## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Highways Phase 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

| | | | |
|---|---|---|---|
| Return Period (years) | 5 | PIMP (%) | 100 |
| M5-60 (mm) | 20.000 | Add Flow / Climate Change (%) | 30 |
| Ratio R | 0.300 | Minimum Backdrop Height (m) | 0.200 |
| Maximum Rainfall (mm/hr) | 550 | Maximum Backdrop Height (m) | 1.500 |
| Maximum Time of Concentration (mins) | 30 | Min Design Depth for Optimisation (m) | 0.900 |
| Foul Sewage (l/s/ha) | 0.000 | Min Vel for Auto Design only (m/s) | 1.00 |
| Volumetric Runoff Coeff. | 1.000 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Network Design Table for Highways Phase 2

# - Indicates pipe length does not match coordinates
« - 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | 13.937 | 1.046 | 13.3 | 0.015 | 5.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.001 | 13.042 | 0.995 | 13.1 | 0.014 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.002 | 16.189 | 1.346 | 12.0 | 0.008 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.003 | 23.477 | 0.885 | 26.5 | 0.049 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.004 | 14.004 | 0.169 | 82.9 | 0.012 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S2.000 | 22.616 | 0.839 | 27.0 | 0.014 | 5.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S1.005 | 23.011 | 0.767 | 30.0 | 0.074 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.006 | 13.430 | 0.480 | 28.0 | 0.008 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | 77.82 | 5.08 | 60.947 | 0.015 | 0.0 | 0.0 | 1.3 | 2.78 | 49.0 | 5.5 |
| S1.001 | 77.37 | 5.16 | 59.900 | 0.029 | 0.0 | 0.0 | 2.4 | 2.80 | 49.5 | 10.6 |
| S1.002 | 76.85 | 5.25 | 58.905 | 0.037 | 0.0 | 0.0 | 3.1 | 2.92 | 51.6 | 13.3 |
| S1.003 | 75.99 | 5.41 | 57.484 | 0.086 | 0.0 | 0.0 | 7.1 | 2.55 | 101.4 | 30.7 |
| S1.004 | 75.11 | 5.57 | 56.599 | 0.098 | 0.0 | 0.0 | 8.0 | 1.44 | 57.1 | 34.7 |
| S2.000 | 77.19 | 5.19 | 57.344 | 0.014 | 0.0 | 0.0 | 1.2 | 1.95 | 34.4 | 5.2 |
| S1.005 | 74.40 | 5.70 | 56.355 | 0.187 | 0.0 | 0.0 | 15.0 | 2.88 | 203.7 | 65.2 |
| S1.006 | 74.01 | 5.78 | 55.588 | 0.195 | 0.0 | 0.0 | 15.6 | 2.98 | 210.8 | 67.7 |

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## Network Design Table for Highways Phase 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.007 | 14.929 | 0.533 | 28.0 | 0.026 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.008 | 32.882 | 1.140 | 28.8 | 0.031 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.000 | 14.889 | 1.118 | 13.3 | 0.015 | 5.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S3.001 | 15.534 | 1.196 | 13.0 | 0.017 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S3.002 | 12.215 | 1.043 | 11.7 | 0.004 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S3.003 | 23.862 | 0.987 | 24.2 | 0.045 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S3.004 | 13.942 | 0.093 | 150.0 | 0.017 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S3.005 | 23.450 | 0.782 | 30.0 | 0.056 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.006 | 16.801 | 0.560 | 30.0 | 0.008 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.007 | 10.712 | 0.357 | 30.0 | 0.028 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.008 | 32.892 | 1.134 | 29.0 | 0.031 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.009 | 13.250 | 0.090 | 147.2 | 0.003 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.009 | 13.458 | 0.360 | 37.4 | 0.000 | 0.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S1.010 | 2.415# | 0.035 | 70.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S4.000 | 7.963 | 0.407 | 19.6 | 0.007 | 5.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S4.001 | 20.261 | 1.036 | 19.6 | 0.009 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S4.002 | 13.250 | 0.132 | 100.4 | 0.008 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S5.000 | 10.159 | 0.454 | 22.4 | 0.012 | 5.00 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.007 | 73.59 | 5.86 | 55.108 | 0.220 | 0.0 | 0.0 | 17.6 | 2.98 | 210.8 | 76.2 |
| S1.008 | 72.65 | 6.05 | 54.575 | 0.251 | 0.0 | 0.0 | 19.8 | 2.94 | 207.7 | 85.6 |
| S3.000 | 77.79 | 5.09 | 60.945 | 0.015 | 0.0 | 0.0 | 1.3 | 2.78 | 49.0 | 5.4 |
| S3.001 | 77.26 | 5.18 | 59.827 | 0.032 | 0.0 | 0.0 | 2.7 | 2.81 | 49.7 | 11.7 |
| S3.002 | 76.87 | 5.25 | 58.631 | 0.036 | 0.0 | 0.0 | 3.0 | 2.96 | 52.3 | 13.1 |
| S3.003 | 76.03 | 5.40 | 57.513 | 0.082 | 0.0 | 0.0 | 6.7 | 2.67 | 106.2 | 29.2 |
| S3.004 | 74.85 | 5.62 | 56.526 | 0.099 | 0.0 | 0.0 | 8.0 | 1.07 | 42.4 | 34.7 |
| S3.005 | 74.14 | 5.75 | 56.358 | 0.154 | 0.0 | 0.0 | 12.4 | 2.88 | 203.7 | 53.7 |
| S3.006 | 73.64 | 5.85 | 55.576 | 0.163 | 0.0 | 0.0 | 13.0 | 2.88 | 203.7 | 56.3 |
| S3.007 | 73.33 | 5.91 | 55.016 | 0.191 | 0.0 | 0.0 | 15.1 | 2.88 | 203.7 | 65.6 |
| S3.008 | 72.40 | 6.10 | 54.659 | 0.222 | 0.0 | 0.0 | 17.4 | 2.93 | 207.2 | 75.5 |
| S3.009 | 71.58 | 6.27 | 53.525 | 0.225 | 0.0 | 0.0 | 17.4 | 1.29 | 91.4 | 75.5 |
| S1.009 | 71.22 | 6.35 | 53.360 | 0.476 | 0.0 | 0.0 | 36.7 | 2.97 | 328.2 | 159.1 |
| S1.010 | 71.13 | 6.36 | 52.000 | 0.476 | 0.0 | 0.0 | 36.7 | 2.17 | 239.5 | 159.1 |
| S4.000 | 77.97 | 5.06 | 53.403 | 0.007 | 0.0 | 0.0 | 0.6 | 2.29 | 40.4 | 2.7 |
| S4.001 | 77.12 | 5.21 | 52.996 | 0.016 | 0.0 | 0.0 | 1.4 | 2.29 | 40.4 | 5.9 |
| S4.002 | 75.89 | 5.43 | 51.960 | 0.024 | 0.0 | 0.0 | 2.0 | 1.00 | 17.7 | 8.6 |
| S5.000 | 77.85 | 5.08 | 53.420 | 0.012 | 0.0 | 0.0 | 1.0 | 2.14 | 37.8 | 4.3 |

