



UNITED UTILITIES SEWER ALIGNMENTS
IMPORTED FROM UU RECORDS

UU COMBINED SEWER

UU SURFACE WATER SEWER

UU ABANDONED DRAINAGE

SEWER ROUTE AND MANHOLES
TO BE SURVEYED

NOTE, UU SEWERS WILL ONLY REQUIRE
MANHOLE
SURVEYS TO BE UNDERTAKEN.

GPR SURVEY KEY

PRIVATE FOUL DRAINAGE

PRIVATE SURFACE DRAINAGE

PRIVATE COMBINED DRAINAGE

EXTENT OF PHASE 1 WORKS

- UU MH REF'S CARRIED OUT
- MH REF'S / INFO
- LINES SURVEYED
- LINES SURVEYED

PRELIMINARY ISSUE

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Client: NETWORK SPACE

Project Name: SOVEREIGN DISTILLERY HUYTON

Sheet Title: PHASE 1 DRAINAGE SURVEY

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale	Sheet	Of	Subsidiary
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0 5 10 15 20 25m
SCALE 1:500

APPENDIX D – MICRODRAINAGE CALCULATIONS

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	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	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 Storm

« - 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	88.720	0.296	299.7	0.452	4.00	0.0	0.600	o	600	Pipe/Conduit	
1.001	19.831	0.066	300.5	0.443	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.002	3.201	0.011	291.0	0.066	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	3.960	0.100	39.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	1.903	0.006	317.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	44.795	0.090	497.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.006	13.862	0.046	301.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	14.607	0.049	298.1	0.059	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	12.853	0.428	30.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	5.313	0.166	32.0	0.326	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	3.960	0.100	39.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.003	4.887	0.016	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.004	84.051	0.159	528.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	30.822	0.616	50.0	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	47.389	0.948	50.0	0.038	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)
1.000	50.00	5.06	23.371	0.452	0.0	0.0	0.0	1.40	396.2	61.2
1.001	50.00	5.29	23.075	0.895	0.0	0.0	0.0	1.40	395.7	121.2
1.002	50.00	5.33	23.009	0.961	0.0	0.0	0.0	1.42	402.2	130.1
1.003	50.00	5.35	22.998	0.961	0.0	0.0	0.0	3.88	1096.4	130.1
1.004	50.00	5.37	22.898	0.961	0.0	0.0	0.0	1.36	385.1	130.1
1.005	50.00	6.06	22.192	0.961	0.0	0.0	0.0	1.08	306.7	130.1
1.006	50.00	6.31	22.102	0.961	0.0	0.0	0.0	0.90	63.7«	130.1
1.007	50.00	6.58	22.056	1.020	0.0	0.0	0.0	0.91	64.0«	138.1
2.000	50.00	4.07	23.800	0.000	0.0	0.0	0.0	2.88	203.7	0.0
2.001	50.00	4.11	23.372	0.326	0.0	0.0	0.0	2.79	197.1	44.1
2.002	50.00	4.13	23.206	0.326	0.0	0.0	0.0	2.51	177.1	44.1
2.003	50.00	4.22	23.106	0.326	0.0	0.0	0.0	0.90	63.8	44.1
2.004	50.00	6.29	22.294	0.326	0.0	0.0	0.0	0.68	47.9	44.1
3.000	50.00	4.28	24.743	0.022	0.0	0.0	0.0	1.85	73.7	3.0
3.001	50.00	4.70	24.127	0.060	0.0	0.0	0.0	1.85	73.7	8.1

Tetra Tech Group Limited		Page 2
3 Sovereign Square Sovereign Street Leeds LS1 4ER		
Date 26/01/2022 14:30 File SW NORTH AND SOUTH 1.MDX	Designed by LUCY.CLAPHAM Checked by	
Innovyze	Network 2020.1	

