

RPS Burks Green		Page 1
Sherwood House Sherwood Avenue Newark NG24 1QQ		
Date 14/12/2017 11:56 File NK018527 Car Park 12121...		
Designed by gordon.barnard Checked by		
Micro Drainage		Network 2016.1

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)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.359	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

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	24.000	0.240	100.0	0.270	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	16.000	0.160	100.0	0.065	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	16.000	0.160	100.0	0.029	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	18.000	0.120	150.0	0.348	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	6.000	0.040	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	1.000	0.007	150.0	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	48.05	5.31	32.375	0.270	0.0	0.0	0.0	1.31	52.0	35.1
2.000	48.21	5.27	32.400	0.065	0.0	0.0	0.0	1.00	17.8	8.5
3.000	48.21	5.27	32.525	0.029	0.0	0.0	0.0	1.00	17.8	3.8
2.001	47.31	5.50	32.090	0.442	0.0	0.0	0.0	1.28	90.6	56.6
1.001	47.06	5.57	31.920	0.712	0.0	0.0	0.0	1.48	163.1	90.7
1.002	47.01	5.58	31.780	0.712	0.0	0.0	0.0	1.48	163.1	90.7

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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	8.000	0.080	100.0	0.037	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	28.000	0.373	75.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
4.002	1.000	0.010	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	1.000	0.007	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	10.000	0.100	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	44.000	0.440	100.0	0.000	0.00	0.0	0.600	o	150	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	48.74	5.13	32.480	0.037	0.0	0.0	0.0	1.00	17.8	4.9
4.001	46.72	5.66	32.400	0.037	0.0	0.0	0.0	0.89	7.0	4.9
4.002	46.66	5.67	32.150	0.037	0.0	0.0	0.0	1.00	17.8	4.9
1.003	46.62	5.69	31.652	0.749	0.0	0.0	0.0	1.48	163.1	94.6
1.004	46.03	5.85	31.604	0.749	0.0	0.0	0.0	1.00	17.8«	94.6
1.005	43.61	6.58	31.428	0.749	0.0	0.0	0.0	1.00	17.8«	94.6

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Manhole Schedules for Storm

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)
1	33.500	1.125	Open Manhole	1200	1.000	32.375	225				
2	33.600	1.200	Open Manhole	1200	2.000	32.400	150				
3	33.725	1.200	Open Manhole	1200	3.000	32.525	150				
4	33.720	1.630	Open Manhole	1200	2.001	32.090	300	2.000	32.240	150	
								3.000	32.365	150	125
5	33.720	1.800	Open Manhole	1350	1.001	31.920	375	1.000	32.135	225	65
								2.001	31.970	300	
6	33.720	1.940	Open Manhole	1350	1.002	31.780	375	1.001	31.880	375	100
6	33.550	1.070	Open Manhole	1200	4.000	32.480	150				
7	33.400	1.000	Open Manhole	1200	4.001	32.400	100	4.000	32.400	150	
8	33.550	1.523	Open Manhole	1200	4.002	32.150	150	4.001	32.027	100	
9	33.600	1.948	Open Manhole	1350	1.003	31.652	375	1.002	31.773	375	121
								4.002	32.140	150	263
10	33.300	1.696	Open Manhole	1350	1.004	31.604	150	1.003	31.645	375	266
11	33.000	1.572	Open Manhole	1200	1.005	31.428	150	1.004	31.504	150	76
	33.000	2.012	Open Manhole	0		OUTFALL		1.005	30.988	150	