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## Network Design Table for Highways Phase 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S5.001 | 22.473 | 1.138 | 19.7 | 0.022 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| S4.003 | 8.530 | 0.498 | 17.1 | 0.020 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.004 | 7.801 | 0.155 | 50.3 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.011 | 20.950 | 1.091 | 19.2 | 0.123 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.012 | 5.569 | 0.254 | 21.9 | 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) | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S5.001 | 76.90 | 5.24 | 52.966 | 0.034 | 0.0 | 0.0 | 2.8 | 2.28 | 40.2 | 12.1 |
| S4.003 | 75.64 | 5.47 | 51.753 | 0.078 | 0.0 | 0.0 | 6.4 | 3.18 | 126.3 | 27.7 |
| S4.004 | 75.26 | 5.54 | 51.255 | 0.078 | 0.0 | 0.0 | 6.4 | 1.85 | 73.5 | 27.7 |
| S1.011 | 70.59 | 6.48 | 51.100 | 0.677 | 0.0 | 0.0 | 51.7 | 3.00 | 119.3« | 224.2 |
| S1.012 | 70.44 | 6.51 | 50.009 | 0.677 | 0.0 | 0.0 | 51.7 | 2.81 | 111.6« | 224.2 |

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## Manhole Schedules for Highways Phase 2

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S10 | 61.997 | 1.050 | Junction | | S1.000 | 60.947 | 150 | | | | |
| S11 | 60.950 | 1.050 | Junction | | S1.001 | 59.900 | 150 | S1.000 | 59.900 | 150 | |
| S12 | 59.955 | 1.050 | Open Manhole | 1200 | S1.002 | 58.905 | 150 | S1.001 | 58.905 | 150 | |
| S13 | 58.609 | 1.125 | Open Manhole | 1200 | S1.003 | 57.484 | 225 | S1.002 | 57.559 | 150 | |
| S14 | 57.724 | 1.125 | Open Manhole | 1200 | S1.004 | 56.599 | 225 | S1.003 | 56.599 | 225 | |
| S18 | 58.394 | 1.050 | Open Manhole | 1200 | S2.000 | 57.344 | 150 | | | | |
| S15 | 57.654 | 1.299 | Open Manhole | 1200 | S1.005 | 56.355 | 300 | S1.004 | 56.430 | 225 | |
| | | | | | | | | S2.000 | 56.505 | 150 | |
| S16 | 57.297 | 1.709 | Open Manhole | 1200 | S1.006 | 55.588 | 300 | S1.005 | 55.588 | 300 | |
| S17 | 56.974 | 1.866 | Open Manhole | 1200 | S1.007 | 55.108 | 300 | S1.006 | 55.108 | 300 | |
| S10 | 56.360 | 1.785 | Open Manhole | 1200 | S1.008 | 54.575 | 300 | S1.007 | 54.575 | 300 | |
| S1 | 61.995 | 1.050 | Junction | | S3.000 | 60.945 | 150 | | | | |
| S2 | 60.877 | 1.050 | Junction | | S3.001 | 59.827 | 150 | S3.000 | 59.827 | 150 | |
| S3 | 59.681 | 1.050 | Open Manhole | 1200 | S3.002 | 58.631 | 150 | S3.001 | 58.631 | 150 | |
| S4 | 58.638 | 1.125 | Open Manhole | 1200 | S3.003 | 57.513 | 225 | S3.002 | 57.588 | 150 | |
| S5 | 57.651 | 1.125 | Open Manhole | 1200 | S3.004 | 56.526 | 225 | S3.003 | 56.526 | 225 | |
| S6 | 57.589 | 1.231 | Open Manhole | 1200 | S3.005 | 56.358 | 300 | S3.004 | 56.433 | 225 | |
| S7 | 57.371 | 1.795 | Open Manhole | 1200 | S3.006 | 55.576 | 300 | S3.005 | 55.576 | 300 | |
| S8 | 56.883 | 1.867 | Open Manhole | 1200 | S3.007 | 55.016 | 300 | S3.006 | 55.016 | 300 | |
| S9 | 56.397 | 1.737 | Open Manhole | 1200 | S3.008 | 54.659 | 300 | S3.007 | 54.659 | 300 | |
| S20 | 54.735 | 1.210 | Open Manhole | 1200 | S3.009 | 53.525 | 300 | S3.008 | 53.525 | 300 | |
| S20 | 54.734 | 1.374 | Open Manhole | 1350 | S1.009 | 53.360 | 375 | S1.008 | 53.435 | 300 | |
| | | | | | | | | S3.009 | 53.435 | 300 | |
| S11 | 54.446 | 2.446 | Open Manhole | 1350 | S1.010 | 52.000 | 375 | S1.009 | 53.000 | 375 | 1000 |
| S25 | 54.593 | 1.190 | Open Manhole | 1200 | S4.000 | 53.403 | 150 | | | | |
| S26 | 54.165 | 1.169 | Junction | | S4.001 | 52.996 | 150 | S4.000 | 52.996 | 150 | |
| S27 | 53.077 | 1.117 | Open Manhole | 1200 | S4.002 | 51.960 | 150 | S4.001 | 51.960 | 150 | |
| S29 | 54.611 | 1.191 | Open Manhole | 1200 | S5.000 | 53.420 | 150 | | | | |
| S30 | 54.134 | 1.168 | Junction | | S5.001 | 52.966 | 150 | S5.000 | 52.966 | 150 | |
| S28 | 53.078 | 1.325 | Open Manhole | 1200 | S4.003 | 51.753 | 225 | S4.002 | 51.828 | 150 | |
| | | | | | | | | S5.001 | 51.828 | 150 | |
| S29 | 52.600 | 1.345 | Open Manhole | 1200 | S4.004 | 51.255 | 225 | S4.003 | 51.255 | 225 | |
| S12 | 52.600 | 1.500 | Open Manhole | 1350 | S1.011 | 51.100 | 225 | S1.010 | 51.966 | 375 | 1016 |
| | | | | | | | | S4.004 | 51.100 | 225 | |
| S13 | 51.375 | 1.366 | Open Manhole | 1200 | S1.012 | 50.009 | 225 | S1.011 | 50.009 | 225 | |
| S | 51.411 | 1.656 | Open Manhole | 0 | | OUTFALL | | S1.012 | 49.755 | 225 | |