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)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	47.036	1.129	41.7	0.043	4.00	0.0	0.600	o	300	Pipe/Conduit	
3.002	3.686	0.074	49.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.003	40.767	0.072	566.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.005	4.579	0.031	147.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	16.343	0.054	302.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.000	17.651	0.059	299.2	0.109	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	10.057	0.034	295.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.002	69.801	0.233	299.6	0.143	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.003	50.569	0.169	299.2	0.143	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.004	69.344	0.231	300.2	0.208	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.005	10.447	0.104	100.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.000	44.216	0.147	300.8	0.095	4.00	0.0	0.600	o	300	Pipe/Conduit	
6.001	65.150	0.217	300.2	0.109	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.006	4.281	0.014	305.8	0.171	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.007	3.575	0.100	35.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.008	1.676	0.034	49.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.009	33.711	0.067	503.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.010	3.228	0.065	49.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.011	5.030	0.320	15.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
7.000	5.087	0.339	15.0	0.048	4.00	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)
4.000	50.00	4.32	24.223	0.043	0.0	0.0	0.0	2.44	172.7	5.8
3.002	50.00	4.73	23.094	0.103	0.0	0.0	0.0	2.23	157.8	13.9
3.003	50.00	5.77	23.020	0.103	0.0	0.0	0.0	0.65	46.2	13.9
2.005	50.00	6.35	22.104	0.429	0.0	0.0	0.0	1.29	91.3	58.1
1.008	50.00	6.82	22.007	1.449	0.0	0.0	0.0	1.16	185.0	196.2
5.000	50.00	4.33	25.867	0.109	0.0	0.0	0.0	0.90	63.9	14.8
5.001	50.00	4.47	25.658	0.109	0.0	0.0	0.0	1.18	187.2	14.8
5.002	50.00	5.30	25.474	0.252	0.0	0.0	0.0	1.40	396.3	34.1
5.003	50.00	5.90	25.241	0.395	0.0	0.0	0.0	1.40	396.6	53.5
5.004	50.00	6.72	25.072	0.603	0.0	0.0	0.0	1.40	395.9	81.7
5.005	50.00	6.80	24.841	0.603	0.0	0.0	0.0	2.43	687.0	81.7
6.000	50.00	4.82	25.453	0.095	0.0	0.0	0.0	0.90	63.7	12.9
6.001	50.00	5.75	25.156	0.204	0.0	0.0	0.0	1.17	185.8	27.6
5.006	50.00	6.85	24.737	0.978	0.0	0.0	0.0	1.39	392.2	132.4
5.007	50.00	6.86	24.723	0.978	0.0	0.0	0.0	4.08	1154.1	132.4
5.008	50.00	6.87	24.623	0.978	0.0	0.0	0.0	3.47	982.3	132.4
5.009	50.00	7.39	24.223	0.978	0.0	0.0	0.0	1.08	305.0	132.4
5.010	50.00	7.41	24.156	0.978	0.0	0.0	0.0	3.46	978.7	132.4
5.011	50.00	7.42	24.091	0.978	0.0	0.0	0.0	6.16	1742.4	132.4
7.000	50.00	4.02	25.900	0.048	0.0	0.0	0.0	4.08	288.3	6.5

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)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.001	22.341	1.489	15.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.012	22.511	1.080	20.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.009	1.000	0.005	200.0	0.000	0.00	0.0	0.600	o	750	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)
7.001	50.00	4.09	25.411	0.048	0.0	0.0	0.0	5.27	838.1	6.5
5.012	50.00	7.49	23.771	1.026	0.0	0.0	0.0	5.35	1512.6	138.9
1.009	50.00	7.50	21.750	2.475	0.0	0.0	0.0	1.98	872.6	335.1

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009		26.834	21.745	0.000	0	0

Simulation Criteria for 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 Coeffiecient	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 Online Controls	2	Number of Storage Structures	3
		Number of Time/Area Diagrams	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)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

