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

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 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 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s)

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level (m)
1.000	S101	15 Winter	100	+30%	100/15	Summer		108.948
2.000	S102	15 Winter	100	+30%				110.760
1.001	S103	15 Winter	100	+30%	100/15	Summer		108.723
1.002	S104	30 Winter	100	+30%	100/15	Winter		108.357
3.000	S105	15 Winter	100	+30%				111.239
3.001	S106	15 Winter	100	+30%				109.783
1.003	S107	30 Winter	100	+30%	100/15	Summer		108.344
1.004	S108	30 Winter	100	+30%	100/15	Summer		108.322
1.005	S109	30 Winter	100	+30%	100/15	Summer		108.285
1.006	S109A	30 Winter	100	+30%	100/15	Summer		108.270
1.007	S110	30 Winter	100	+30%	100/15	Summer		108.077

PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S101	0.173	0.000	0.75			36.8	SURCHARGED	
2.000	S102	-0.115	0.000	0.48			51.9	OK	
1.001	S103	0.342	0.000	1.45			121.3	SURCHARGED	

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

PN	US/MH Name	Surcharged		Flooded		Flow / Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Overflow Cap.	Flow / Overflow (l/s)					
1.002	S104	0.280	0.000	0.19				130.3	SURCHARGED	
3.000	S105	-0.145	0.000	0.27				26.6	OK	
3.001	S106	-0.090	0.000	0.67				62.0	OK	
1.003	S107	0.462	0.000	0.22				162.8	SURCHARGED	
1.004	S108	0.662	0.000	0.20				148.6	SURCHARGED	
1.005	S109	0.849	0.000	0.31				138.0	SURCHARGED	
1.006	S109A	0.890	0.000	0.15				133.4	SURCHARGED	
1.007	S110	1.332	0.000	1.09				149.6	FLOOD RISK	

Storm Water Network 2

STORM SEWER DESIGN

Network Design Details (1 in 2 yr)

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2


Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	40
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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

Network Design Table for Surface Network 2

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
1.000	25.065	0.135	185.7	0.087	5.00	0.0	0.600	o	375	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	5.31	105.375	0.087	0.0	0.0	4.7	1.33	146.5	16.5

STORM SEWER DESIGN

SW Manhole Schedules

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Manhole Schedules for Surface Network 2


MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S201	107.005	1.630	Open Manhole	2100	1.000	105.375	375				
S49	106.894	1.654	Open Manhole	1350		OUTFALL		1.000	105.240	375	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S201	360276.515	438011.955	360276.515	438011.955	Required	
S49	360257.043	437996.172			No Entry	

Storm Water Network 3

STORM SEWER DESIGN

Network Design Details (1 in 2 yr), Online Controls & Storage Structures

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3










Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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


Network Design Table for Surface Network 3

« - Indicates pipe capacity < flow
















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
1.000	18.574	0.113	164.4	0.129	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	21.020	0.127	165.5	0.023	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	38.591	0.234	164.9	0.082	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	20.496	0.637	32.2	0.052	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	20.288	0.630	32.2	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	33.160	1.079	30.7	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	32.000	0.905	35.4	0.084	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	18.105	0.540	33.5	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	21.220	0.633	33.5	0.055	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)
1.000	50.00	5.30	113.750	0.129	0.0	0.0	0.0	1.02	40.4	17.5
1.001	50.00	5.65	113.637	0.152	0.0	0.0	0.0	1.01	40.3	20.6
1.002	50.00	6.18	113.435	0.234	0.0	0.0	0.0	1.22	86.3	31.7
2.000	50.00	5.15	115.622	0.052	0.0	0.0	0.0	2.31	92.0	7.0
2.001	50.00	5.29	114.985	0.099	0.0	0.0	0.0	2.31	92.0	13.4
2.002	50.00	5.53	114.355	0.127	0.0	0.0	0.0	2.37	94.2	17.2
1.003	50.00	6.38	113.201	0.445	0.0	0.0	0.0	2.65	187.5	60.3
1.004	49.71	6.49	112.296	0.476	0.0	0.0	0.0	2.72	192.6	64.1
1.005	49.30	6.62	111.756	0.531	0.0	0.0	0.0	2.72	192.6	70.9


