


Ironsides Farrar Ltd		Page 1
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	10
Ratio R	0.413	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	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	0.385	4-8	0.097

Total Area Contributing (ha) = 0.482


Total Pipe Volume (m³) = 251.268

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)	n	HYD SECT	DIA (mm)	Section	Type	Auto Design
1.000	59.760	1.000	59.8	0.058	4.00	0.0		0.025	\/	-1	Pipe/Conduit		
1.001	3.380	0.100	33.8	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit		
1.002	23.610	0.400	59.0	0.026	0.00	0.0		0.025	\/	-1	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	50.00	4.41	108.000	0.058	0.0	0.0	0.8	2.46	3541.2	8.6
1.001	50.00	4.43	107.000	0.058	0.0	0.0	0.8	2.71	191.8	8.6
1.002	50.00	4.58	106.600	0.084	0.0	0.0	1.1	2.47	3563.2	12.5


Ironside Farrar Ltd		Page 2
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	38.680	0.750	51.6	0.065	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	14.520	0.100	145.2	0.050	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	6.320	0.027	230.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.004	84.000	2.000	42.0	0.000	0.00	0.0		0.025	\/	-1	Pipe/Conduit	
3.000	25.280	0.250	101.1	0.110	4.00	0.0	0.600		o	300	Pipe/Conduit	
3.001	41.340	1.000	41.3	0.078	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.002	9.330	0.300	31.1	0.055	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.003	22.970	0.480	47.9	0.040	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.005	6.530	0.044	150.0	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)
2.000	50.00	4.35	106.800	0.065	0.0	0.0	0.9	1.83	72.6	9.7
2.001	50.00	4.58	106.050	0.115	0.0	0.0	1.6	1.08	43.1	17.1
1.003	50.00	4.69	105.875	0.199	0.0	0.0	2.7	1.03	73.0	29.6
1.004	50.00	5.16	105.548	0.199	0.0	0.0	2.7	2.93	4224.1	29.6
3.000	50.00	4.27	105.500	0.110	0.0	0.0	1.5	1.56	110.5	16.4
3.001	50.00	4.55	105.250	0.188	0.0	0.0	2.5	2.45	173.4	28.0
3.002	50.00	4.61	104.250	0.243	0.0	0.0	3.3	2.83	200.0	36.2
3.003	50.00	4.77	103.950	0.283	0.0	0.0	3.8	2.28	161.1	42.2
1.005	50.00	5.25	103.470	0.482	0.0	0.0	6.5	1.28	90.6	71.8

Ironsides Farrar Ltd		Page 3
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	


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	\/	-1	1	108.600	108.000	0.000	Junction	
1.001	o	300	2	107.600	107.000	0.300	Open Manhole	10000
1.002	\/	-1	3	107.600	106.600	0.400	Open Manhole	10000
2.000	o	225	4	108.000	106.800	0.975	Open Manhole	1200
2.001	o	225	5	107.250	106.050	0.975	Open Manhole	1200
1.003	o	300	6	107.200	105.875	1.025	Open Manhole	10000
1.004	\/	-1	7	107.100	105.548	0.952	Open Manhole	10000
3.000	o	300	8	106.900	105.500	1.100	Open Manhole	1200
3.001	o	300	9	106.650	105.250	1.100	Open Manhole	1200
3.002	o	300	10	105.400	104.250	0.850	Open Manhole	1200
3.003	o	300	11	105.000	103.950	0.750	Open Manhole	1200
1.005	o	300	12	104.600	103.470	0.830	Open Manhole	10000