ACO Q-Brake Manhole: SC1, DS/PN: 1.008, Volume (m³): 5.7

Design Head (m) 5.000 Design Flow (l/s) 100.7 Diameter (mm) 312 Invert Level (m) 22.007

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	33.7	0.800	96.0	2.000	72.7	4.000	89.9	7.000	118.9
0.200	47.7	1.000	100.6	2.200	66.7	4.500	95.4	7.500	123.1
0.300	58.4	1.200	97.8	2.400	69.6	5.000	100.5	8.000	127.1
0.400	67.5	1.400	92.9	2.600	72.5	5.500	105.4	8.500	131.1
0.500	75.4	1.600	86.9	3.000	77.9	6.000	110.1	9.000	134.9
0.600	82.6	1.800	80.1	3.500	84.1	6.500	114.6	9.500	138.6

ACO Q-Brake Manhole: SC2, DS/PN: 5.012, Volume (m³): 8.2

Design Head (m) 1.500 Design Flow (l/s) 78.3 Diameter (mm) 323 Invert Level (m) 23.771

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	36.2	0.800	77.9	2.000	90.5	4.000	128.1	7.000	169.4
0.200	51.1	1.000	75.9	2.200	95.0	4.500	135.8	7.500	175.3
0.300	62.6	1.200	72.6	2.400	99.2	5.000	143.2	8.000	181.1
0.400	72.3	1.400	75.8	2.600	103.2	5.500	150.2	8.500	186.7
0.500	76.6	1.600	81.0	3.000	110.9	6.000	156.8	9.000	192.1
0.600	78.0	1.800	85.9	3.500	119.8	6.500	163.2	9.500	197.3

Storage Structures for Storm

Tank or Pond Manhole: TANK INLET 1, DS/PN: 1.005

Invert Level (m) 22.192

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	270.0	1.000	270.0	1.001	0.0

Tank or Pond Manhole: TANK INLET 1/2, DS/PN: 2.004

Invert Level (m) 22.294

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	470.0	0.800	470.0	0.801	0.0

Tank or Pond Manhole: TANK INLET 3, DS/PN: 5.009

Invert Level (m) 24.223

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	330.0	1.000	330.0	1.001	0.0

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

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 Online Controls	2	Number of Storage Structures	3
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	20.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R	0.400
		Cv (Winter)	0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5	Second Increment (Extended)	
DTS Status			ON
DVD Status			ON
Inertia 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)			1, 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)	Surcharged Depth (m)
1.000	SW1.00	15 Winter	100	+40%	100/15 Summer				24.727	0.756
1.001	SW 1.01	15 Winter	100	+40%	30/15 Summer				24.568	0.893
1.002	SW1.02	15 Winter	100	+40%	30/15 Winter				24.319	0.710
1.003	BS INLET 1	15 Winter	100	+40%					23.598	0.000
1.004	BS OUTLET 1	15 Winter	100	+40%					23.498	0.000
1.005	TANK INLET 1	60 Winter	100	+40%	100/15 Summer				23.188	0.396
1.006	TANK OUTLET 1	60 Winter	100	+40%	30/15 Summer				23.163	0.761
1.007	SW1.07	60 Winter	100	+40%	30/15 Summer				22.986	0.630
2.000	SW2.00	15 Winter	100	+40%	100/15 Summer				25.190	1.090
2.001	SW2.01	15 Winter	100	+40%	30/15 Summer				25.196	1.524
2.002	BS INLET 2	180 Summer	100	+40%					23.506	0.000
2.003	BS OUTLET 2	180 Summer	100	+40%					23.406	0.000
2.004	TANK INLET 1/2	120 Winter	100	+40%	100/30 Winter				22.724	0.130
3.000	SW3.00	15 Winter	100	+40%					24.813	-0.155
3.001	SW3.01	15 Winter	100	+40%					24.248	-0.104
4.000	SW4.00	15 Winter	100	+40%					24.307	-0.216
3.002	SW3.02	15 Winter	100	+40%	100/15 Summer				23.492	0.098
3.003	TANK INLET 2/2	15 Winter	100	+40%	100/15 Summer				23.401	0.081
2.005	TANK OUTLET 2	60 Winter	100	+40%	30/15 Winter				22.765	0.361
1.008	SC1	60 Winter	100	+40%	30/30 Winter				22.788	0.331
5.000	SW5.00	15 Winter	100	+40%	100/15 Summer				26.271	0.104
5.001	SW5.01	15 Winter	100	+40%	100/15 Winter				26.188	0.080
5.002	SW5.02	15 Winter	100	+40%	100/15 Winter				26.111	0.037
5.003	SW5.03	15 Winter	100	+40%	100/15 Summer				25.958	0.117
5.004	SW5.04	15 Winter	100	+40%	100/15 Summer				25.896	0.224
5.005	SW5.05	15 Winter	100	+40%	100/15 Summer				25.771	0.330
6.000	SW6.00	15 Winter	100	+40%	100/15 Summer				25.835	0.082
6.001	SW6.01	15 Winter	100	+40%	100/15 Summer				25.745	0.139
5.006	SW506	15 Winter	100	+40%	100/15 Summer				25.649	0.312
5.007	BS INLET 3	15 Summer	100	+40%					25.323	0.000
5.008	BS OUTLET 3	15 Summer	100	+40%					25.223	0.000
5.009	TANK INLET 3	60 Winter	100	+40%	100/15 Winter				25.073	0.250