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Network Design Table for Surface Network 3

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
1.006	26.149	0.972	26.9	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	14.101	0.463	30.5	0.032	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	66.749	1.420	47.0	0.081	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	11.314	0.343	33.0	0.089	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.009	75.598	2.291	33.0	0.107	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	19.351	0.586	33.0	0.150	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	20.774	0.472	44.0	0.094	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	31.984	0.727	44.0	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	15.379	0.349	44.1	0.087	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.011	9.311	0.023	404.8	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
5.000	33.973	0.085	399.7	0.120	5.00	0.0	0.600	o	1500	Pipe/Conduit	
5.001	19.633	0.049	400.7	0.096	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.012	62.392	0.156	399.9	0.058	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.013	17.480	0.044	397.3	0.054	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.014	12.998	0.078	166.6	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)	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)
1.006	48.86	6.76	111.123	0.561	0.0	0.0	0.0	3.04	215.1	74.2
1.007	48.67	6.82	110.001	0.593	0.0	0.0	0.0	3.69	587.6	78.2
3.000	50.00	5.58	112.437	0.081	0.0	0.0	0.0	1.91	76.1	11.0
1.008	48.51	6.88	109.538	0.763	0.0	0.0	0.0	3.55	564.5	100.2
1.009	47.48	7.23	109.194	0.870	0.0	0.0	0.0	3.55	564.4	111.9
1.010	47.23	7.32	105.438	1.020	0.0	0.0	0.0	3.55	564.2	130.5
4.000	50.00	5.23	109.677	0.094	0.0	0.0	0.0	1.52	26.9	12.7
4.001	50.00	5.58	107.728	0.118	0.0	0.0	0.0	1.52	26.9	16.0
4.002	50.00	5.75	105.501	0.205	0.0	0.0	0.0	1.52	26.9x	27.8
1.011	47.02	7.40	103.802	1.225	0.0	0.0	0.0	2.13	3756.4	156.0
5.000	50.00	5.26	103.912	0.120	0.0	0.0	0.0	2.14	3780.6	16.2
5.001	50.00	5.42	103.827	0.216	0.0	0.0	0.0	2.14	3775.9	29.2
1.012	45.73	7.88	103.778	1.499	0.0	0.0	0.0	2.14	3779.3	185.7
1.013	45.39	8.02	103.622	1.553	0.0	0.0	0.0	2.15	3792.1	190.9
1.014	44.85	8.23	103.578	1.553	0.0	0.0	0.0	1.01	40.2x	190.9

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Online Controls for Surface Network 3

Depth/Flow Relationship Manhole: S324, DS/PN: 1.014, Volume (m³): 48.8

Invert Level (m) 103.578

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.9700	0.800	34.6400	2.000	33.5200	3.800	46.2000
0.200	17.9600	1.000	32.1700	2.200	35.1600	4.200	48.5800
0.300	26.1200	1.200	30.5300	2.400	36.7200	4.600	50.8400
0.400	31.6700	1.400	29.7200	2.600	38.2200	5.000	53.0000
0.500	34.7400	1.600	29.9800	3.000	41.0500		
0.600	35.8600	1.800	31.8000	3.400	43.7000		

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Storage Structures for Surface Network 3

Tank or Pond Manhole: S324, DS/PN: 1.014

Invert Level (m) 106.350

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	451.4	0.800	1004.1

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SW Manhole Schedules

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Manhole Schedules for Surface Network 3