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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	o	225	1	33.500	32.375	0.900	Open Manhole	1200
2.000	o	150	2	33.600	32.400	1.050	Open Manhole	1200
3.000	o	150	3	33.725	32.525	1.050	Open Manhole	1200
2.001	o	300	4	33.720	32.090	1.330	Open Manhole	1200
1.001	o	375	5	33.720	31.920	1.425	Open Manhole	1350
1.002	o	375	6	33.720	31.780	1.565	Open Manhole	1350
4.000	o	150	6	33.550	32.480	0.920	Open Manhole	1200
4.001	o	100	7	33.400	32.400	0.900	Open Manhole	1200
4.002	o	150	8	33.550	32.150	1.250	Open Manhole	1200
1.003	o	375	9	33.600	31.652	1.573	Open Manhole	1350
1.004	o	150	10	33.300	31.604	1.546	Open Manhole	1350
1.005	o	150	11	33.000	31.428	1.422	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)
1.000	24.000	100.0	5	33.720	32.135	1.360	Open Manhole	1350
2.000	16.000	100.0	4	33.720	32.240	1.330	Open Manhole	1200
3.000	16.000	100.0	4	33.720	32.365	1.205	Open Manhole	1200
2.001	18.000	150.0	5	33.720	31.970	1.450	Open Manhole	1350
1.001	6.000	150.0	6	33.720	31.880	1.465	Open Manhole	1350
1.002	1.000	150.0	9	33.600	31.773	1.452	Open Manhole	1350
4.000	8.000	100.0	7	33.400	32.400	0.850	Open Manhole	1200
4.001	28.000	75.0	8	33.550	32.027	1.423	Open Manhole	1200
4.002	1.000	100.0	9	33.600	32.140	1.310	Open Manhole	1350
1.003	1.000	150.0	10	33.300	31.645	1.280	Open Manhole	1350
1.004	10.000	100.0	11	33.000	31.504	1.346	Open Manhole	1200
1.005	44.000	100.0		33.000	30.988	1.862	Open Manhole	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	33.000	30.988	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 * 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	2
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)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.359		

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 10, DS/PN: 1.004, Volume (m³): 2.4

Unit Reference	MD-SHE-0069-2300-1200-2300
Design Head (m)	1.200
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	69
Invert Level (m)	31.604
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.3
Flush-Flo™	0.304	2.1
Kick-Flo®	0.617	1.7
Mean Flow over Head Range	-	1.9

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)
0.100	1.7	1.200	2.3	3.000	3.5	7.000	5.2
0.200	2.0	1.400	2.5	3.500	3.8	7.500	5.4
0.300	2.1	1.600	2.6	4.000	4.0	8.000	5.6
0.400	2.1	1.800	2.8	4.500	4.2	8.500	5.7
0.500	2.0	2.000	2.9	5.000	4.5	9.000	5.9
0.600	1.8	2.200	3.0	5.500	4.7	9.500	6.0
0.800	1.9	2.400	3.2	6.000	4.8		
1.000	2.1	2.600	3.3	6.500	5.0		