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## Manhole Schedules for Highways Phase 2

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North) |
|---|---|---|---|---|---|---|
| S10 | 423172.259 | 419420.575 | | | No Entry |  |
| S11 | 423185.077 | 419426.048 | | | No Entry |  |
| S12 | 423197.708 | 419429.295 | 423197.708 | 419429.295 | Required |  |
| S13 | 423212.054 | 419436.798 | 423212.054 | 419436.798 | Required |  |
| S14 | 423233.968 | 419428.374 | 423233.968 | 419428.374 | Required |  |
| S18 | 423254.291 | 419413.124 | 423254.291 | 419413.124 | Required |  |
| S15 | 423246.611 | 419434.397 | 423246.611 | 419434.397 | Required |  |
| S16 | 423254.828 | 419455.890 | 423254.828 | 419455.890 | Required |  |
| S17 | 423267.616 | 419459.995 | 423267.616 | 419459.995 | Required |  |
| S10 | 423280.659 | 419467.259 | 423280.659 | 419467.259 | Required |  |
| S1 | 423167.013 | 419432.742 | | | No Entry |  |
| S2 | 423180.660 | 419438.697 | | | No Entry |  |
| S3 | 423194.227 | 419446.264 | 423194.227 | 419446.264 | Required |  |
| S4 | 423205.954 | 419449.681 | 423205.954 | 419449.681 | Required |  |
| S5 | 423214.503 | 419471.959 | 423214.503 | 419471.959 | Required |  |

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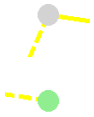
## Manhole Schedules for Highways Phase 2

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North) |
|---|---|---|---|---|---|---|
| S6 | 423227.348 | 419477.381 | 423227.348 | 419477.381 | Required | |
| S7 | 423249.270 | 419469.052 | 423249.270 | 419469.052 | Required | |
| S8 | 423264.277 | 419476.606 | 423264.277 | 419476.606 | Required | |
| S9 | 423274.643 | 419479.307 | 423274.643 | 419479.307 | Required | |
| S20 | 423304.846 | 419492.333 | 423304.846 | 419492.333 | Required | |
| S20 | 423310.766 | 419480.479 | 423310.766 | 419480.479 | Required | |
| S11 | 423316.779 | 419468.440 | 423316.779 | 419468.440 | Required | |
| S25 | 423307.194 | 419493.548 | 423307.194 | 419493.548 | Required | |
| S26 | 423314.048 | 419497.602 | | | No Entry | |
| S27 | 423329.733 | 419510.429 | 423329.733 | 419510.429 | Required | |
| S29 | 423313.105 | 419481.662 | 423313.105 | 419481.662 | Required | |
| S30 | 423321.832 | 419486.861 | | | No Entry | |
| S28 | 423339.184 | 419501.143 | 423339.184 | 419501.143 | Required | |
| S29 | 423345.269 | 419495.164 | 423345.269 | 419495.164 | Required | |
| S12 | 423352.882 | 419496.865 | 423352.882 | 419496.865 | Required | |

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## Manhole Schedules for Highways Phase 2

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North) |
|---|---|---|---|---|---|---|
| S13 | 423361.458 | 419515.980 | 423361.458 | 419515.980 | Required | |
| S | 423366.962 | 419515.132 | | | No Entry | |



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## PIPELINE SCHEDULES for Highways Phase 2

### Upstream Manhole

# - Indicates pipe length does not match coordinates

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S1.000 | o | 150 | S10 | 61.997 | 60.947 | 0.900 | Junction | |
| S1.001 | o | 150 | S11 | 60.950 | 59.900 | 0.900 | Junction | |
| S1.002 | o | 150 | S12 | 59.955 | 58.905 | 0.900 | Open Manhole | 1200 |
| S1.003 | o | 225 | S13 | 58.609 | 57.484 | 0.900 | Open Manhole | 1200 |
| S1.004 | o | 225 | S14 | 57.724 | 56.599 | 0.900 | Open Manhole | 1200 |
| S2.000 | o | 150 | S18 | 58.394 | 57.344 | 0.900 | Open Manhole | 1200 |
| S1.005 | o | 300 | S15 | 57.654 | 56.355 | 0.999 | Open Manhole | 1200 |
| S1.006 | o | 300 | S16 | 57.297 | 55.588 | 1.409 | Open Manhole | 1200 |
| S1.007 | o | 300 | S17 | 56.974 | 55.108 | 1.566 | Open Manhole | 1200 |
| S1.008 | o | 300 | S10 | 56.360 | 54.575 | 1.485 | Open Manhole | 1200 |
| S3.000 | o | 150 | S1 | 61.995 | 60.945 | 0.900 | Junction | |
| S3.001 | o | 150 | S2 | 60.877 | 59.827 | 0.900 | Junction | |
| S3.002 | o | 150 | S3 | 59.681 | 58.631 | 0.900 | Open Manhole | 1200 |
| S3.003 | o | 225 | S4 | 58.638 | 57.513 | 0.900 | Open Manhole | 1200 |
| S3.004 | o | 225 | S5 | 57.651 | 56.526 | 0.900 | Open Manhole | 1200 |
| S3.005 | o | 300 | S6 | 57.589 | 56.358 | 0.931 | 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) |
|---|---|---|---|---|---|---|---|---|
| S1.000 | 13.937 | 13.3 | S11 | 60.950 | 59.900 | 0.900 | Junction | |
| S1.001 | 13.042 | 13.1 | S12 | 59.955 | 58.905 | 0.900 | Open Manhole | 1200 |
| S1.002 | 16.189 | 12.0 | S13 | 58.609 | 57.559 | 0.900 | Open Manhole | 1200 |
| S1.003 | 23.477 | 26.5 | S14 | 57.724 | 56.599 | 0.900 | Open Manhole | 1200 |
| S1.004 | 14.004 | 82.9 | S15 | 57.654 | 56.430 | 0.998 | Open Manhole | 1200 |
| S2.000 | 22.616 | 27.0 | S15 | 57.654 | 56.505 | 0.998 | Open Manhole | 1200 |
| S1.005 | 23.011 | 30.0 | S16 | 57.297 | 55.588 | 1.409 | Open Manhole | 1200 |
| S1.006 | 13.430 | 28.0 | S17 | 56.974 | 55.108 | 1.566 | Open Manhole | 1200 |
| S1.007 | 14.929 | 28.0 | S10 | 56.360 | 54.575 | 1.485 | Open Manhole | 1200 |
| S1.008 | 32.882 | 28.8 | S20 | 54.734 | 53.435 | 0.999 | Open Manhole | 1350 |
| S3.000 | 14.889 | 13.3 | S2 | 60.877 | 59.827 | 0.900 | Junction | |
| S3.001 | 15.534 | 13.0 | S3 | 59.681 | 58.631 | 0.900 | Open Manhole | 1200 |
| S3.002 | 12.215 | 11.7 | S4 | 58.638 | 57.588 | 0.900 | Open Manhole | 1200 |
| S3.003 | 23.862 | 24.2 | S5 | 57.651 | 56.526 | 0.900 | Open Manhole | 1200 |
| S3.004 | 13.942 | 150.0 | S6 | 57.589 | 56.433 | 0.931 | Open Manhole | 1200 |
| S3.005 | 23.450 | 30.0 | S7 | 57.371 | 55.576 | 1.495 | Open Manhole | 1200 |