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S301	116.010	2.260	Open Manhole	1800	1.000	113.750	225				
S302	115.684	2.047	Open Manhole	1800	1.001	113.637	225	1.000	113.637	225	
S303	115.415	1.980	Open Manhole	1800	1.002	113.435	300	1.001	113.510	225	
S304	117.197	1.575	Open Manhole	1350	2.000	115.622	225				
S305	116.721	1.736	Open Manhole	1350	2.001	114.985	225	2.000	114.985	225	
S306	116.084	1.729	Open Manhole	1350	2.002	114.355	225	2.001	114.355	225	
S307	115.067	1.866	Open Manhole	1800	1.003	113.201	300	1.002	113.201	300	
								2.002	113.276	225	
S308	114.042	1.746	Open Manhole	1350	1.004	112.296	300	1.003	112.296	300	
S309	113.576	1.820	Open Manhole	1350	1.005	111.756	300	1.004	111.756	300	
S310	113.216	2.093	Open Manhole	1350	1.006	111.123	300	1.005	111.123	300	
S311	113.012	3.011	Open Manhole	1500	1.007	110.001	450	1.006	110.151	300	
S312	114.027	1.590	Open Manhole	1500	3.000	112.437	225				
S313	113.198	3.660	Open Manhole	1800	1.008	109.538	450	1.007	109.538	450	
								3.000	111.017	225	1254
S314	112.916	3.722	Open Manhole	1800	1.009	109.194	450	1.008	109.195	450	1
S315	111.041	5.603	Open Manhole	1800	1.010	105.438	450	1.009	106.903	450	1465
S316	111.170	1.493	Open Manhole	1350	4.000	109.677	150				
S317	110.773	3.045	Open Manhole	1200	4.001	107.728	150	4.000	109.205	150	1477
S318	110.263	4.762	Open Manhole	1350	4.002	105.501	150	4.001	107.001	150	1500
S319	110.208	6.406	Open Manhole	3000	1.011	103.802	1500	1.010	104.852	450	
								4.002	105.152	150	
S320	109.345	5.433	Open Manhole	3000	5.000	103.912	1500				
S321	109.856	6.029	Open Manhole	3000	5.001	103.827	1500	5.000	103.827	1500	
S322	109.780	6.002	Open Manhole	3000	1.012	103.778	1500	1.011	103.779	1500	1
								5.001	103.778	1500	
S323	107.270	3.648	Open Manhole	3000	1.013	103.622	1500	1.012	103.622	1500	
S324	106.860	3.282	Open Manhole	3000	1.014	103.578	225	1.013	103.578	1500	
S325	103.900	0.400	Open Manhole	0		OUTFALL		1.014	103.500	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S301	360511.561	437893.841	360511.561	437893.841	Required	

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Manhole Schedules for Surface Network 3

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S302	360496.828	437882.530	360496.828	437882.530	Required	
S303	360484.705	437865.358	360484.705	437865.358	Required	
S304	360540.687	437834.207	360540.687	437834.207	Required	
S305	360524.091	437822.179	360524.091	437822.179	Required	
S306	360503.953	437819.724	360503.953	437819.724	Required	
S307	360472.084	437828.889	360472.084	437828.889	Required	
S308	360441.293	437837.603	360441.293	437837.603	Required	
S309	360429.491	437851.332	360429.491	437851.332	Required	
S310	360424.950	437872.060	360424.950	437872.060	Required	
S311	360414.973	437896.231	360414.973	437896.231	Required	
S312	360465.454	437958.539	360465.454	437958.539	Required	
S313	360426.523	437904.320	360426.523	437904.320	Required	
S314	360420.446	437913.864	360420.446	437913.864	Required	
S315	360379.843	437977.633	360379.843	437977.633	Required	
S316	360422.942	438021.553	360422.942	438021.553	Required	

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Manhole Schedules for Surface Network 3