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Storage Structures for Storm Tank or Pond Manhole: 7, DS/PN: 4.001 Invert Level (m) 32.400 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>13.0</td><td>0.400</td><td>27.0</td><td>0.800</td><td>41.0</td></tr><tr><td>0.200</td><td>20.0</td><td>0.600</td><td>34.0</td><td>1.000</td><td>48.0</td></tr></tbody></table> Tank or Pond Manhole: 9, DS/PN: 1.003 Invert Level (m) 31.652 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>475.0</td><td>0.200</td><td>475.0</td><td>0.600</td><td>475.0</td><td>0.800</td><td>475.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	13.0	0.400	27.0	0.800	41.0	0.200	20.0	0.600	34.0	1.000	48.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	475.0	0.200	475.0	0.600	475.0	0.800	475.0
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<u>Summary Wizard of 15 minute 30 year Summer I+0% for Storm</u> <u>Simulation Criteria</u> 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 2 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FSR Ratio R 0.359 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.000 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON DVD Status OFF Inertia Status OFF Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 360, 600 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 20 <table border="1"> <thead> <tr> <th rowspan="2">PN</th> <th rowspan="2">US/MH Name</th> <th rowspan="2">Storm Rank</th> <th colspan="2">Water</th> <th colspan="2">Surcharged</th> <th colspan="2">Flooded</th> <th colspan="2">Pipe</th> <th rowspan="2">Status</th> </tr> <tr> <th>Level (m)</th> <th>Depth (m)</th> <th>Volume (m³)</th> <th>Flow / Cap.</th> <th>Flow / Overflow (l/s)</th> <th>Flow (l/s)</th> </tr> </thead> <tbody> <tr><td>1.000</td><td>1</td><td>7</td><td>33.085</td><td>0.485</td><td>0.000</td><td>1.45</td><td>69.1</td><td>SURCHARGED</td></tr> <tr><td>2.000</td><td>2</td><td>7</td><td>33.033</td><td>0.483</td><td>0.000</td><td>1.18</td><td>19.4</td><td>SURCHARGED</td></tr> <tr><td>3.000</td><td>3</td><td>7</td><td>32.895</td><td>0.220</td><td>0.000</td><td>0.61</td><td>10.1</td><td>SURCHARGED</td></tr> <tr><td>2.001</td><td>4</td><td>7</td><td>32.861</td><td>0.471</td><td>0.000</td><td>1.54</td><td>119.6</td><td>SURCHARGED</td></tr> <tr><td>1.001</td><td>5</td><td>8</td><td>32.579</td><td>0.284</td><td>0.000</td><td>1.75</td><td>183.5</td><td>SURCHARGED</td></tr> <tr><td>1.002</td><td>6</td><td>13</td><td>32.353</td><td>0.198</td><td>0.000</td><td>2.00</td><td>182.9</td><td>SURCHARGED</td></tr> <tr><td>4.000</td><td>6</td><td>9</td><td>32.575</td><td>-0.055</td><td>0.000</td><td>0.71</td><td>11.0</td><td>OK</td></tr> <tr><td>4.001</td><td>7</td><td>11</td><td>32.521</td><td>0.021</td><td>0.000</td><td>0.88</td><td>6.0</td><td>SURCHARGED</td></tr> <tr><td>4.002</td><td>8</td><td>17</td><td>32.230</td><td>-0.070</td><td>0.000</td><td>0.55</td><td>6.0</td><td>OK</td></tr> <tr><td>1.003</td><td>9</td><td>30</td><td>31.850</td><td>-0.177</td><td>0.000</td><td>0.03</td><td>2.5</td><td>OK</td></tr> <tr><td>1.004</td><td>10</td><td>37</td><td>31.830</td><td>0.076</td><td>0.000</td><td>0.13</td><td>2.1</td><td>SURCHARGED</td></tr> <tr><td>1.005</td><td>11</td><td>30</td><td>31.463</td><td>-0.115</td><td>0.000</td><td>0.12</td><td>2.1</td><td>OK</td></tr> </tbody> </table>			PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe		Status	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow / Overflow (l/s)	Flow (l/s)	1.000	1	7	33.085	0.485	0.000	1.45	69.1	SURCHARGED	2.000	2	7	33.033	0.483	0.000	1.18	19.4	SURCHARGED	3.000	3	7	32.895	0.220	0.000	0.61	10.1	SURCHARGED	2.001	4	7	32.861	0.471	0.000	1.54	119.6	SURCHARGED	1.001	5	8	32.579	0.284	0.000	1.75	183.5	SURCHARGED	1.002	6	13	32.353	0.198	0.000	2.00	182.9	SURCHARGED	4.000	6	9	32.575	-0.055	0.000	0.71	11.0	OK	4.001	7	11	32.521	0.021	0.000	0.88	6.0	SURCHARGED	4.002	8	17	32.230	-0.070	0.000	0.55	6.0	OK	1.003	9	30	31.850	-0.177	0.000	0.03	2.5	OK	1.004	10	37	31.830	0.076	0.000	0.13	2.1	SURCHARGED	1.005	11	30	31.463	-0.115	0.000	0.12	2.1	OK