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW1.00	0.000	0.67		245.8	FLOOD RISK	
1.001	SW 1.01	0.000	1.67		496.6	SURCHARGED	
1.002	SW1.02	0.000	2.36		532.4	SURCHARGED	
1.003	BS INLET 1	0.000	1.53		529.4	SURCHARGED*	
1.004	BS OUTLET 1	0.000	1.51		525.1	SURCHARGED*	
1.005	TANK INLET 1	0.000	0.39		103.5	SURCHARGED	
1.006	TANK OUTLET 1	0.000	1.96		103.3	SURCHARGED	
1.007	SW1.07	0.000	2.01		107.6	SURCHARGED	
2.000	SW2.00	0.000	0.06		9.8	SURCHARGED	
2.001	SW2.01	0.000	1.89		192.6	SURCHARGED	
2.002	BS INLET 2	0.000	0.79		62.8	SURCHARGED*	
2.003	BS OUTLET 2	0.000	1.01		61.9	SURCHARGED*	
2.004	TANK INLET 1/2	0.000	0.66		30.4	SURCHARGED	
3.000	SW3.00	0.000	0.21		14.6	OK	
3.001	SW3.01	0.000	0.56		39.4	OK	
4.000	SW4.00	0.000	0.18		28.5	OK	
3.002	SW3.02	0.000	0.95		64.8	SURCHARGED	
3.003	TANK INLET 2/2	0.000	1.50		64.7	SURCHARGED	
2.005	TANK OUTLET 2	0.000	0.50		29.6	SURCHARGED	
1.008	SC1	0.000	0.61		88.2	SURCHARGED	
5.000	SW5.00	0.000	1.32		72.2	SURCHARGED	
5.001	SW5.01	0.000	0.55		71.9	SURCHARGED	
5.002	SW5.02	0.000	0.42		152.0	SURCHARGED	
5.003	SW5.03	0.000	0.52		180.2	SURCHARGED	
5.004	SW5.04	0.000	0.68		242.1	SURCHARGED	
5.005	SW5.05	0.000	0.64		221.1	SURCHARGED	
6.000	SW6.00	0.000	1.00		59.3	SURCHARGED	
6.001	SW6.01	0.000	0.63		108.8	SURCHARGED	
5.006	SW506	0.000	1.80		395.3	SURCHARGED	
5.007	BS INLET 3	0.000	1.06		368.2	SURCHARGED*	
5.008	BS OUTLET 3	0.000	1.06		367.2	SURCHARGED*	
5.009	TANK INLET 3	0.000	0.66		166.0	SURCHARGED	