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S317	360402.923	438016.002	360402.923	438016.002	Required	
S318	360374.989	438000.425	360374.989	438000.425	Required	
S319	360364.390	437989.281	360364.390	437989.281	Required	
S320	360314.485	437963.005	360314.485	437963.005	Required	
S321	360343.099	437981.320	360343.099	437981.320	Required	
S322	360357.105	437995.079	360357.105	437995.079	Required	
S323	360316.597	438042.533	360316.597	438042.533	Required	
S324	360305.768	438056.255	360305.768	438056.255	Required	
S325	360295.300	438063.960			No Entry	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event

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Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	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 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)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Barratt Homes Manchester		Page 1
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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

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 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 30
Climate Change (%) 0

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	S301	15 Winter	30	+0%	30/15 Winter				113.980
1.001	S302	15 Winter	30	+0%	30/15 Summer				113.878
1.002	S303	15 Winter	30	+0%					113.634
2.000	S304	15 Winter	30	+0%					115.686
2.001	S305	15 Winter	30	+0%					115.077
2.002	S306	15 Winter	30	+0%					114.458
1.003	S307	15 Winter	30	+0%					113.390
1.004	S308	15 Winter	30	+0%					112.499
1.005	S309	15 Winter	30	+0%					111.973
1.006	S310	15 Winter	30	+0%					111.328
1.007	S311	15 Winter	30	+0%					110.205
3.000	S312	15 Winter	30	+0%					112.524
1.008	S313	15 Winter	30	+0%					109.800
1.009	S314	15 Winter	30	+0%					109.405
1.010	S315	15 Winter	30	+0%					105.701
4.000	S316	15 Winter	30	+0%	30/15 Winter				109.837
4.001	S317	15 Winter	30	+0%	30/15 Summer				108.213
4.002	S318	15 Winter	30	+0%	30/15 Summer				106.824
1.011	S319	120 Winter	30	+0%	30/120 Winter				105.336
5.000	S320	120 Winter	30	+0%					105.336

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged		Flooded		Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow (l/s)	Overflow (l/s)					
1.000	S301	0.005	0.000	0.95				34.5	SURCHARGED	
1.001	S302	0.016	0.000	1.08				39.4	SURCHARGED	
1.002	S303	-0.101	0.000	0.76				60.5	OK	
2.000	S304	-0.161	0.000	0.18				14.7	OK	
2.001	S305	-0.133	0.000	0.35				28.9	OK	
2.002	S306	-0.122	0.000	0.42				37.2	OK	
1.003	S307	-0.111	0.000	0.70				119.8	OK	
1.004	S308	-0.097	0.000	0.78				129.0	OK	
1.005	S309	-0.083	0.000	0.86				144.5	OK	
1.006	S310	-0.095	0.000	0.79				152.9	OK	
1.007	S311	-0.246	0.000	0.42				161.4	OK	
3.000	S312	-0.138	0.000	0.31				22.8	OK	
1.008	S313	-0.188	0.000	0.63				208.0	OK	
1.009	S314	-0.239	0.000	0.45				235.6	OK	
1.010	S315	-0.187	0.000	0.64				274.4	OK	
4.000	S316	0.010	0.000	1.01				25.7	SURCHARGED	
4.001	S317	0.335	0.000	1.21				31.2	SURCHARGED	
4.002	S318	1.173	0.000	2.07				51.3	SURCHARGED	
1.011	S319	0.034	0.000	0.10				127.1	SURCHARGED	
5.000	S320	-0.076	0.000	0.00				8.4	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.001	S321	120	Winter	30	+0%	30/120	Winter		105.335
1.012	S322	120	Winter	30	+0%	30/120	Winter		105.336
1.013	S323	120	Winter	30	+0%	30/60	Winter		105.334
1.014	S324	120	Winter	30	+0%	30/15	Summer		105.334

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.001	S321	0.008	0.000	0.01		10.9	SURCHARGED	
1.012	S322	0.058	0.000	0.03		96.8	SURCHARGED	
1.013	S323	0.212	0.000	0.03		49.4	SURCHARGED	
1.014	S324	1.531	0.000	1.03		35.6	SURCHARGED	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event with Surcharged Outfall