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<u>Summary Wizard of 180 minute 30 year Summer I+0% for Storm</u> <u>Simulation Criteria</u> 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 2 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FSR Ratio R 0.359 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.000 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON DVD Status OFF Inertia Status OFF Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 360, 600 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 20 <table border="1"> <thead> <tr> <th rowspan="2">PN</th> <th rowspan="2">US/MH Name</th> <th rowspan="2">Storm Rank</th> <th colspan="2">Water</th> <th colspan="2">Surcharged</th> <th colspan="2">Flooded</th> <th colspan="2">Pipe</th> <th rowspan="2">Status</th> </tr> <tr> <th>Level (m)</th> <th>Depth (m)</th> <th>Volume (m³)</th> <th>Flow / Cap.</th> <th>Flow / Overflow (l/s)</th> <th>Flow (l/s)</th> </tr> </thead> <tbody> <tr><td>1.000</td><td>1</td><td>23</td><td>32.501</td><td>-0.099</td><td>0.000</td><td>0.60</td><td></td><td>28.9</td><td>OK</td></tr> <tr><td>2.000</td><td>2</td><td>24</td><td>32.468</td><td>-0.082</td><td>0.000</td><td>0.42</td><td></td><td>7.0</td><td>OK</td></tr> <tr><td>3.000</td><td>3</td><td>22</td><td>32.569</td><td>-0.106</td><td>0.000</td><td>0.19</td><td></td><td>3.1</td><td>OK</td></tr> <tr><td>2.001</td><td>4</td><td>23</td><td>32.260</td><td>-0.130</td><td>0.000</td><td>0.61</td><td></td><td>47.5</td><td>OK</td></tr> <tr><td>1.001</td><td>5</td><td>27</td><td>32.159</td><td>-0.136</td><td>0.000</td><td>0.73</td><td></td><td>76.5</td><td>OK</td></tr> <tr><td>1.002</td><td>6</td><td>28</td><td>32.085</td><td>-0.070</td><td>0.000</td><td>0.83</td><td></td><td>76.4</td><td>OK</td></tr> <tr><td>4.000</td><td>6</td><td>23</td><td>32.531</td><td>-0.099</td><td>0.000</td><td>0.26</td><td></td><td>4.0</td><td>OK</td></tr> <tr><td>4.001</td><td>7</td><td>22</td><td>32.454</td><td>-0.046</td><td>0.000</td><td>0.56</td><td></td><td>3.8</td><td>OK</td></tr> <tr><td>4.002</td><td>8</td><td>24</td><td>32.211</td><td>-0.089</td><td>0.000</td><td>0.35</td><td></td><td>3.8</td><td>OK</td></tr> <tr><td>1.003</td><td>9</td><td>18</td><td>32.085</td><td>0.058</td><td>0.000</td><td>0.06</td><td></td><td>5.5</td><td>SURCHARGED</td></tr> <tr><td>1.004</td><td>10</td><td>18</td><td>32.202</td><td>0.448</td><td>0.000</td><td>0.13</td><td></td><td>2.1</td><td>SURCHARGED</td></tr> <tr><td>1.005</td><td>11</td><td>27</td><td>31.463</td><td>-0.115</td><td>0.000</td><td>0.12</td><td></td><td>2.1</td><td>OK</td></tr> </tbody> </table>			PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe		Status	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow / Overflow (l/s)	Flow (l/s)	1.000	1	23	32.501	-0.099	0.000	0.60		28.9	OK	2.000	2	24	32.468	-0.082	0.000	0.42		7.0	OK	3.000	3	22	32.569	-0.106	0.000	0.19		3.1	OK	2.001	4	23	32.260	-0.130	0.000	0.61		47.5	OK	1.001	5	27	32.159	-0.136	0.000	0.73		76.5	OK	1.002	6	28	32.085	-0.070	0.000	0.83		76.4	OK	4.000	6	23	32.531	-0.099	0.000	0.26		4.0	OK	4.001	7	22	32.454	-0.046	0.000	0.56		3.8	OK	4.002	8	24	32.211	-0.089	0.000	0.35		3.8	OK	1.003	9	18	32.085	0.058	0.000	0.06		5.5	SURCHARGED	1.004	10	18	32.202	0.448	0.000	0.13		2.1	SURCHARGED	1.005	11	27	31.463	-0.115	0.000	0.12		2.1	OK
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% 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	Foul Sewage per hectare (l/s)	0.000			Number of Input Hydrographs	0	Number of Storage Structures	2	Number of Online Controls	1	Number of Time/Area Diagrams	0	Number of Offline Controls	0	Number of Real Time Controls	0	Rainfall Model	FSR	Ratio R	0.359	Region England and Wales	Cv (Summer)	0.750		M5-60 (mm)	19.000	Cv (Winter)	0.840	Margin for Flood Risk Warning (mm)	300.0	Analysis Timestep	2.5 Second Increment (Extended)	DTS Status	ON	DVD Status	OFF	Inertia Status	OFF	Profile(s)	Summer and Winter	Duration(s) (mins)	15, 30, 60, 120, 180, 360, 600	Return Period(s) (years)	1, 30, 100	Climate Change (%)	0, 0, 20				Water	Surcharged	Flooded		Pipe		PN	US/MH Name	Storm Rank	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	1.000	1	2	33.506	0.906	6.216	1.92	91.6		FLOOD	2.000	2	2	33.602	1.052	1.840	2.06	34.0		FLOOD	3.000	3	2	33.628	0.953	0.000	1.03	17.0		FLOOD RISK	2.001	4	2	33.565	1.175	0.000	2.24	174.5		FLOOD RISK	1.001	5	2	32.932	0.637	0.000	2.36	248.3		SURCHARGED	1.002	6	4	32.529	0.374	0.000	2.70	247.4		SURCHARGED	4.000	6	2	32.653	0.023	0.000	1.07	16.6		SURCHARGED	4.001	7	4	32.602	0.102	0.000	0.99	6.7		SURCHARGED	4.002	8	14	32.236	-0.064	0.000	0.62	6.7		OK	1.003	9	24	31.961	-0.066	0.000	0.06	5.2		OK	1.004	10	24	32.072	0.318	0.000	0.13	2.1		SURCHARGED	1.005	11	28	31.463	-0.115	0.000	0.12	2.1		OK
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Designed by gordon.barnard Checked by		
Micro Drainage		Network 2016.1