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## PIPELINE SCHEDULES for Highways Phase 2

### 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) |
|---|---|---|---|---|---|---|---|---|
| S3.006 | o | 300 | S7 | 57.371 | 55.576 | 1.495 | Open Manhole | 1200 |
| S3.007 | o | 300 | S8 | 56.883 | 55.016 | 1.567 | Open Manhole | 1200 |
| S3.008 | o | 300 | S9 | 56.397 | 54.659 | 1.437 | Open Manhole | 1200 |
| S3.009 | o | 300 | S20 | 54.735 | 53.525 | 0.910 | Open Manhole | 1200 |
| S1.009 | o | 375 | S20 | 54.734 | 53.360 | 0.999 | Open Manhole | 1350 |
| S1.010 | o | 375 | S11 | 54.446 | 52.000 | 2.071 | Open Manhole | 1350 |
| S4.000 | o | 150 | S25 | 54.593 | 53.403 | 1.040 | Open Manhole | 1200 |
| S4.001 | o | 150 | S26 | 54.165 | 52.996 | 1.019 | Junction | |
| S4.002 | o | 150 | S27 | 53.077 | 51.960 | 0.967 | Open Manhole | 1200 |
| S5.000 | o | 150 | S29 | 54.611 | 53.420 | 1.041 | Open Manhole | 1200 |
| S5.001 | o | 150 | S30 | 54.134 | 52.966 | 1.018 | Junction | |
| S4.003 | o | 225 | S28 | 53.078 | 51.753 | 1.100 | Open Manhole | 1200 |
| S4.004 | o | 225 | S29 | 52.600 | 51.255 | 1.120 | Open Manhole | 1200 |
| S1.011 | o | 225 | S12 | 52.600 | 51.100 | 1.275 | Open Manhole | 1350 |
| S1.012 | o | 225 | S13 | 51.375 | 50.009 | 1.141 | 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) |
|---|---|---|---|---|---|---|---|---|
| S3.006 | 16.801 | 30.0 | S8 | 56.883 | 55.016 | 1.567 | Open Manhole | 1200 |
| S3.007 | 10.712 | 30.0 | S9 | 56.397 | 54.659 | 1.437 | Open Manhole | 1200 |
| S3.008 | 32.892 | 29.0 | S20 | 54.735 | 53.525 | 0.910 | Open Manhole | 1200 |
| S3.009 | 13.250 | 147.2 | S20 | 54.734 | 53.435 | 0.999 | Open Manhole | 1350 |
| S1.009 | 13.458 | 37.4 | S11 | 54.446 | 53.000 | 1.071 | Open Manhole | 1350 |
| S1.010 | 2.415# | 70.0 | S12 | 52.600 | 51.966 | 0.260 | Open Manhole | 1350 |
| S4.000 | 7.963 | 19.6 | S26 | 54.165 | 52.996 | 1.019 | Junction | |
| S4.001 | 20.261 | 19.6 | S27 | 53.077 | 51.960 | 0.967 | Open Manhole | 1200 |
| S4.002 | 13.250 | 100.4 | S28 | 53.078 | 51.828 | 1.100 | Open Manhole | 1200 |
| S5.000 | 10.159 | 22.4 | S30 | 54.134 | 52.966 | 1.018 | Junction | |
| S5.001 | 22.473 | 19.7 | S28 | 53.078 | 51.828 | 1.100 | Open Manhole | 1200 |
| S4.003 | 8.530 | 17.1 | S29 | 52.600 | 51.255 | 1.120 | Open Manhole | 1200 |
| S4.004 | 7.801 | 50.3 | S12 | 52.600 | 51.100 | 1.275 | Open Manhole | 1350 |
| S1.011 | 20.950 | 19.2 | S13 | 51.375 | 50.009 | 1.141 | Open Manhole | 1200 |
| S1.012 | 5.569 | 21.9 | S | 51.411 | 49.755 | 1.431 | Open Manhole | 0 |

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## Area Summary for Highways Phase 2