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Surcharged Outfall Details for Surface Network 3

Outfall	Outfall C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level (mm)	(mm)
			(m)		

1.014 s325 103.900 103.500 103.500 0 0

Datum (m) 103.400 Offset (mins) 0

Time	Depth	Time	Depth	Time	Depth	Time	Depth	Time	Depth	Time	Depth
(mins)	(m)	(mins)	(m)	(mins)	(m)	(mins)	(m)	(mins)	(m)	(mins)	(m)
1	1.000	42	1.000	83	1.000	124	1.000	165	1.000	206	1.000
2	1.000	43	1.000	84	1.000	125	1.000	166	1.000	207	1.000
3	1.000	44	1.000	85	1.000	126	1.000	167	1.000	208	1.000
4	1.000	45	1.000	86	1.000	127	1.000	168	1.000	209	1.000
5	1.000	46	1.000	87	1.000	128	1.000	169	1.000	210	1.000
6	1.000	47	1.000	88	1.000	129	1.000	170	1.000	211	1.000
7	1.000	48	1.000	89	1.000	130	1.000	171	1.000	212	1.000
8	1.000	49	1.000	90	1.000	131	1.000	172	1.000	213	1.000
9	1.000	50	1.000	91	1.000	132	1.000	173	1.000	214	1.000
10	1.000	51	1.000	92	1.000	133	1.000	174	1.000	215	1.000
11	1.000	52	1.000	93	1.000	134	1.000	175	1.000	216	1.000
12	1.000	53	1.000	94	1.000	135	1.000	176	1.000	217	1.000
13	1.000	54	1.000	95	1.000	136	1.000	177	1.000	218	1.000
14	1.000	55	1.000	96	1.000	137	1.000	178	1.000	219	1.000
15	1.000	56	1.000	97	1.000	138	1.000	179	1.000	220	1.000
16	1.000	57	1.000	98	1.000	139	1.000	180	1.000	221	1.000
17	1.000	58	1.000	99	1.000	140	1.000	181	1.000	222	1.000
18	1.000	59	1.000	100	1.000	141	1.000	182	1.000	223	1.000
19	1.000	60	1.000	101	1.000	142	1.000	183	1.000	224	1.000
20	1.000	61	1.000	102	1.000	143	1.000	184	1.000	225	1.000
21	1.000	62	1.000	103	1.000	144	1.000	185	1.000	226	1.000
22	1.000	63	1.000	104	1.000	145	1.000	186	1.000	227	1.000
23	1.000	64	1.000	105	1.000	146	1.000	187	1.000	228	1.000
24	1.000	65	1.000	106	1.000	147	1.000	188	1.000	229	1.000
25	1.000	66	1.000	107	1.000	148	1.000	189	1.000	230	1.000
26	1.000	67	1.000	108	1.000	149	1.000	190	1.000	231	1.000
27	1.000	68	1.000	109	1.000	150	1.000	191	1.000	232	1.000
28	1.000	69	1.000	110	1.000	151	1.000	192	1.000	233	1.000
29	1.000	70	1.000	111	1.000	152	1.000	193	1.000	234	1.000
30	1.000	71	1.000	112	1.000	153	1.000	194	1.000	235	1.000
31	1.000	72	1.000	113	1.000	154	1.000	195	1.000	236	1.000
32	1.000	73	1.000	114	1.000	155	1.000	196	1.000	237	1.000
33	1.000	74	1.000	115	1.000	156	1.000	197	1.000	238	1.000
34	1.000	75	1.000	116	1.000	157	1.000	198	1.000	239	1.000
35	1.000	76	1.000	117	1.000	158	1.000	199	1.000	240	1.000
36	1.000	77	1.000	118	1.000	159	1.000	200	1.000	241	1.000
37	1.000	78	1.000	119	1.000	160	1.000	201	1.000	242	1.000
38	1.000	79	1.000	120	1.000	161	1.000	202	1.000	243	1.000
39	1.000	80	1.000	121	1.000	162	1.000	203	1.000	244	1.000
40	1.000	81	1.000	122	1.000	163	1.000	204	1.000	245	1.000
41	1.000	82	1.000	123	1.000	164	1.000	205	1.000	246	1.000