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

										Water Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
5.010	TANK OUTLET 3	30 Winter	100	+40%	100/15 Summer				25.196	0.440
5.011	SW5.11	30 Winter	100	+40%	100/15 Summer				25.236	0.545
7.000	SW7.00	15 Winter	100	+40%					25.995	-0.205
7.001	SW7.01	15 Winter	100	+40%					25.473	-0.388
5.012	SC2	30 Winter	100	+40%	30/15 Summer				25.238	0.867
1.009	MH 6805	60 Winter	100	+40%					22.100	-0.400

										Level Exceeded
PN	US/MH Name	Flooded Volume (m³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status				
5.010	TANK OUTLET 3	0.000	0.44		154.2	SURCHARGED				
5.011	SW5.11	0.000	0.21		120.3	SURCHARGED				
7.000	SW7.00	0.000	0.22		31.9	OK				
7.001	SW7.01	0.000	0.05		31.9	OK				
5.012	SC2	0.000	0.08		78.2	SURCHARGED				
1.009	MH 6805	0.000	0.44		166.2	OK				

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	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	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 Storm

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	75.133	0.376	199.8	0.096	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	22.699	0.113	200.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	8.926	0.446	20.0	0.382	4.00	0.0	0.600	o	450	Pipe/Conduit	
2.001	16.011	0.640	25.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	20.954	0.099	210.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	75.095	0.250	300.0	0.131	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	1.674	0.006	300.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	3.960	0.100	39.6	0.388	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.006	1.799	0.006	300.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.007	7.328	0.024	300.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.008	2.744	0.005	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.009	8.460	0.028	300.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.010	14.659	0.150	97.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.011	1.000	0.005	200.0	0.000	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	5.13	23.000	0.096	0.0	0.0	0.0	1.11	78.4	13.0
1.001	50.00	5.47	22.624	0.096	0.0	0.0	0.0	1.11	78.2	13.0
2.000	50.00	4.03	23.500	0.382	0.0	0.0	0.0	4.56	725.6	51.7
2.001	50.00	4.10	23.054	0.382	0.0	0.0	0.0	4.08	648.8	51.7
1.002	50.00	5.68	22.211	0.478	0.0	0.0	0.0	1.67	473.3	64.7
1.003	50.00	6.57	22.112	0.609	0.0	0.0	0.0	1.40	396.0	82.5
1.004	50.00	6.59	21.851	0.609	0.0	0.0	0.0	1.40	396.0	82.5
1.005	50.00	6.61	21.845	0.997	0.0	0.0	0.0	3.88	1096.4	135.0
1.006	50.00	6.63	21.745	0.997	0.0	0.0	0.0	1.40	396.0	135.0
1.007	50.00	6.72	21.739	0.997	0.0	0.0	0.0	1.40	396.0	135.0
1.008	50.00	6.76	21.339	0.997	0.0	0.0	0.0	1.08	306.0	135.0
1.009	50.00	6.86	21.334	0.997	0.0	0.0	0.0	1.40	396.0	135.0
1.010	50.00	7.00	21.302	0.997	0.0	0.0	0.0	1.83	202.5	135.0
1.011	50.00	7.01	21.152	0.997	0.0	0.0	0.0	1.28	141.1	135.0

Free Flowing Outfall Details for 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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1.01123.53221.14721.15200

Simulation Criteria for 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 Coeffiecient	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 0Number of Offline Controls 0Number of Time/Area Diagrams 0
Number of Online Controls 1Number of Storage Structures 1Number 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)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

ACO Q-Brake Manhole: SC3, DS/PN: 1.010, Volume (m³): 4.9

Design Head (m) 2.000 Design Flow (l/s) 69.3 Diameter (mm) 295 Invert Level (m) 21.302