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | Classification | Road, Foot and Cycle Path | 100 | 0.008 | 0.008 | 0.008 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.003 | 0.003 | 0.011 |
| | Classification | Swales | 100 | 0.004 | 0.004 | 0.015 |
| 1.001 | Classification | Swales | 100 | 0.004 | 0.004 | 0.004 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.008 | 0.008 | 0.012 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.003 | 0.003 | 0.014 |
| 1.002 | Classification | Road, Foot and Cycle Path | 100 | 0.008 | 0.008 | 0.008 |
| 1.003 | Classification | Swales | 100 | 0.012 | 0.012 | 0.012 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.020 | 0.020 | 0.031 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.018 | 0.018 | 0.049 |
| | Classification | Green | 100 | 0.011 | 0.011 | 0.060 |
| 1.004 | Classification | Road, Foot and Cycle Path | 100 | 0.007 | 0.007 | 0.007 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.005 | 0.005 | 0.012 |
| 2.000 | Classification | Road, Foot and Cycle Path | 100 | 0.014 | 0.014 | 0.014 |
| 1.005 | Classification | Road, Foot and Cycle Path | 100 | 0.029 | 0.029 | 0.029 |
| | Classification | Swales | 100 | 0.012 | 0.012 | 0.041 |
| | Classification | Green | 100 | 0.011 | 0.011 | 0.051 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.033 | 0.033 | 0.085 |
| 1.006 | Classification | Road, Foot and Cycle Path | 100 | 0.008 | 0.008 | 0.008 |
| 1.007 | Classification | Road, Foot and Cycle Path | 100 | 0.021 | 0.021 | 0.021 |
| | Classification | Swales | 100 | 0.004 | 0.004 | 0.026 |
| 1.008 | Classification | Road, Foot and Cycle Path | 100 | 0.017 | 0.017 | 0.017 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.006 | 0.006 | 0.023 |
| | Classification | Swales | 100 | 0.008 | 0.008 | 0.031 |
| 3.000 | Classification | Road, Foot and Cycle Path | 100 | 0.008 | 0.008 | 0.008 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.003 | 0.003 | 0.011 |
| | Classification | Swales | 100 | 0.004 | 0.004 | 0.015 |
| 3.001 | Classification | Swales | 100 | 0.005 | 0.005 | 0.005 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.010 | 0.010 | 0.014 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.003 | 0.003 | 0.017 |
| 3.002 | Classification | Road, Foot and Cycle Path | 100 | 0.004 | 0.004 | 0.004 |
| 3.003 | Classification | Swales | 100 | 0.012 | 0.012 | 0.012 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.016 | 0.016 | 0.028 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.018 | 0.018 | 0.045 |
| | Classification | Green | 100 | 0.011 | 0.011 | 0.056 |
| 3.004 | Classification | Road, Foot and Cycle Path | 100 | 0.017 | 0.017 | 0.017 |
| 3.005 | Classification | Swales | 100 | 0.012 | 0.012 | 0.012 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.039 | 0.039 | 0.050 |
| | Classification | Green | 100 | 0.011 | 0.011 | 0.061 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.005 | 0.005 | 0.066 |
| 3.006 | Classification | Road, Foot and Cycle Path | 100 | 0.008 | 0.008 | 0.008 |
| 3.007 | Classification | Road, Foot and Cycle Path | 100 | 0.024 | 0.024 | 0.024 |
| | Classification | Swales | 100 | 0.003 | 0.003 | 0.028 |
| 3.008 | Classification | Road, Foot and Cycle Path | 100 | 0.017 | 0.017 | 0.017 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.006 | 0.006 | 0.023 |
| | Classification | Swales | 100 | 0.008 | 0.008 | 0.031 |
| 3.009 | Classification | Swales | 100 | 0.003 | 0.003 | 0.003 |
| 1.009 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 4.000 | Classification | Road, Foot and Cycle Path | 100 | 0.002 | 0.002 | 0.002 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.005 | 0.005 | 0.007 |

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## Area Summary for Highways Phase 2

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 4.001 | Classification | Swales | 100 | 0.005 | 0.005 | 0.005 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.004 | 0.004 | 0.009 |
| 4.002 | Classification | Swales | 100 | 0.002 | 0.002 | 0.002 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.002 | 0.002 | 0.003 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.004 | 0.004 | 0.008 |
| 5.000 | Classification | Road, Foot and Cycle Path | 100 | 0.003 | 0.003 | 0.003 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.006 | 0.006 | 0.009 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.003 | 0.003 | 0.012 |
| 5.001 | Classification | Swales | 100 | 0.005 | 0.005 | 0.005 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.012 | 0.012 | 0.017 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.005 | 0.005 | 0.022 |
| 4.003 | Classification | Swales | 100 | 0.002 | 0.002 | 0.002 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.011 | 0.011 | 0.014 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.002 | 0.002 | 0.015 |
| | Classification | Road, Foot and Cycle Path | 100 | 0.005 | 0.005 | 0.020 |
| 4.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.011 | Classification | Basin | 100 | 0.123 | 0.123 | 0.123 |
| | Classification | Green | 100 | 0.137 | 0.137 | 0.259 |
| 1.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| | | | | Total | Total | Total |
| | | | | 0.856 | 0.856 | 0.856 |

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## Online Controls for Highways Phase 2

### Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.011, Volume (m³): 2.5

| | |
|---|---|
| Unit Reference | MD-SHE-0079-3000-1200-3000 |
| Design Head (m) | 1.200 |
| Design Flow (l/s) | 3.0 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 79 |
| Invert Level (m) | 51.100 |
| Minimum Outlet Pipe Diameter (mm) | 100 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) |
|---|---|---|
| Design Point (Calculated) | 1.200 | 3.0 |
| Flush-Flo™ | 0.348 | 2.9 |
| Kick-Flo® | 0.707 | 2.4 |
| Mean Flow over Head Range | - | 2.6 |

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 | 2.3 | 1.200 | 3.0 | 3.000 | 4.6 | 7.000 | 6.8 |
| 0.200 | 2.8 | 1.400 | 3.2 | 3.500 | 4.9 | 7.500 | 7.0 |
| 0.300 | 2.9 | 1.600 | 3.4 | 4.000 | 5.2 | 8.000 | 7.3 |
| 0.400 | 2.9 | 1.800 | 3.6 | 4.500 | 5.5 | 8.500 | 7.5 |
| 0.500 | 2.8 | 2.000 | 3.8 | 5.000 | 5.8 | 9.000 | 7.7 |
| 0.600 | 2.7 | 2.200 | 4.0 | 5.500 | 6.1 | 9.500 | 7.9 |
| 0.800 | 2.5 | 2.400 | 4.1 | 6.000 | 6.3 | | |
| 1.000 | 2.8 | 2.600 | 4.3 | 6.500 | 6.6 | | |

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## Storage Structures for Highways Phase 2