Summary Wizard of 30 minute 100 year Summer I+20% 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 Coeffiecient	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	2
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	0.359
Region England and Wales Cv (Summer)	0.750		
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 360, 600
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

			Water	Surcharged	Flooded		Pipe	
PN	US/MH Name	Storm Rank	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000	1	3	33.504	0.904	4.489	1.85	88.4	FLOOD
2.000	2	3	33.601	1.051	0.810	1.73	28.5	FLOOD
3.000	3	3	33.509	0.834	0.000	0.86	14.2	FLOOD RISK
2.001	4	3	33.459	1.069	0.000	2.10	163.3	FLOOD RISK
1.001	5	3	32.896	0.601	0.000	2.29	241.0	SURCHARGED
1.002	6	5	32.510	0.355	0.000	2.64	241.3	SURCHARGED
4.000	6	4	32.649	0.019	0.000	0.98	15.1	SURCHARGED
4.001	7	3	32.609	0.109	0.000	1.00	6.8	SURCHARGED
4.002	8	13	32.236	-0.064	0.000	0.63	6.8	OK
1.003	9	19	32.065	0.038	0.000	0.06	5.2	SURCHARGED
1.004	10	19	32.181	0.427	0.000	0.13	2.1	SURCHARGED
1.005	11	26	31.463	-0.115	0.000	0.12	2.1	OK

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Designed by gordon.barnard Checked by		
Micro Drainage		Network 2016.1

Summary Wizard of 60 minute 100 year Summer I+20% 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 Storage Structures	2
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	0.359
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 360, 600
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm Rank	Water			Surcharged		Flooded		Pipe	Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow / Overflow (l/s)	Flow (l/s)			
1.000	1	5	33.347	0.747	0.000	1.64	78.5	FLOOD RISK			
2.000	2	5	33.252	0.702	0.000	1.23	20.2	SURCHARGED			
3.000	3	5	33.076	0.401	0.000	0.60	9.9	SURCHARGED			
2.001	4	5	33.036	0.646	0.000	1.68	131.1	SURCHARGED			
1.001	5	5	32.694	0.399	0.000	1.97	207.1	SURCHARGED			
1.002	6	10	32.411	0.256	0.000	2.26	207.0	SURCHARGED			
4.000	6	5	32.605	-0.025	0.000	0.77	11.9	OK			
4.001	7	6	32.582	0.082	0.000	0.96	6.6	SURCHARGED			
4.002	8	15	32.234	-0.066	0.000	0.61	6.6	OK			
1.003	9	12	32.175	0.148	0.000	0.07	6.3	SURCHARGED			
1.004	10	12	32.311	0.557	0.000	0.13	2.1	SURCHARGED			
1.005	11	29	31.463	-0.115	0.000	0.12	2.1	OK			