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	30.2	0.800	68.9	2.000	69.5	4.000	98.3	7.000	130.0
0.200	42.6	1.000	66.5	2.200	72.9	4.500	104.3	7.500	134.6
0.300	52.2	1.200	62.7	2.400	76.1	5.000	109.9	8.000	139.0
0.400	60.3	1.400	58.1	2.600	79.2	5.500	115.3	8.500	143.3
0.500	66.7	1.600	62.2	3.000	85.1	6.000	120.4	9.000	147.4
0.600	68.8	1.800	65.9	3.500	91.9	6.500	125.3	9.500	151.5

Storage Structures for Storm

Tank or Pond Manhole: TANK S INLET, DS/PN: 1.008

Invert Level (m) 21.339

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	255.0	1.000	255.0	1.010	0.0

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

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 Online Controls	1	Number of Storage Structures	1
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	20.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R	0.400
		Cv (Winter)	0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5	Second Increment (Extended)	
DTS Status			ON
DVD Status			ON
Inertia 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)			1, 30, 100
Climate Change (%)			0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged	
									Level (m)	Depth (m)
1.000	SWS1.00	15 Winter	100	+40%	100/15	Summer			23.722	0.422
1.001	SWS1.01	60 Winter	100	+40%	100/15	Summer			23.645	0.721
2.000	SWS2.00	15 Winter	100	+40%					23.847	-0.103
2.001	SWS2.01	15 Winter	100	+40%	100/15	Summer			23.708	0.205
1.002	SWS1.02	60 Winter	100	+40%	100/15	Summer			23.639	0.828
1.003	SWS1.03	60 Winter	100	+40%	100/15	Summer			23.633	0.922
1.004	SWS1.04	60 Winter	100	+40%	30/15	Summer			23.561	1.110
1.005	BS S INLET	180 Summer	100	+40%					22.445	0.000
1.006	BS S OUTLET	180 Summer	100	+40%					22.345	0.000
1.007	SWS1.07	60 Winter	100	+40%	100/15	Summer			23.540	1.201
1.008	TANK S INLET	60 Winter	100	+40%	100/15	Summer			23.533	1.594
1.009	TANK S OUTLET	60 Winter	100	+40%	30/30	Summer			23.528	1.595
1.010	SC3	60 Winter	100	+40%	30/15	Summer			23.520	1.843
1.011	MH 27	120 Summer	100	+40%					21.412	-0.115

PN	US/MH Name	Flooded		Half Drain		Pipe		Status	Level Exceeded
		Volume (m³)	Flow / Cap. (l/s)	Time (mins)	Flow (l/s)				
1.000	SWS1.00	0.000	0.69		51.7			SURCHARGED	
1.001	SWS1.01	0.000	0.59		40.6			SURCHARGED	
2.000	SWS2.00	0.000	0.67		251.2			OK	
2.001	SWS2.01	0.000	0.53		237.1			SURCHARGED	
1.002	SWS1.02	0.000	0.47		164.2			SURCHARGED	
1.003	SWS1.03	0.000	0.55		197.4			SURCHARGED	
1.004	SWS1.04	0.000	0.92		216.0			SURCHARGED	
1.005	BS S INLET	0.000	0.56		194.2			SURCHARGED*	
1.006	BS S OUTLET	0.000	0.56		193.9			SURCHARGED*	
1.007	SWS1.07	0.000	1.40		315.0			SURCHARGED	
1.008	TANK S INLET	0.000	0.53		119.9			SURCHARGED	
1.009	TANK S OUTLET	0.000	0.35		82.4			FLOOD RISK	

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

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
1.010	SC3	0.000	0.47			71.0	FLOOD RISK	
1.011	MH 27	0.000	0.75			69.1	OK	

APPENDIX E – PHASE 1 FLOOD EXCEEDANCE ROUTE PLAN