### Tank or Pond Manhole: S12, DS/PN: S1.011

Invert Level (m) 51.100

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 410.0 | 1.500 | 796.6 |

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

### 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 | 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 0.300 |
| Region | England and Wales | Cv (Summer) | 1.000 |
| M5-60 (mm) | 20.000 | Cv (Winter) | 1.000 |

| | | | |
|---|---|---|---|
| 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) | 1, 30, 100 |
| Climate Change (%) | 30, 30, 30 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S10 | 15 Summer | 1 | +30% | | | | | 60.971 |
| S1.001 | S11 | 15 Summer | 1 | +30% | | | | | 59.934 |
| S1.002 | S12 | 15 Summer | 1 | +30% | | | | | 58.943 |
| S1.003 | S13 | 15 Summer | 1 | +30% | | | | | 57.546 |
| S1.004 | S14 | 15 Summer | 1 | +30% | 30/15 Summer | | | | 56.692 |
| S2.000 | S18 | 15 Summer | 1 | +30% | | | | | 57.374 |
| S1.005 | S15 | 15 Summer | 1 | +30% | | | | | 56.443 |
| S1.006 | S16 | 15 Summer | 1 | +30% | | | | | 55.680 |
| S1.007 | S17 | 15 Summer | 1 | +30% | | | | | 55.205 |
| S1.008 | S10 | 15 Summer | 1 | +30% | 100/15 Summer | | | | 54.674 |
| S3.000 | S1 | 15 Summer | 1 | +30% | | | | | 60.970 |
| S3.001 | S2 | 15 Summer | 1 | +30% | | | | | 59.863 |
| S3.002 | S3 | 15 Summer | 1 | +30% | | | | | 58.670 |
| S3.003 | S4 | 15 Summer | 1 | +30% | | | | | 57.572 |
| S3.004 | S5 | 15 Summer | 1 | +30% | 30/15 Summer | | | | 56.637 |
| S3.005 | S6 | 15 Summer | 1 | +30% | | | | | 56.436 |
| S3.006 | S7 | 15 Summer | 1 | +30% | | | | | 55.659 |
| S3.007 | S8 | 15 Summer | 1 | +30% | 100/15 Summer | | | | 55.113 |
| S3.008 | S9 | 15 Summer | 1 | +30% | 100/15 Summer | | | | 54.752 |

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

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S10 | -0.125 | 0.000 | 0.06 | | | 3.1 | OK* | |
| S1.001 | S11 | -0.116 | 0.000 | 0.11 | | | 5.6 | OK* | |
| S1.002 | S12 | -0.112 | 0.000 | 0.14 | | | 6.9 | OK | |
| S1.003 | S13 | -0.163 | 0.000 | 0.17 | | | 15.6 | OK | |
| S1.004 | S14 | -0.132 | 0.000 | 0.35 | | | 17.6 | OK | |
| S2.000 | S18 | -0.119 | 0.000 | 0.09 | | | 3.0 | OK | |
| S1.005 | S15 | -0.212 | 0.000 | 0.19 | | | 33.4 | OK | |
| S1.006 | S16 | -0.208 | 0.000 | 0.20 | | | 35.0 | OK | |
| S1.007 | S17 | -0.203 | 0.000 | 0.22 | | | 39.5 | OK | |
| S1.008 | S10 | -0.201 | 0.000 | 0.24 | | | 44.9 | OK | |
| S3.000 | S1 | -0.125 | 0.000 | 0.06 | | | 3.1 | OK* | |
| S3.001 | S2 | -0.115 | 0.000 | 0.12 | | | 6.2 | OK* | |
| S3.002 | S3 | -0.112 | 0.000 | 0.14 | | | 6.9 | OK | |
| S3.003 | S4 | -0.166 | 0.000 | 0.15 | | | 14.8 | OK | |
| S3.004 | S5 | -0.114 | 0.000 | 0.48 | | | 17.7 | OK | |
| S3.005 | S6 | -0.222 | 0.000 | 0.15 | | | 27.3 | OK | |
| S3.006 | S7 | -0.217 | 0.000 | 0.17 | | | 28.9 | OK | |
| S3.007 | S8 | -0.203 | 0.000 | 0.23 | | | 33.8 | OK | |
| S3.008 | S9 | -0.207 | 0.000 | 0.21 | | | 39.2 | OK | |

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

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S3.009 | S20 | 15 Summer | 1 | +30% | 30/15 Summer | | | | 53.680 |
| S1.009 | S20 | 15 Summer | 1 | +30% | 30/15 Summer | | | | 53.515 |
| S1.010 | S11 | 15 Summer | 1 | +30% | 30/15 Summer | | | | 52.252 |
| S4.000 | S25 | 15 Summer | 1 | +30% | | | | | 53.423 |
| S4.001 | S26 | 15 Summer | 1 | +30% | | | | | 53.024 |
| S4.002 | S27 | 15 Summer | 1 | +30% | 100/15 Summer | | | | 52.014 |
| S5.000 | S29 | 15 Summer | 1 | +30% | | | | | 53.447 |
| S5.001 | S30 | 15 Summer | 1 | +30% | | | | | 53.006 |
| S4.003 | S28 | 15 Summer | 1 | +30% | 30/480 Summer | | | | 51.810 |
| S4.004 | S29 | 1440 Summer | 1 | +30% | 1/360 Summer | | | | 51.543 |
| S1.011 | S12 | 1440 Summer | 1 | +30% | 1/60 Summer | | | | 51.543 |
| S1.012 | S13 | 600 Summer | 1 | +30% | | | | | 50.038 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| S3.009 | S20 | -0.145 | 0.000 | 0.53 | | | 39.7 | OK | |
| S1.009 | S20 | -0.220 | 0.000 | 0.36 | | | 84.5 | OK | |
| S1.010 | S11 | -0.123 | 0.000 | 0.78 | | | 84.1 | OK | |
| S4.000 | S25 | -0.130 | 0.000 | 0.04 | | | 1.6 | OK | |
| S4.001 | S26 | -0.122 | 0.000 | 0.08 | | | 3.1 | OK* | |
| S4.002 | S27 | -0.096 | 0.000 | 0.28 | | | 4.5 | OK | |
| S5.000 | S29 | -0.123 | 0.000 | 0.07 | | | 2.5 | OK | |
| S5.001 | S30 | -0.110 | 0.000 | 0.16 | | | 6.3 | OK* | |
| S4.003 | S28 | -0.168 | 0.000 | 0.14 | | | 14.2 | OK | |
| S4.004 | S29 | 0.063 | 0.000 | 0.03 | | | 1.8 | SURCHARGED | |
| S1.011 | S12 | 0.218 | 0.000 | 0.03 | | | 2.9 | SURCHARGED | |
| S1.012 | S13 | -0.196 | 0.000 | 0.04 | | | 2.9 | OK | |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