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Overflow (l/s)	Pipe Flow (l/s)									Status	1.000	1	6	33.150	0.550	0.000	1.49	71.4	SURCHARGED	2.000	2	6	33.086	0.536	0.000	1.18	19.5	SURCHARGED	3.000	3	6	32.940	0.265	0.000	0.62	10.1	SURCHARGED	2.001	4	6	32.902	0.512	0.000	1.57	122.3	SURCHARGED	1.001	5	6	32.608	0.313	0.000	1.80	188.7	SURCHARGED	1.002	6	11	32.367	0.212	0.000	2.07	189.7	SURCHARGED	4.000	6	8	32.578	-0.052	0.000	0.74	11.5	OK	4.001	7	9	32.533	0.033	0.000	0.90	6.1	SURCHARGED	4.002	8	16	32.231	-0.069	0.000	0.56	6.1	OK	1.003	9	27	31.875	-0.152	0.000	0.04	3.3	OK	1.004	10	27	31.934	0.180	0.000	0.13	2.1	SURCHARGED	1.005	11	7	31.463	-0.115	0.000	0.12	2.1	OK
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Summary Wizard of 15 minute 100 year Winter I+20% 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 Storage Structures	2
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	0.359
Region England and Wales Cv (Summer)	0.750		
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 360, 600
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm Rank	Water		Surcharged		Flooded		Pipe		Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow / Overflow (l/s)	Flow (l/s)			
1.000	1	1	33.508	0.908	8.428	1.96		93.5		FLOOD	
2.000	2	1	33.603	1.053	3.067	2.16		35.6		FLOOD	
3.000	3	1	33.671	0.996	0.000	0.99		16.3		FLOOD RISK	
2.001	4	1	33.616	1.226	0.000	2.28		177.8		FLOOD RISK	
1.001	5	1	32.957	0.662	0.000	2.39		251.1		SURCHARGED	
1.002	6	2	32.540	0.385	0.000	2.74		250.9		SURCHARGED	
4.000	6	1	32.673	0.043	0.000	1.12		17.3		SURCHARGED	
4.001	7	1	32.624	0.124	0.000	1.02		6.9		SURCHARGED	
4.002	8	11	32.237	-0.063	0.000	0.64		6.9		OK	
1.003	9	22	31.999	-0.028	0.000	0.06		5.4		OK	
1.004	10	22	32.101	0.347	0.000	0.13		2.1		SURCHARGED	
1.005	11	15	31.463	-0.115	0.000	0.12		2.1		OK	

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Summary Wizard of 30 minute 100 year Winter I+20% 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 Storage Structures 2
 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 0.359
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 360, 600
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 20

			Water	Surcharged	Flooded		Pipe	
	US/MH	Storm	Level	Depth	Volume	Flow / Overflow	Flow	
PN	Name	Rank	(m)	(m)	(m³)	Cap.	(l/s)	Status
1.000	1	4	33.503	0.903	3.155	1.85	88.4	FLOOD
2.000	2	4	33.600	1.050	0.069	1.47	24.2	FLOOD
3.000	3	4	33.385	0.710	0.000	0.72	11.9	SURCHARGED
2.001	4	4	33.326	0.936	0.000	1.99	154.9	SURCHARGED
1.001	5	4	32.844	0.549	0.000	2.23	233.9	SURCHARGED
1.002	6	7	32.486	0.331	0.000	2.55	233.6	SURCHARGED
4.000	6	3	32.651	0.021	0.000	0.88	13.6	SURCHARGED
4.001	7	2	32.622	0.122	0.000	1.02	6.9	SURCHARGED
4.002	8	12	32.237	-0.063	0.000	0.64	6.9	OK
1.003	9	16	32.115	0.088	0.000	0.07	6.2	SURCHARGED
1.004	10	16	32.245	0.491	0.000	0.13	2.1	SURCHARGED
1.005	11	25	31.463	-0.115	0.000	0.12	2.1	OK

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Summary Wizard of 60 minute 100 year Winter I+20% 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 Storage Structures	2
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	0.359
Region England and Wales	Cv (Summer)	0.750	
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 360, 600
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

			Water	Surcharged	Flooded		Pipe	
PN	US/MH Name	Storm Rank	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000	1	8	33.034	0.434	0.000	1.42	67.8	SURCHARGED
2.000	2	8	32.956	0.406	0.000	1.02	16.7	SURCHARGED
3.000	3	8	32.829	0.154	0.000	0.47	7.8	SURCHARGED
2.001	4	8	32.798	0.408	0.000	1.44	111.9	SURCHARGED
1.001	5	9	32.549	0.254	0.000	1.70	179.0	SURCHARGED
1.002	6	15	32.339	0.184	0.000	1.96	179.1	SURCHARGED
4.000	6	7	32.594	-0.036	0.000	0.63	9.7	OK
4.001	7	7	32.573	0.073	0.000	0.95	6.5	SURCHARGED
4.002	8	10	32.238	-0.062	0.000	0.60	6.5	OK
1.003	9	10	32.238	0.211	0.000	0.07	6.2	SURCHARGED
1.004	10	9	32.376	0.622	0.000	0.13	2.1	SURCHARGED
1.005	11	24	31.463	-0.115	0.000	0.12	2.1	OK

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$$\text{Channel capacity} = 0.029 \text{ m}^3/\text{m} \times 50\text{m} = 1.45 \text{ m}^3$$