Surcharged Outfall Details for Surface Network 3

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
247	1.000	266	1.000	285	1.000	304	1.000	323	1.000	342	1.000
248	1.000	267	1.000	286	1.000	305	1.000	324	1.000	343	1.000
249	1.000	268	1.000	287	1.000	306	1.000	325	1.000	344	1.000
250	1.000	269	1.000	288	1.000	307	1.000	326	1.000	345	1.000
251	1.000	270	1.000	289	1.000	308	1.000	327	1.000	346	1.000
252	1.000	271	1.000	290	1.000	309	1.000	328	1.000	347	1.000
253	1.000	272	1.000	291	1.000	310	1.000	329	1.000	348	1.000
254	1.000	273	1.000	292	1.000	311	1.000	330	1.000	349	1.000
255	1.000	274	1.000	293	1.000	312	1.000	331	1.000	350	1.000
256	1.000	275	1.000	294	1.000	313	1.000	332	1.000	351	1.000
257	1.000	276	1.000	295	1.000	314	1.000	333	1.000	352	1.000
258	1.000	277	1.000	296	1.000	315	1.000	334	1.000	353	1.000
259	1.000	278	1.000	297	1.000	316	1.000	335	1.000	354	1.000
260	1.000	279	1.000	298	1.000	317	1.000	336	1.000	355	1.000
261	1.000	280	1.000	299	1.000	318	1.000	337	1.000	356	1.000
262	1.000	281	1.000	300	1.000	319	1.000	338	1.000	357	1.000
263	1.000	282	1.000	301	1.000	320	1.000	339	1.000	358	1.000
264	1.000	283	1.000	302	1.000	321	1.000	340	1.000	359	1.000
265	1.000	284	1.000	303	1.000	322	1.000	341	1.000	360	1.000

Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	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 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)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

STORM SEWER DESIGN

Rainfall Simulation

1:100 year event +30% Climate Change

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Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	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 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)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

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 0.281
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
 Analysis Timestep Fine Inertia Status ON
 DTS Status ON

Profile(s)

Duration(s) (mins) Summer and Winter
 15, 30, 60, 120, 180, 240, 360, 480, 600,
 720, 960, 1440, 2160, 2880, 4320, 5760,
 7200, 8640, 10080
 Return Period(s) (years) 100
 Climate Change (%) 30

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	S301	15 Winter	100	+30%	100/15 Summer				114.517
1.001	S302	15 Winter	100	+30%	100/15 Summer				114.306
1.002	S303	15 Winter	100	+30%	100/15 Summer				114.023
2.000	S304	15 Winter	100	+30%					115.706
2.001	S305	15 Winter	100	+30%					115.109
2.002	S306	15 Winter	100	+30%					114.497
1.003	S307	15 Winter	100	+30%	100/15 Summer				113.773
1.004	S308	15 Winter	100	+30%	100/15 Summer				112.918
1.005	S309	15 Winter	100	+30%	100/15 Summer				112.322
1.006	S310	15 Winter	100	+30%	100/15 Summer				111.506
1.007	S311	15 Winter	100	+30%					110.242
3.000	S312	15 Winter	100	+30%					112.553
1.008	S313	15 Winter	100	+30%					109.870
1.009	S314	15 Winter	100	+30%					109.461
1.010	S315	180 Winter	100	+30%	100/30 Summer				106.936
4.000	S316	15 Winter	100	+30%	100/15 Summer				110.526
4.001	S317	15 Winter	100	+30%	100/15 Summer				109.687
4.002	S318	15 Winter	100	+30%	100/15 Summer				108.016
1.011	S319	180 Winter	100	+30%	100/15 Winter				106.741
5.000	S320	180 Winter	100	+30%	100/15 Winter				106.740

