


















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STORM SEWER DESIGN by the Modified Rational Method


Network Design Table for Metals Recovery

« - Indicates pipe capacity < flow

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
S1.000	10.822	0.049	220.9	0.240	1.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.001	25.656	0.750	34.2	0.000	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.002	28.244	0.056	504.4	0.329	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.003	44.099	0.088	501.1	0.000	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.004	18.842	0.038	495.8	0.293	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.005	20.509	0.041	500.2	0.299	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.006	16.995	0.034	500.0	0.000	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S2.000	31.653	0.063	502.4	0.266	1.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S2.001	70.999	0.237	299.6	0.247	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S2.002	28.276	0.057	496.1	0.340	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S2.003	69.676	0.139	501.3	0.357	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S2.004	84.842	0.170	499.1	0.000	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S2.005	65.885	0.391	168.5	0.343	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.007	39.905	0.080	498.8	0.000	0.00	0.0	0.018	1.5	\	500	1:1.5 Ditch	
S1.008	30.932	0.103	300.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.009	26.738	6.000	4.5	0.000	0.00	0.0	0.600		o	300	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	250.00	1.15	7.599	0.240	0.0	0.0	0.0	1.19	339.9	130.2
S1.001	250.00	1.29	7.550	0.240	0.0	0.0	0.0	3.03	863.6	130.2
S1.002	250.00	1.89	6.800	0.570	0.0	0.0	0.0	0.79	224.9«	308.6
S1.003	225.60	2.82	6.744	0.570	0.0	0.0	0.0	0.79	225.6«	308.6
S1.004	206.00	3.21	6.655	0.863	0.0	0.0	0.0	0.80	226.8«	385.1
S1.005	188.76	3.64	6.618	1.162	0.0	0.0	0.0	0.79	225.8«	475.1
S1.006	176.90	4.00	6.577	1.162	0.0	0.0	0.0	0.79	225.9«	475.1
S2.000	250.00	1.67	7.600	0.266	0.0	0.0	0.0	0.79	225.3	144.1
S2.001	225.29	2.82	7.537	0.513	0.0	0.0	0.0	1.02	291.8	250.3
S2.002	197.41	3.42	7.300	0.853	0.0	0.0	0.0	0.80	226.8«	364.7
S2.003	154.08	4.88	7.243	1.209	0.0	0.0	0.0	0.79	225.6«	403.7
S2.004	124.17	6.66	7.104	1.209	0.0	0.0	0.0	0.79	226.1«	403.7
S2.005	114.74	7.47	6.934	1.552	0.0	0.0	0.0	1.37	389.1«	403.7
S1.007	106.58	8.31	6.543	2.714	0.0	0.0	0.0	0.79	226.2«	626.7
S1.008	101.78	8.88	5.488	2.714	0.0	0.0	0.0	0.90	63.8«	626.7
S1.009	101.31	8.94	5.583	2.714	0.0	0.0	0.0	7.50	529.9«	626.7

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Area Summary for Metals Recovery

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.240	0.240	0.240
1.001	-	-	100	0.000	0.000	0.000
1.002	User	-	100	0.329	0.329	0.329
1.003	-	-	100	0.000	0.000	0.000
1.004	User	-	100	0.293	0.293	0.293
1.005	User	-	100	0.299	0.299	0.299
1.006	-	-	100	0.000	0.000	0.000
2.000	User	-	100	0.266	0.266	0.266
2.001	User	-	100	0.247	0.247	0.247
2.002	User	-	100	0.340	0.340	0.340
2.003	User	-	100	0.357	0.357	0.357
2.004	-	-	100	0.000	0.000	0.000
2.005	User	-	100	0.343	0.343	0.343
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.714	2.714	2.714

Free Flowing Outfall Details for Metals Recovery

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
S1.009	S	1.634	-0.417	0.000	0	0


Simulation Criteria for Metals Recovery

Volumetric Runoff Coeff	0.600	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 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)	0.283
Return Period (years)	30	F (1km)	2.340
FEH Rainfall Version	1999	Summer Storms	Yes
Site Location	GB 454100 523250 NZ 54100 23250	Winter Storms	Yes
C (1km)	-0.022	Cv (Summer)	0.600
D1 (1km)	0.381	Cv (Winter)	0.840
D2 (1km)	0.379	Storm Duration (mins)	30
D3 (1km)	0.256		

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Online Controls for Metals Recovery


Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.008, Volume (m³): 163.6

Unit Reference	MD-SHE-0244-3220-1000-3220
Design Head (m)	1.000
Design Flow (l/s)	32.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	244
Invert Level (m)	5.488
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	32.2	Kick-Flo®	0.751	28.1
Flush-Flo™	0.390	32.1	Mean Flow over Head Range	-	26.5

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	8.0	0.800	28.9	2.000	44.9	4.000	62.8	7.000	82.5
0.200	24.8	1.000	32.2	2.200	47.0	4.500	66.5	7.500	85.3
0.300	31.7	1.200	35.1	2.400	49.1	5.000	70.0	8.000	88.0
0.400	32.1	1.400	37.8	2.600	51.0	5.500	73.3	8.500	90.7
0.500	31.8	1.600	40.3	3.000	54.6	6.000	76.5	9.000	93.2
0.600	31.0	1.800	42.7	3.500	58.9	6.500	79.5	9.500	95.7


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Storage Structures for Metals Recovery

Infiltration Basin Manhole: S9, DS/PN: S1.008

Invert Level (m) 5.488 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	786.8	1.000	786.8

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

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 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) 0.256
FEH Rainfall Version 1999 E (1km) 0.283
Site Location GB 454100 523250 NZ 54100 23250 F (1km) 2.340
C (1km) -0.022 Cv (Summer) 0.600
D1 (1km) 0.381 Cv (Winter) 0.600
D2 (1km) 0.379

Margin for Flood Risk Warning (mm) 0.0 DVD Status ON
Analysis Timestep Fine 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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Summer	1	+0%					7.686	-0.313
S1.001	S2	15 Summer	1	+0%					7.600	-0.350
S1.002	S3	15 Summer	1	+0%					6.951	-0.549
S1.003	S4	15 Summer	1	+0%					6.899	-1.101
S1.004	S5	15 Summer	1	+0%					6.840	-1.160
S1.005	S6	15 Summer	1	+0%					6.816	-1.184
S1.006	S7	30 Summer	1	+0%					6.784	-1.216
S2.000	S8	15 Summer	1	+0%					7.712	-0.288
S2.001	S9	15 Summer	1	+0%					7.644	-0.356
S2.002	S10	15 Summer	1	+0%					7.465	-0.535
S2.003	S11	15 Summer	1	+0%					7.414	-0.586
S2.004	S12	15 Summer	1	+0%					7.263	-0.737
S2.005	S13	15 Summer	1	+0%					7.060	-0.885
S1.007	S8	30 Summer	1	+0%					6.767	-1.233
S1.008	S9	720 Summer	1	+0%	1/720 Summer				5.789	0.001
S1.009	S10	720 Summer	1	+0%					5.621	-0.262

PN	US/MH Name	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.05	28.8	OK	
S1.001	S2	0.000	0.02	30.4	OK	
S1.002	S3	0.000	0.03	47.2	OK	
S1.003	S4	0.000	0.01	43.6	OK	
S1.004	S5	0.000	0.01	60.7	OK	
S1.005	S6	0.000	0.01	77.4	OK	
S1.006	S7	0.000	0.01	70.9	OK	
S2.000	S8	0.000	0.07	29.3	OK	
S2.001	S9	0.000	0.05	39.1	OK	
S2.002	S10	0.000	0.04	55.3	OK	

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

PN	US/MH Name	Flooded		Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)		
S2.003	S11	0.000	0.04	71.7	OK	
S2.004	S12	0.000	0.03	67.1	OK	
S2.005	S13	0.000	0.02	78.3	OK	
S1.007	S8	0.000	0.02	137.1	OK	
S1.008	S9	0.000	0.31	18.3	SURCHARGED	
S1.009	S10	0.000	0.04	18.3	OK	

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

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 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) 0.256
FEH Rainfall Version 1999 E (1km) 0.283
Site Location GB 454100 523250 NZ 54100 23250 F (1km) 2.340
C (1km) -0.022 Cv (Summer) 0.600
D1 (1km) 0.381 Cv (Winter) 0.600
D2 (1km) 0.379

Margin for Flood Risk Warning (mm) 0.0 DVD Status ON
Analysis Timestep Fine 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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Summer	30	+0%					7.759	-0.240
S1.001	S2	15 Summer	30	+0%					7.645	-0.305
S1.002	S3	15 Summer	30	+0%					7.092	-0.408
S1.003	S4	15 Summer	30	+0%					7.054	-0.946
S1.004	S5	15 Summer	30	+0%					7.016	-0.984
S1.005	S6	15 Summer	30	+0%					6.997	-1.003
S1.006	S7	15 Summer	30	+0%					6.967	-1.033
S2.000	S8	15 Summer	30	+0%					7.808	-0.192
S2.001	S9	15 Summer	30	+0%					7.747	-0.253
S2.002	S10	15 Summer	30	+0%					7.621	-0.379
S2.003	S11	15 Summer	30	+0%					7.570	-0.430
S2.004	S12	15 Summer	30	+0%					7.411	-0.589
S2.005	S13	15 Summer	30	+0%					7.169	-0.776
S1.007	S8	15 Summer	30	+0%					6.952	-1.048
S1.008	S9	480 Summer	30	+0%	1/720 Summer				6.098	0.310
S1.009	S10	480 Summer	30	+0%					5.634	-0.249