### 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 | 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 0.300 |
| Region | England and Wales | Cv (Summer) | 1.000 |
| M5-60 (mm) | 20.000 | Cv (Winter) | 1.000 |

| | | | |
|---|---|---|---|
| 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) | 1, 30, 100 |
| Climate Change (%) | 30, 30, 30 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S10 | 15 Summer | 30 | +30% | | | | | 60.986 |
| S1.001 | S11 | 15 Summer | 30 | +30% | | | | | 59.959 |
| S1.002 | S12 | 15 Summer | 30 | +30% | | | | | 58.973 |
| S1.003 | S13 | 15 Summer | 30 | +30% | | | | | 57.600 |
| S1.004 | S14 | 15 Summer | 30 | +30% | 30/15 Summer | | | | 56.854 |
| S2.000 | S18 | 15 Summer | 30 | +30% | | | | | 57.392 |
| S1.005 | S15 | 15 Summer | 30 | +30% | | | | | 56.520 |
| S1.006 | S16 | 15 Summer | 30 | +30% | | | | | 55.762 |
| S1.007 | S17 | 15 Summer | 30 | +30% | | | | | 55.295 |
| S1.008 | S10 | 15 Summer | 30 | +30% | 100/15 Summer | | | | 54.769 |
| S3.000 | S1 | 15 Summer | 30 | +30% | | | | | 60.985 |
| S3.001 | S2 | 15 Summer | 30 | +30% | | | | | 59.889 |
| S3.002 | S3 | 15 Summer | 30 | +30% | | | | | 58.699 |
| S3.003 | S4 | 15 Summer | 30 | +30% | | | | | 57.622 |
| S3.004 | S5 | 15 Summer | 30 | +30% | 30/15 Summer | | | | 56.859 |
| S3.005 | S6 | 15 Summer | 30 | +30% | | | | | 56.506 |
| S3.006 | S7 | 15 Summer | 30 | +30% | | | | | 55.732 |
| S3.007 | S8 | 15 Summer | 30 | +30% | 100/15 Summer | | | | 55.207 |
| S3.008 | S9 | 15 Summer | 30 | +30% | 100/15 Summer | | | | 54.839 |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S10 | -0.110 | 0.000 | 0.16 | | | 7.7 | OK* | |
| S1.001 | S11 | -0.092 | 0.000 | 0.32 | | | 15.8 | OK* | |
| S1.002 | S12 | -0.082 | 0.000 | 0.42 | | | 20.1 | OK | |
| S1.003 | S13 | -0.109 | 0.000 | 0.52 | | | 48.5 | OK | |
| S1.004 | S14 | 0.030 | 0.000 | 1.09 | | | 54.5 | SURCHARGED | |
| S2.000 | S18 | -0.102 | 0.000 | 0.23 | | | 7.4 | OK | |
| S1.005 | S15 | -0.135 | 0.000 | 0.57 | | | 103.5 | OK | |
| S1.006 | S16 | -0.126 | 0.000 | 0.62 | | | 107.1 | OK | |
| S1.007 | S17 | -0.113 | 0.000 | 0.68 | | | 120.6 | OK | |
| S1.008 | S10 | -0.106 | 0.000 | 0.72 | | | 136.8 | OK | |
| S3.000 | S1 | -0.111 | 0.000 | 0.16 | | | 7.6 | OK* | |
| S3.001 | S2 | -0.088 | 0.000 | 0.35 | | | 17.6 | OK* | |
| S3.002 | S3 | -0.082 | 0.000 | 0.42 | | | 19.9 | OK | |
| S3.003 | S4 | -0.116 | 0.000 | 0.47 | | | 46.0 | OK | |
| S3.004 | S5 | 0.108 | 0.000 | 1.49 | | | 55.1 | SURCHARGED | |
| S3.005 | S6 | -0.152 | 0.000 | 0.48 | | | 86.5 | OK | |
| S3.006 | S7 | -0.144 | 0.000 | 0.52 | | | 90.4 | OK | |
| S3.007 | S8 | -0.110 | 0.000 | 0.70 | | | 105.1 | OK | |
| S3.008 | S9 | -0.121 | 0.000 | 0.64 | | | 121.5 | OK | |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S3.009 | S20 | 15 Summer | 30 | +30% | 30/15 Summer | | | | 54.029 |
| S1.009 | S20 | 15 Summer | 30 | +30% | 30/15 Summer | | | | 53.793 |
| S1.010 | S11 | 15 Summer | 30 | +30% | 30/15 Summer | | | | 52.760 |
| S4.000 | S25 | 15 Summer | 30 | +30% | | | | | 53.436 |
| S4.001 | S26 | 15 Summer | 30 | +30% | | | | | 53.044 |
| S4.002 | S27 | 1440 Winter | 30 | +30% | 100/15 Summer | | | | 52.067 |
| S5.000 | S29 | 15 Summer | 30 | +30% | | | | | 53.463 |
| S5.001 | S30 | 15 Summer | 30 | +30% | | | | | 53.038 |
| S4.003 | S28 | 1440 Winter | 30 | +30% | 30/480 Summer | | | | 52.066 |
| S4.004 | S29 | 1440 Winter | 30 | +30% | 1/360 Summer | | | | 52.066 |
| S1.011 | S12 | 1440 Winter | 30 | +30% | 1/60 Summer | | | | 52.066 |
| S1.012 | S13 | 30 Winter | 30 | +30% | | | | | 50.038 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| S3.009 | S20 | 0.204 | 0.000 | 1.63 | | | 122.6 | SURCHARGED | |
| S1.009 | S20 | 0.058 | 0.000 | 1.10 | | | 258.9 | SURCHARGED | |
| S1.010 | S11 | 0.385 | 0.000 | 2.39 | | | 256.3 | SURCHARGED | |
| S4.000 | S25 | -0.117 | 0.000 | 0.11 | | | 3.8 | OK | |
| S4.001 | S26 | -0.102 | 0.000 | 0.22 | | | 8.9 | OK* | |
| S4.002 | S27 | -0.043 | 0.000 | 0.05 | | | 0.7 | OK | |
| S5.000 | S29 | -0.107 | 0.000 | 0.18 | | | 6.0 | OK | |
| S5.001 | S30 | -0.078 | 0.000 | 0.46 | | | 18.5 | OK* | |
| S4.003 | S28 | 0.088 | 0.000 | 0.02 | | | 2.4 | SURCHARGED | |
| S4.004 | S29 | 0.586 | 0.000 | 0.04 | | | 2.3 | SURCHARGED | |
| S1.011 | S12 | 0.741 | 0.000 | 0.03 | | | 2.9 | SURCHARGED | |
| S1.012 | S13 | -0.196 | 0.000 | 0.04 | | | 2.9 | OK | |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

