4.758	97.1	S	290.500	289.661	0.614	Open Manhole	0

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Area Summary for New Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.000	User	-	100	0.011	0.011	0.011
	User	-	100	0.008	0.008	0.019
3.001	User	-	100	0.020	0.020	0.020
3.002	User	-	100	0.023	0.023	0.023
	User	-	100	0.015	0.015	0.038
	User	-	100	0.032	0.032	0.070
3.003	User	-	100	0.034	0.034	0.034
3.004	-	-	100	0.000	0.000	0.000
3.005	User	-	100	0.066	0.066	0.066
4.000	User	-	100	0.015	0.015	0.015
5.000	User	-	100	0.014	0.014	0.014
5.001	User	-	100	0.057	0.057	0.057
	User	-	100	0.041	0.041	0.098
3.006	User	-	100	0.009	0.009	0.009
3.007	-	-	100	0.000	0.000	0.000
3.008	-	-	100	0.000	0.000	0.000
3.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.346	0.346	0.346

Free Flowing Outfall Details for New 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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S3.009	S	290.500	289.661	0.000	0	0
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Simulation Criteria for New 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 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	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 406150 373600 SK 06150 73600	Cv (Winter)	0.840
Data Type		Catchment Storm Duration (mins)	30

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Online Controls for New Storm

Hydro-Brake® Optimum Manhole: S10, DS/PN: S3.006, Volume (m³): 3.5

Unit Reference	MD-SHE-0094-4200-1215-4200
Design Head (m)	1.215
Design Flow (l/s)	4.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	290.899
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.215	4.2	Kick-Flo®	0.753	3.4
Flush-Flo™	0.365	4.2	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)
0.100	3.0	0.800	3.5	2.000	5.3	4.000	7.3	7.000	9.5
0.200	3.9	1.000	3.8	2.200	5.5	4.500	7.7	7.500	9.9
0.300	4.2	1.200	4.2	2.400	5.8	5.000	8.1	8.000	10.2
0.400	4.2	1.400	4.5	2.600	6.0	5.500	8.5	8.500	10.5
0.500	4.1	1.600	4.8	3.000	6.4	6.000	8.9	9.000	10.8
0.600	4.0	1.800	5.0	3.500	6.9	6.500	9.2	9.500	11.0

Storage Structures for New Storm

Cellular Storage Pipe: S3.004

Manning's N 0.050 Infiltration Coefficient Side (m/hr) 0.00000
Invert Level (m) 290.914 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	187.0	187.0	1.200	187.0	254.2	1.201	0.0	254.2

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

Simulation Criteria

Volumetric Runoff Coeff 0.750 Foul Sewage per hectare (l/s) 0.000
 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

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

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 360, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S3.000	S1	15 minute 2 year Winter I+0%	293.000	291.615	-0.187	0.000	0.07		2.9
S3.001	S2	15 minute 2 year Winter I+0%	293.100	291.511	-0.175	0.000	0.11		5.4
S3.002	S3	15 minute 2 year Winter I+0%	292.680	291.301	-0.141	0.000	0.29		14.2
S3.003	S4	360 minute 2 year Winter I+0%	292.794	291.154	-0.019	0.000	0.14		4.2
S3.004	S5	360 minute 2 year Winter I+0%	292.781	291.153	-0.962	0.000	0.00		4.2
S3.005	S6	360 minute 2 year Winter I+0%	292.877	291.153	0.015	0.000	0.12		3.7
S4.000	S7	360 minute 2 year Winter I+0%	292.807	291.152	-0.075	0.000	0.01		0.5
S5.000	S8	15 minute 2 year Winter I+0%	292.933	291.371	-0.195	0.000	0.04		2.1
S5.001	S9	15 minute 2 year Winter I+0%	292.942	291.200	-0.140	0.000	0.30		14.4
S3.006	S10	360 minute 2 year Winter I+0%	292.898	291.152	0.028	0.000	0.10		4.1
S3.007	SHB	360 minute 2 year Winter I+0%	292.724	290.862	-0.178	0.000	0.10		4.1
S3.008	SESR25/C1	360 minute 2 year Winter I+0%	292.722	290.539	-0.190	0.000	0.06		4.1
S3.009	S11	360 minute 2 year Winter I+0%	291.993	289.764	-0.171	0.000	0.13		4.1

PN	US/MH Name	Status
S3.000	S1	OK
S3.001	S2	OK
S3.002	S3	OK
S3.003	S4	OK
S3.004	S5	OK
S3.005	S6	SURCHARGED
S4.000	S7	OK
S5.000	S8	OK
S5.001	S9	OK

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

	US/MH	
PN	Name	Status
S3.006	S10	SURCHARGED
S3.007	SHB	OK
S3.008	SESR25/C1	OK
S3.009	S11	OK

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

Simulation Criteria

Volumetric Runoff Coeff 0.750 Foul Sewage per hectare (l/s) 0.000
 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

