

The Alan Johnston Partnership		Page 1
1 Dale Street Liverpool L2 2ET	Bigdale Drive 223-080	
Date 01/07/2023 File 223-080.MDX	Designed by JPR Checked by JCM	
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)	100	PIMP (%)	100
M5-60 (mm)	19.500	Add Flow / Climate Change (%)	0
Ratio R	0.384	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	18.570	0.480	38.7	0.078	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	12.450	0.450	27.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	2.250	0.110	20.5	0.004	0.00	0.0	0.600	o	150	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	5.19	31.000	0.078	0.0	0.0	0.0	1.62	28.7	10.6
1.001	50.00	5.30	30.520	0.086	0.0	0.0	0.0	1.92	34.0	11.6
1.002	50.00	5.32	30.070	0.090	0.0	0.0	0.0	2.24	39.5	12.2

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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	England and Wales
Return Period (years)	100	M5-60 (mm)	19.500

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<u>Synthetic Rainfall Details</u> Ratio R 0.384 Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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Summary Wizard of 240 minute 2 year Summer I+0% 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	0
Number of Online Controls	0	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	0.385
Region England and Wales	Cv (Summer)	0.750	
M5-60 (mm)	19.500 Cv (Winter)	0.840	

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
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)	2, 30, 100
Climate Change (%)	0, 0, 40

Water Surcharged Flooded							Pipe
PN	US/MH Name	Storm Rank	Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s) Status
1.000	1	46	31.036	-0.114	0.000	0.14	3.6 OK
1.001	2	46	30.556	-0.114	0.000	0.13	4.0 OK
1.002	3	46	30.115	-0.105	0.000	0.20	4.2 OK

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<u>Rainfall Hyetograph for 240 minute 2 year Summer I+0% (Storm)</u> <table><tr><th>Time (mins)</th><th>Rain (mm/hr)</th><th>Time (mins)</th><th>Rain (mm/hr)</th><th>Time (mins)</th><th>Rain (mm/hr)</th><th>Time (mins)</th><th>Rain (mm/hr)</th><th>Time (mins)</th><th>Rain (mm/hr)</th></tr><tr><td>4</td><td>1.914</td><td>52</td><td>2.764</td><td>100</td><td>10.466</td><td>148</td><td>8.600</td><td>196</td><td>2.634</td></tr><tr><td>8</td><td>1.961</td><td>56</td><td>2.906</td><td>104</td><td>12.286</td><td>152</td><td>7.265</td><td>200</td><td>2.540</td></tr><tr><td>12</td><td>2.008</td><td>60</td><td>3.048</td><td>108</td><td>14.247</td><td>156</td><td>6.107</td><td>204</td><td>2.445</td></tr><tr><td>16</td><td>2.067</td><td>64</td><td>3.237</td><td>112</td><td>16.798</td><td>160</td><td>5.210</td><td>208</td><td>2.339</td></tr><tr><td>20</td><td>2.115</td><td>68</td><td>3.438</td><td>116</td><td>19.397</td><td>164</td><td>4.607</td><td>212</td><td>2.256</td></tr><tr><td>24</td><td>2.162</td><td>72</td><td>3.709</td><td>120</td><td>22.351</td><td>168</td><td>4.111</td><td>216</td><td>2.209</td></tr><tr><td>28</td><td>2.209</td><td>76</td><td>4.111</td><td>124</td><td>22.351</td><td>172</td><td>3.709</td><td>220</td><td>2.162</td></tr><tr><td>32</td><td>2.256</td><td>80</td><td>4.607</td><td>128</td><td>19.397</td><td>176</td><td>3.438</td><td>224</td><td>2.115</td></tr><tr><td>36</td><td>2.339</td><td>84</td><td>5.210</td><td>132</td><td>16.798</td><td>180</td><td>3.237</td><td>228</td><td>2.067</td></tr><tr><td>40</td><td>2.445</td><td>88</td><td>6.107</td><td>136</td><td>14.247</td><td>184</td><td>3.048</td><td>232</td><td>2.008</td></tr><tr><td>44</td><td>2.540</td><td>92</td><td>7.265</td><td>140</td><td>12.286</td><td>188</td><td>2.906</td><td>236</td><td>1.961</td></tr><tr><td>48</td><td>2.634</td><td>96</td><td>8.600</td><td>144</td><td>10.466</td><td>192</td><td>2.764</td><td>240</td><td>1.914</td></tr></table>						Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	4	1.914	52	2.764	100	10.466	148	8.600	196	2.634	8	1.961	56	2.906	104	12.286	152	7.265	200	2.540	12	2.008	60	3.048	108	14.247	156	6.107	204	2.445	16	2.067	64	3.237	112	16.798	160	5.210	208	2.339	20	2.115	68	3.438	116	19.397	164	4.607	212	2.256	24	2.162	72	3.709	120	22.351	168	4.111	216	2.209	28	2.209	76	4.111	124	22.351	172	3.709	220	2.162	32	2.256	80	4.607	128	19.397	176	3.438	224	2.115	36	2.339	84	5.210	132	16.798	180	3.237	228	2.067	40	2.445	88	6.107	136	14.247	184	3.048	232	2.008	44	2.540	92	7.265	140	12.286	188	2.906	236	1.961	48	2.634	96	8.600	144	10.466	192	2.764	240	1.914
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