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S301	0.542	0.000	0.000	1.40		51.0	SURCHARGED	
1.001	S302	0.444	0.000	0.000	1.60		58.7	SURCHARGED	
1.002	S303	0.288	0.000	0.000	1.06		85.1	SURCHARGED	
2.000	S304	-0.141	0.000	0.000	0.30		24.7	OK	
2.001	S305	-0.101	0.000	0.000	0.58		48.4	OK	
2.002	S306	-0.083	0.000	0.000	0.71		62.4	OK	
1.003	S307	0.272	0.000	0.000	0.96		164.9	SURCHARGED	
1.004	S308	0.322	0.000	0.000	1.05		174.0	SURCHARGED	
1.005	S309	0.266	0.000	0.000	1.13		191.5	SURCHARGED	
1.006	S310	0.083	0.000	0.000	1.05		201.7	SURCHARGED	
1.007	S311	-0.209	0.000	0.000	0.56		213.3	OK	
3.000	S312	-0.109	0.000	0.000	0.52		38.3	OK	
1.008	S313	-0.118	0.000	0.000	0.88		291.4	OK	
1.009	S314	-0.183	0.000	0.000	0.65		341.8	OK	
1.010	S315	1.048	0.000	0.000	0.33		140.5	SURCHARGED	
4.000	S316	0.699	0.000	0.000	1.47		37.3	SURCHARGED	
4.001	S317	1.809	0.000	0.000	1.62		41.9	SURCHARGED	
4.002	S318	2.365	0.000	0.000	2.77		68.8	SURCHARGED	
1.011	S319	1.439	0.000	0.000	0.12		160.1	SURCHARGED	
5.000	S320	1.328	0.000	0.000	0.01		14.2	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.001	S321	180	Winter	100	+30%	100/15	Winter		106.740
1.012	S322	180	Winter	100	+30%	100/15	Winter		106.740
1.013	S323	180	Winter	100	+30%	100/15	Summer		106.739
1.014	S324	180	Winter	100	+30%	100/15	Summer		106.738

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.001	S321	1.413	0.000	0.01		23.0	SURCHARGED	
1.012	S322	1.462	0.000	0.07		187.8	SURCHARGED	
1.013	S323	1.617	0.000	0.10		193.2	SURCHARGED	
1.014	S324	2.935	0.000	1.20		41.8	FLOOD RISK	

Storm Water Network 4

STORM SEWER DESIGN

Network Design Details (1 in 2 yr), Online Controls & Storage Structures

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 4








Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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


Network Design Table for Surface Network 4

« - Indicates pipe capacity < flow






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
1.000	44.626	0.915	48.8	0.052	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	62.713	1.492	42.0	0.081	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	55.083	0.334	164.9	0.152	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	78.483	2.116	37.1	0.102	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	21.967	0.295	74.5	0.015	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	23.540	0.316	74.5	0.164	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	46.945	2.235	21.0	0.110	0.00	0.0	0.600	o	375	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	5.40	116.777	0.052	0.0	0.0	0.0	1.88	74.7	7.0
1.001	50.00	5.91	115.862	0.133	0.0	0.0	0.0	2.02	80.5	18.0
2.000	50.00	5.90	114.704	0.152	0.0	0.0	0.0	1.02	40.4	20.6
1.002	50.00	6.35	114.220	0.387	0.0	0.0	0.0	2.98	329.5	52.4
3.000	50.00	5.24	112.865	0.015	0.0	0.0	0.0	1.52	60.3	2.0
3.001	50.00	5.50	112.570	0.179	0.0	0.0	0.0	1.52	60.3	24.2
1.003	49.52	6.55	112.104	0.676	0.0	0.0	0.0	3.97	438.3	90.7


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Network Design Table for Surface Network 4