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	59.760	59.8	2	107.600	107.000	0.000	Open Manhole	10000
1.001	3.380	33.8	3	107.600	106.900	0.400	Open Manhole	10000
1.002	23.610	59.0	6	107.200	106.200	0.400	Open Manhole	10000
2.000	38.680	51.6	5	107.250	106.050	0.975	Open Manhole	1200
2.001	14.520	145.2	6	107.200	105.950	1.025	Open Manhole	10000
1.003	6.320	230.0	7	107.100	105.848	0.952	Open Manhole	10000
1.004	84.000	42.0	12	104.600	103.548	0.452	Open Manhole	10000
3.000	25.280	101.1	9	106.650	105.250	1.100	Open Manhole	1200
3.001	41.340	41.3	10	105.400	104.250	0.850	Open Manhole	1200
3.002	9.330	31.1	11	105.000	103.950	0.750	Open Manhole	1200
3.003	22.970	47.9	12	104.600	103.470	0.830	Open Manhole	10000
1.005	6.530	150.0	Basin	104.000	103.426	0.274	Open Manhole	0

Ironside Farrar Ltd		Page 4
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	


Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /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 0    Number of Storage Structures 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)	20.000	Storm Duration (mins)	30
Ratio R	0.413		

Ironsides Farrar Ltd		Page 5
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

2 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 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/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 0    Number of Storage Structures 0    Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 446944 234772 SP 46944 34772  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840  
  
Margin for Flood Risk Warning (mm) 300.0  
Analysis Timestep 2.5 Second Increment (Extended)  
DTS Status OFF  
DVD Status ON  
Inertia Status ON


Profile(s) Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360  
Return Period(s) (years) 2, 30, 100  
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%					108.022
1.001	2	30 Winter	2	+0%					107.046
1.002	3	15 Winter	2	+0%					106.613
2.000	4	15 Winter	2	+0%	100/15 Summer				106.865
2.001	5	15 Winter	2	+0%	30/15 Summer				106.169
1.003	6	30 Winter	2	+0%	100/15 Summer				105.983
1.004	7	30 Winter	2	+0%					105.570
3.000	8	15 Winter	2	+0%	100/15 Summer				105.595
3.001	9	15 Winter	2	+0%	100/15 Summer				105.343
3.002	10	15 Winter	2	+0%	100/15 Summer				104.365
3.003	11	15 Winter	2	+0%	100/15 Summer				104.071

Ironside Farrar Ltd		Page 6
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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


PN	US/MH Name	Surcharged Flooded			Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
1.000	1	-0.578	0.000	0.00		11.5	OK
1.001	2	-0.254	0.000	0.06		4.5	OK
1.002	3	-0.587	0.000	0.00		6.9	OK
2.000	4	-0.160	0.000	0.19		12.8	OK
2.001	5	-0.106	0.000	0.54		20.5	OK
1.003	6	-0.192	0.000	0.28		14.5	OK
1.004	7	-0.578	0.000	0.00		13.9	OK
3.000	8	-0.205	0.000	0.22		21.8	OK
3.001	9	-0.207	0.000	0.21		33.7	OK
3.002	10	-0.185	0.000	0.31		42.0	OK
3.003	11	-0.179	0.000	0.34		48.6	OK

Ironside Farrar Ltd		Page 7
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.005	12 30	Winter	2	+0%	30/15	Summer			103.636

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap. (l/s)	Flow (l/s)			
1.005	12	-0.134	0.000	0.59	36.2	OK		

Ironsides Farrar Ltd		Page 8
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/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 0    Number of Storage Structures 0    Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 446944 234772 SP 46944 34772  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840  
  
Margin for Flood Risk Warning (mm) 300.0  
Analysis Timestep 2.5 Second Increment (Extended)  
DTS Status OFF  
DVD Status ON  
Inertia Status ON

Profile(s) Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360  
Return Period(s) (years) 2, 30, 100  
Climate Change (%) 0, 0, 40


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	1	15 Winter	30	+0%					108.047
1.001	2	15 Winter	30	+0%					107.082
1.002	3	30 Winter	30	+0%					106.633
2.000	4	15 Winter	30	+0%	100/15 Summer				106.900
2.001	5	15 Summer	30	+0%	30/15 Summer				106.341
1.003	6	30 Winter	30	+0%	100/15 Summer				106.071
1.004	7	30 Winter	30	+0%					105.606
3.000	8	15 Winter	30	+0%	100/15 Summer				105.646
3.001	9	15 Winter	30	+0%	100/15 Summer				105.401
3.002	10	15 Winter	30	+0%	100/15 Summer				104.447
3.003	11	15 Winter	30	+0%	100/15 Summer				104.164