### 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 | 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 0.300 |
| Region | England and Wales | Cv (Summer) | 1.000 |
| M5-60 (mm) | 20.000 | Cv (Winter) | 1.000 |

| | | | |
|---|---|---|---|
| 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) | 1, 30, 100 |
| Climate Change (%) | 30, 30, 30 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S10 | 15 Summer | 100 | +30% | | | | | 60.992 |
| S1.001 | S11 | 15 Summer | 100 | +30% | | | | | 59.968 |
| S1.002 | S12 | 15 Summer | 100 | +30% | | | | | 58.984 |
| S1.003 | S13 | 15 Summer | 100 | +30% | | | | | 57.620 |
| S1.004 | S14 | 15 Summer | 100 | +30% | 30/15 Summer | | | | 56.996 |
| S2.000 | S18 | 15 Summer | 100 | +30% | | | | | 57.399 |
| S1.005 | S15 | 15 Summer | 100 | +30% | | | | | 56.551 |
| S1.006 | S16 | 15 Summer | 100 | +30% | | | | | 55.796 |
| S1.007 | S17 | 15 Summer | 100 | +30% | | | | | 55.357 |
| S1.008 | S10 | 15 Summer | 100 | +30% | 100/15 Summer | | | | 54.952 |
| S3.000 | S1 | 15 Summer | 100 | +30% | | | | | 60.991 |
| S3.001 | S2 | 15 Summer | 100 | +30% | | | | | 59.899 |
| S3.002 | S3 | 15 Summer | 100 | +30% | | | | | 58.711 |
| S3.003 | S4 | 15 Summer | 100 | +30% | | | | | 57.640 |
| S3.004 | S5 | 15 Summer | 100 | +30% | 30/15 Summer | | | | 57.002 |
| S3.005 | S6 | 15 Summer | 100 | +30% | | | | | 56.531 |
| S3.006 | S7 | 15 Summer | 100 | +30% | | | | | 55.760 |
| S3.007 | S8 | 15 Summer | 100 | +30% | 100/15 Summer | | | | 55.326 |
| S3.008 | S9 | 15 Summer | 100 | +30% | 100/15 Summer | | | | 55.072 |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S10 | -0.104 | 0.000 | 0.20 | | | 9.9 | OK* | |
| S1.001 | S11 | -0.083 | 0.000 | 0.41 | | | 20.4 | OK* | |
| S1.002 | S12 | -0.071 | 0.000 | 0.54 | | | 26.0 | OK | |
| S1.003 | S13 | -0.089 | 0.000 | 0.67 | | | 62.7 | OK | |
| S1.004 | S14 | 0.172 | 0.000 | 1.42 | | | 70.5 | SURCHARGED | |
| S2.000 | S18 | -0.094 | 0.000 | 0.29 | | | 9.5 | OK | |
| S1.005 | S15 | -0.104 | 0.000 | 0.74 | | | 134.0 | OK | |
| S1.006 | S16 | -0.092 | 0.000 | 0.80 | | | 138.6 | OK | |
| S1.007 | S17 | -0.051 | 0.000 | 0.88 | | | 155.0 | OK | |
| S1.008 | S10 | 0.077 | 0.000 | 0.91 | | | 172.6 | SURCHARGED | |
| S3.000 | S1 | -0.104 | 0.000 | 0.20 | | | 9.8 | OK* | |
| S3.001 | S2 | -0.079 | 0.000 | 0.46 | | | 22.8 | OK* | |
| S3.002 | S3 | -0.071 | 0.000 | 0.54 | | | 25.8 | OK | |
| S3.003 | S4 | -0.098 | 0.000 | 0.61 | | | 59.5 | OK | |
| S3.004 | S5 | 0.251 | 0.000 | 1.92 | | | 70.8 | SURCHARGED | |
| S3.005 | S6 | -0.127 | 0.000 | 0.62 | | | 111.2 | OK | |
| S3.006 | S7 | -0.116 | 0.000 | 0.67 | | | 116.1 | OK | |
| S3.007 | S8 | 0.010 | 0.000 | 0.88 | | | 132.4 | SURCHARGED | |
| S3.008 | S9 | 0.113 | 0.000 | 0.78 | | | 148.1 | SURCHARGED | |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S3.009 | S20 | 15 Summer | 100 | +30% | 30/15 Summer | | | | 54.384 |
| S1.009 | S20 | 15 Summer | 100 | +30% | 30/15 Summer | | | | 54.028 |
| S1.010 | S11 | 15 Summer | 100 | +30% | 30/15 Summer | | | | 52.992 |
| S4.000 | S25 | 15 Summer | 100 | +30% | | | | | 53.441 |
| S4.001 | S26 | 15 Summer | 100 | +30% | | | | | 53.051 |
| S4.002 | S27 | 1440 Winter | 100 | +30% | 100/15 Summer | | | | 52.298 |
| S5.000 | S29 | 15 Summer | 100 | +30% | | | | | 53.469 |
| S5.001 | S30 | 15 Summer | 100 | +30% | | | | | 53.050 |
| S4.003 | S28 | 1440 Winter | 100 | +30% | 30/480 Summer | | | | 52.297 |
| S4.004 | S29 | 1440 Winter | 100 | +30% | 1/360 Summer | | | | 52.297 |
| S1.011 | S12 | 1440 Winter | 100 | +30% | 1/60 Summer | | | | 52.297 |
| S1.012 | S13 | 1440 Winter | 100 | +30% | | | | | 50.038 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| S3.009 | S20 | 0.559 | 0.000 | 1.99 | | | 149.6 | SURCHARGED | |
| S1.009 | S20 | 0.293 | 0.000 | 1.35 | | | 317.1 | SURCHARGED | |
| S1.010 | S11 | 0.617 | 0.000 | 2.98 | | | 319.4 | SURCHARGED | |
| S4.000 | S25 | -0.112 | 0.000 | 0.14 | | | 5.0 | OK | |
| S4.001 | S26 | -0.095 | 0.000 | 0.29 | | | 11.5 | OK* | |
| S4.002 | S27 | 0.188 | 0.000 | 0.06 | | | 0.9 | SURCHARGED | |
| S5.000 | S29 | -0.101 | 0.000 | 0.23 | | | 7.8 | OK | |
| S5.001 | S30 | -0.066 | 0.000 | 0.59 | | | 23.9 | OK* | |
| S4.003 | S28 | 0.319 | 0.000 | 0.03 | | | 2.9 | SURCHARGED | |
| S4.004 | S29 | 0.817 | 0.000 | 0.05 | | | 2.9 | SURCHARGED | |
| S1.011 | S12 | 0.972 | 0.000 | 0.03 | | | 3.0 | SURCHARGED | |
| S1.012 | S13 | -0.196 | 0.000 | 0.04 | | | 3.0 | OK | |

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