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
1.004	20.767	0.052	399.4	0.046	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	31.022	0.078	397.7	0.054	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.006	25.220	0.063	400.3	0.054	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.007	14.107	0.035	403.1	0.077	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.008	6.573	0.047	139.9	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)	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)
1.004	48.47	6.89	109.794	0.722	0.0	0.0	0.0	1.01	160.8	94.8
1.005	47.77	7.13	108.692	0.776	0.0	0.0	0.0	2.14	3790.0	100.4
1.006	47.22	7.33	108.614	0.830	0.0	0.0	0.0	2.14	3777.6	106.1
1.007	46.91	7.44	108.551	0.907	0.0	0.0	0.0	2.13	3764.7	115.2
1.008	46.64	7.54	108.516	0.907	0.0	0.0	0.0	1.10	43.9x	115.2

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Online Controls for Surface Network 4

Depth/Flow Relationship Manhole: S414, DS/PN: 1.008, Volume (m³): 38.0

Invert Level (m) 108.516

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3600	0.800	20.7500	2.000	23.3300	3.200	29.5100
0.200	13.6600	1.000	19.4100	2.200	24.4700	3.400	30.4200
0.300	18.9100	1.200	18.8000	2.400	25.5600	3.600	31.3000
0.400	21.8000	1.400	19.5200	2.600	26.6000	3.800	32.1600
0.500	22.7900	1.600	20.8700	2.800	27.6000		
0.600	22.5500	1.800	22.1300	3.000	28.5700		

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Storage Structures for Surface Network 4


Tank or Pond Manhole: S414, DS/PN: 1.008

Invert Level (m) 110.850

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	586.3	0.500	777.8








STORM SEWER DESIGN

SW Manhole Schedules

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Manhole Schedules for Surface Network 4

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S401	118.355	1.578	Open Manhole	1350	1.000	116.777	225				
S402	118.935	3.073	Open Manhole	1500	1.001	115.862	225	1.000	115.862	225	
S404	116.328	1.624	Open Manhole	1350	2.000	114.704	225				
S405	116.856	2.636	Open Manhole	1800	1.002	114.220	375	1.001	114.370	225	
								2.000	114.370	225	
S407	114.456	1.591	Open Manhole	1350	3.000	112.865	225				
S408	114.523	1.953	Open Manhole	1350	3.001	112.570	225	3.000	112.570	225	
S409	114.256	2.152	Open Manhole	1800	1.003	112.104	375	1.002	112.104	375	
								3.001	112.254	225	
S410	112.505	2.711	Open Manhole	1500	1.004	109.794	450	1.003	109.869	375	
S411	111.719	3.027	Open Manhole	3000	1.005	108.692	1500	1.004	109.742	450	
S412	111.859	3.245	Open Manhole	3000	1.006	108.614	1500	1.005	108.614	1500	
S413	111.580	3.029	Open Manhole	3000	1.007	108.551	1500	1.006	108.551	1500	
S414	111.120	2.604	Open Manhole	3000	1.008	108.516	225	1.007	108.516	1500	
S415	108.700	0.231	Open Manhole	0		OUTFALL		1.008	108.469	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S401	360582.948	437865.029	360582.948	437865.029	Required	
S402	360618.846	437891.540	360618.846	437891.540	Required	
S404	360537.418	437909.396	360537.418	437909.396	Required	
S405	360581.742	437942.099	360581.742	437942.099	Required	
S407	360497.984	437978.850	360497.984	437978.850	Required	
S408	360516.085	437991.296	360516.085	437991.296	Required	
S409	360535.078	438005.203	360535.078	438005.203	Required	

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Manhole Schedules for Surface Network 4

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S410	360507.343	438043.080	360507.343	438043.080	Required	
S411	360495.124	438059.871	360495.124	438059.871	Required	
S412	360468.964	438043.196	360468.964	438043.196	Required	
S413	360447.697	438029.641	360447.697	438029.641	Required	
S414	360435.030	438035.851	360435.030	438035.851	Required	
S415	360428.660	438037.473			No Entry	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event