Ironside Farrar Ltd		Page 9
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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


PN	US/MH Name	Surcharged		Flooded		Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)			
1.000	1	-0.553	0.000	0.01		25.0	OK	
1.001	2	-0.218	0.000	0.17		13.3	OK	
1.002	3	-0.567	0.000	0.01		17.5	OK	
2.000	4	-0.125	0.000	0.41		28.0	OK	
2.001	5	0.066	0.000	1.29		48.6	SURCHARGED	
1.003	6	-0.104	0.000	0.76		39.0	OK	
1.004	7	-0.541	0.000	0.01		37.0	OK	
3.000	8	-0.154	0.000	0.48		47.5	OK	
3.001	9	-0.149	0.000	0.50		80.7	OK	
3.002	10	-0.103	0.000	0.76		104.0	OK	
3.003	11	-0.086	0.000	0.84		120.2	OK	

Ironsides Farrar Ltd		Page 10
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.005	12	30 Winter	30	+0%	30/15 Summer				103.823

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
1.005	12	0.053	0.000	1.36	83.5	SURCHARGED		

Ironsides Farrar Ltd		Page 11
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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 10.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/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 0    Number of Storage Structures 0    Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 446944 234772 SP 46944 34772  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840  
  
Margin for Flood Risk Warning (mm) 300.0  
Analysis Timestep 2.5 Second Increment (Extended)  
DTS Status OFF  
DVD Status ON  
Inertia Status ON


Profile(s) Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360  
Return Period(s) (years) 2, 30, 100  
Climate Change (%) 0, 0, 40

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	1 15	Winter	100	+40%					108.069
1.001	2 15	Winter	100	+40%					107.125
1.002	3 15	Winter	100	+40%					106.665
2.000	4 15	Winter	100	+40%	100/15	Summer			107.068
2.001	5 15	Winter	100	+40%	30/15	Summer			106.687
1.003	6 30	Winter	100	+40%	100/15	Summer			106.221
1.004	7 30	Winter	100	+40%					105.628
3.000	8 15	Winter	100	+40%	100/15	Summer			105.839
3.001	9 15	Winter	100	+40%	100/15	Summer			105.702
3.002	10 15	Winter	100	+40%	100/15	Summer			105.114
3.003	11 15	Winter	100	+40%	100/15	Summer			104.718

Ironside Farrar Ltd		Page 12
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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

PN	US/MH Name	Surcharged		Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow (l/s)					
1.000	1	-0.531	0.000	0.01		45.0		OK	
1.001	2	-0.175	0.000	0.36		28.5		OK	
1.002	3	-0.535	0.000	0.01		37.6		OK	
2.000	4	0.043	0.000	0.70		47.9		SURCHARGED	
2.001	5	0.412	0.000	2.25		84.9		SURCHARGED	
1.003	6	0.046	0.000	1.44		74.0		SURCHARGED	
1.004	7	-0.520	0.000	0.02		73.0		OK	
3.000	8	0.039	0.000	0.82		81.3		SURCHARGED	
3.001	9	0.152	0.000	0.80		128.7		SURCHARGED	
3.002	10	0.564	0.000	1.16		158.8		FLOOD RISK	
3.003	11	0.468	0.000	1.29		184.2		FLOOD RISK	

Ironside Farrar Ltd		Page 13
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury SW Network 1	
Date 09/10/2019 File Berry Hill Network 1 191...	Designed by srg Checked by	
Micro Drainage	Network 2019.1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.005	12 30	Winter	100	+40%	30/15	Summer			104.067

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
1.005	12	0.297	0.000	2.43	149.1	SURCHARGED		