PN	US/MH Name	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.14	85.5	OK	
S1.001	S2	0.000	0.06	86.5	OK	
S1.002	S3	0.000	0.12	159.7	OK	
S1.003	S4	0.000	0.03	147.9	OK	
S1.004	S5	0.000	0.04	197.2	OK	
S1.005	S6	0.000	0.04	261.3	OK	
S1.006	S7	0.000	0.04	252.2	OK	
S2.000	S8	0.000	0.21	86.6	OK	
S2.001	S9	0.000	0.18	130.9	OK	
S2.002	S10	0.000	0.14	191.1	OK	

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

PN	US/MH Name	Flooded		Pipe	Status	Level Exceeded
		Volume (m ³)	Flow / Overflow Cap. (l/s)	Flow (l/s)		
S2.003	S11	0.000	0.15	251.3	OK	
S2.004	S12	0.000	0.09	225.9	OK	
S2.005	S13	0.000	0.05	245.4	OK	
S1.007	S8	0.000	0.06	431.8	OK	
S1.008	S9	0.000	0.55	32.1	SURCHARGED	
S1.009	S10	0.000	0.07	32.1	OK	

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

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 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) 0.256
FEH Rainfall Version 1999 E (1km) 0.283
Site Location GB 454100 523250 NZ 54100 23250 F (1km) 2.340
C (1km) -0.022 Cv (Summer) 0.600
D1 (1km) 0.381 Cv (Winter) 0.600
D2 (1km) 0.379

Margin for Flood Risk Warning (mm) 0.0 DVD Status ON
Analysis Timestep Fine 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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Summer	100	+20%					7.814	-0.185
S1.001	S2	15 Summer	100	+20%					7.682	-0.268
S1.002	S3	15 Summer	100	+20%					7.196	-0.304
S1.003	S4	15 Summer	100	+20%					7.164	-0.836
S1.004	S5	15 Summer	100	+20%					7.134	-0.866
S1.005	S6	15 Summer	100	+20%					7.118	-0.882
S1.006	S7	15 Summer	100	+20%					7.090	-0.910
S2.000	S8	15 Summer	100	+20%					7.880	-0.120
S2.001	S9	15 Summer	100	+20%					7.820	-0.180
S2.002	S10	15 Summer	100	+20%					7.726	-0.274
S2.003	S11	15 Summer	100	+20%					7.677	-0.323
S2.004	S12	15 Summer	100	+20%					7.515	-0.485
S2.005	S13	15 Summer	100	+20%					7.260	-0.685
S1.007	S8	15 Summer	100	+20%					7.076	-0.924
S1.008	S9	480 Summer	100	+20%	1/720 Summer				6.555	0.767
S1.009	S10	720 Summer	100	+20%					5.634	-0.249

PN	US/MH Name	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.25	154.9	OK	
S1.001	S2	0.000	0.11	150.3	OK	
S1.002	S3	0.000	0.21	285.1	OK	
S1.003	S4	0.000	0.05	256.2	OK	
S1.004	S5	0.000	0.06	344.7	OK	
S1.005	S6	0.000	0.08	455.2	OK	
S1.006	S7	0.000	0.08	444.6	OK	
S2.000	S8	0.000	0.38	152.4	OK	
S2.001	S9	0.000	0.33	232.3	OK	
S2.002	S10	0.000	0.25	342.0	OK	

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XP Solutions	Network 2018.1.1	

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

PN	US/MH Name	Flooded		Pipe	Status	Level Exceeded
		Volume (m ³)	Flow / Overflow Cap. (l/s)	Flow (l/s)		
S2.003	S11	0.000	0.28	448.6	OK	
S2.004	S12	0.000	0.17	404.0	OK	
S2.005	S13	0.000	0.10	453.5	OK	
S1.007	S8	0.000	0.10	756.3	OK	
S1.008	S9	0.000	0.55	32.1	SURCHARGED	
S1.009	S10	0.000	0.07	32.1	OK	