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

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 360, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water			Surcharged		Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
				Level (m)	Depth (m)	Flow (m³/s)	Flow (l/s)	Flow (l/s)				
S3.000	S1	15 minute 30 year Winter I+0%	293.000	291.634	-0.168	0.000	0.14	6.3				
S3.001	S2	15 minute 30 year Winter I+0%	293.100	291.541	-0.145	0.000	0.27	13.0				
S3.002	S3	360 minute 30 year Winter I+0%	292.680	291.446	0.003	0.000	0.12	5.9				
S3.003	S4	360 minute 30 year Winter I+0%	292.794	291.443	0.270	0.000	0.25	7.4				
S3.004	S5	360 minute 30 year Winter I+0%	292.781	291.442	-0.673	0.000	0.00	7.3				
S3.005	S6	360 minute 30 year Winter I+0%	292.877	291.442	0.304	0.000	0.16	4.9				
S4.000	S7	360 minute 30 year Winter I+0%	292.807	291.456	0.229	0.000	0.02	0.8				
S5.000	S8	360 minute 30 year Winter I+0%	292.933	291.452	-0.114	0.000	0.02	0.8				
S5.001	S9	360 minute 30 year Winter I+0%	292.942	291.453	0.113	0.000	0.12	5.8				
S3.006	S10	360 minute 30 year Winter I+0%	292.898	291.467	0.343	0.000	0.10	4.2				
S3.007	SHB	360 minute 30 year Summer I+0%	292.724	290.862	-0.178	0.000	0.10	4.2				
S3.008	SESR25/C1	360 minute 30 year Winter I+0%	292.722	290.540	-0.189	0.000	0.06	4.2				
S3.009	S11	30 minute 30 year Winter I+0%	291.993	289.764	-0.171	0.000	0.13	4.2				

PN	US/MH Name	Status
S3.000	S1	OK
S3.001	S2	OK
S3.002	S3	SURCHARGED
S3.003	S4	SURCHARGED
S3.004	S5	OK
S3.005	S6	SURCHARGED
S4.000	S7	SURCHARGED
S5.000	S8	OK
S5.001	S9	SURCHARGED

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

	US/MH	
PN	Name	Status
S3.006	S10	SURCHARGED
S3.007	SHB	OK
S3.008	SESR25/C1	OK
S3.009	S11	OK

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

Simulation Criteria

Volumetric Runoff Coeff 0.750 Foul Sewage per hectare (l/s) 0.000
 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 Coeffiecient 0.800
 Manhole Headloss Coeff (Global) 0.500 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

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 360, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S3.000	S1	360 minute 100 year Winter I+40%	293.000	292.100	0.298	0.000	0.04		1.9
S3.001	S2	360 minute 100 year Winter I+40%	293.100	292.100	0.414	0.000	0.08		3.7
S3.002	S3	360 minute 100 year Winter I+40%	292.680	292.099	0.656	0.000	0.21		9.9
S3.003	S4	360 minute 100 year Winter I+40%	292.794	292.095	0.923	0.000	0.44		13.1
S3.004	S5	360 minute 100 year Winter I+40%	292.781	292.094	-0.021	0.000	0.00		13.0
S3.005	S6	360 minute 100 year Winter I+40%	292.877	292.095	0.957	0.000	0.15		4.5
S4.000	S7	360 minute 100 year Winter I+40%	292.807	292.110	0.883	0.000	0.03		1.4
S5.000	S8	360 minute 100 year Winter I+40%	292.933	292.107	0.541	0.000	0.03		1.3
S5.001	S9	360 minute 100 year Winter I+40%	292.942	292.108	0.768	0.000	0.22		10.6
S3.006	S10	360 minute 100 year Winter I+40%	292.898	292.115	0.991	0.000	0.10		4.2
S3.007	SHB	1440 minute 100 year Summer I+40%	292.724	290.862	-0.178	0.000	0.10		4.2
S3.008	SESR25/C1	1440 minute 100 year Winter I+40%	292.722	290.540	-0.189	0.000	0.06		4.2
S3.009	S11	1440 minute 100 year Winter I+40%	291.993	289.764	-0.171	0.000	0.13		4.2

PN	US/MH Name	Status
S3.000	S1	SURCHARGED
S3.001	S2	SURCHARGED
S3.002	S3	SURCHARGED
S3.003	S4	SURCHARGED
S3.004	S5	OK
S3.005	S6	SURCHARGED
S4.000	S7	SURCHARGED
S5.000	S8	SURCHARGED
S5.001	S9	SURCHARGED

Glanville Consultants Ltd		Page 12
575- 599 Maxted Road Hemel Hempstead Herts HP2 7ED	McDonald`s Buxton Proposed Surface Water GC4210567	
Date 2/29/2024 3:43 PM File proposed.MDX	Designed by FG Checked by	
Micro Drainage	Network 2019.1	

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

PN	US/MH Name	Status
S3.006	S10	SURCHARGED
S3.007	SHB	OK
S3.008	SESR25/C1	OK
S3.009	S11	OK