1 in 100 + 20 % exceedance flooding, max 100mm depth

$$\text{Channel capacity} = 0.029 \text{ m}^3/\text{m} \times 56\text{m} = 1.62 \text{ m}^3$$

$$\text{Channel capacity} = 0.029 \text{ m}^3/\text{m} \times 24\text{m} = 0.70 \text{ m}^3$$

$$\text{Channel capacity} = 0.053 \text{ m}^3/\text{m} \times 85\text{m} = 4.50 \text{ m}^3$$

Manhole Ref	Cover Level (m)	Manhole Depth (m)	Manhole Ø (mm)	Pipe Out Invert Level (m)	Pipe Out Ø (mm)	Pipe In Invert Level (m)	Pipe In Ø (mm)	Comments
S1	33.500	1.120	1200	32.375	225	-	-	-
S2	33.725	1.805	1200	31.920	375	32.125	225	-
S3	33.725	1.945	1200	31.780	375	31.780	375	-
S4	33.600	1.200	1200	32.400	150	-	-	-
S5	33.725	1.200	1200	32.525	150	-	-	-
S6	33.500	1.410	1200	32.115	300	32.265	150	-
S7	33.550	1.070	1200	32.480	150	-	-	-
S8	33.550	1.573	1200	31.977	150	32.027	100	-
S9	33.600	1.505	1200	31.645	150	31.645	375	Hydrobrake chamber
S10	33.725	2.180	1200	31.545	150	31.105	150	-
S11	33.000	1.895	1200	31.105	150	31.105	150	-
S12	32.800	1.855	1200	30.945	150	30.945	150	-
S13	33.000	2.405	1200	30.595	150	30.595	150	-
S14	32.000	2.105	1200	29.895	150	29.895	150	-
S15	31.500	1.925	1200	29.575	150	29.575	150	-
S16	31.000	1.905	1200	29.095	150	29.095	150	-
S17	32.000	3.800	1200	28.200	225	28.575	150	connects to existing surface drain

Flood Exceedance Routing.

Worst case 1 in 100 + 20 % 15 minute, winter profile

$$\text{U/S PN1.000} = 8.428 \text{ m}^3 \text{ flooding } (> 3.07 \text{ m}^3 \text{ channel capacity}) - 5.36 \text{ m}^3 \text{ flood}$$

$$\text{U/S PN2.000} = 3.067 \text{ m}^3 \text{ flooding } (< 5.20 \text{ m}^3 \text{ channel capacity}) \therefore \text{ok.}$$

- Notes
- This drawing has been prepared in accordance with the scope of RPS's agreement with the client and is subject to the terms and conditions of that agreement. RPS accepts no liability for any use of the document other than that for which it was prepared.
 - It is recommended that the recipient should verify the accuracy of the information contained in this drawing before using it for any purpose.
 - This drawing should be used in conjunction with all other relevant drawings and specifications.
 - Refer to drawing N001027-RPS-XX-00-DR-C-01710 for alterations.

- Key:
- FW Sewer
 - SW Sewer
 - FW Manhole
 - SW Manhole
 - FW Sewer (Existing)
 - SW Sewer (Existing)
 - SW rising main
 - Slit drain
 - OB Outfall Box
 - SDP Siphonic Down Pipe
 - Secondary siphonic outlet
 - RWP Rainwater pipe (c/w RE)
 - Penstock Chamber
 - AB Access Box
 - DP (GF) Drain point (Ground Floor)
 - DP (FF) Drain point (First Floor)

The contractor is to verify all drainage connection points to satisfy himself all works are in accordance with the design and specifications. Any discrepancies are to be reported to the engineer immediately where further advice will be given. All drainage works are to be completed in accordance with the design and specifications. All drainage works are to be completed in accordance with the design and specifications. All drainage works are to be completed in accordance with the design and specifications.

AD4	Design design details, addit. layout updated.	WB	GB	25.12.17
AD3	Design design details, addit. layout updated.	WB	GB	25.12.17
AD2	Design design details, addit. layout updated.	WB	GB	25.12.17
AD1	Design design details, addit. layout updated.	WB	GB	25.12.17

RPS

Client: ASDS
Park Spring Road
Little Houghton
South Yorkshire

Project Office Extension

Title: Car Park Drainage Layout
Sheet 1 of 2

Scale: 1:200 @ A0

Drawn by: AA

Checked by: AA

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AD4

S2

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