

# PROPOSED SURFACE WATER DRAINAGE CALCULATIONS

AT

**HOLT ROAD, WREXHAM**

FOR

**EURO GARAGES LTD**

Our Ref: **10802/002/01**

# **STORM WATER DESIGN NETWORK 1**

|                                                         |                                                              |                                                                                     |
|---------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Sanderson Associates                                    |                                                              | Page 0                                                                              |
| Sanderson House<br>Jubilee Way<br>Huddersfield, WF4 4TD | Euro Garages Ltd<br>Holt Road, Wrexham<br>Storm Network 1 v1 |  |
| Date 19/12/2018 11:11<br>File Storm Net 1 v1.mdx        | Designed by LM<br>Checked by                                 |                                                                                     |
| Micro Drainage                                          | Network 2018.1.1                                             |                                                                                     |

### STORM SEWER DESIGN by the Modified Rational Method

#### Design Criteria for STORM NET 1 V1.SWS

Pipe Sizes STORM NET 2 V1 Manhole Sizes STORM NET 2 V1

|                                        |        |                                       |       |
|----------------------------------------|--------|---------------------------------------|-------|
| FSR Rainfall Model - England and Wales |        |                                       |       |
| Return Period (years)                  | 1      | PIMP (%)                              | 100   |
| M5-60 (mm)                             | 18.000 | Add Flow / Climate Change (%)         | 0     |
| Ratio R                                | 0.322  | Minimum Backdrop Height (m)           | 0.000 |
| Maximum Rainfall (mm/hr)               | 75     | Maximum Backdrop Height (m)           | 0.000 |
| 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

#### Time Area Diagram for STORM NET 1 V1.SWS

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|
| 0-4            | 0.258        | 4-8            | 0.072        |

Total Area Contributing (ha) = 0.330

Total Pipe Volume (m³) = 5.395

#### Network Design Table for STORM NET 1 V1.SWS

# - Indicates pipe length does not match coordinates

| PN    | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                        |
|-------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|-------------|-------------|--------------|---------------------------------------------------------------------------------------|
| 1.000 | 13.208        | 0.403       | 32.8           | 0.067          | 4.00           | 0.0                | 0.600     | o           | 225         | Pipe/Conduit |  |
| 2.000 | 38.470        | 0.508       | 75.7           | 0.028          | 4.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |
| 3.000 | 29.735        | 0.297       | 100.1          | 0.033          | 4.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |

#### Network Results Table

| PN    | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|-------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| 1.000 | 47.77           | 4.10           | 74.950       | 0.067            | 0.0                  | 0.0           | 0.0               | 2.29         | 91.2         | 8.7           |
| 2.000 | 45.90           | 4.55           | 75.300       | 0.028            | 0.0                  | 0.0           | 0.0               | 1.16         | 20.4         | 3.5           |
| 3.000 | 46.14           | 4.49           | 75.300       | 0.033            | 0.0                  | 0.0           | 0.0               | 1.00         | 17.7         | 4.1           |

| Sanderson Associates                                    |                 |                |                |                  |                                                              |                    |                   |              |              | Page 1                                                                              |                                                                                     |
|---------------------------------------------------------|-----------------|----------------|----------------|------------------|--------------------------------------------------------------|--------------------|-------------------|--------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Sanderson House<br>Jubilee Way<br>Huddersfield, WF4 4TD |                 |                |                |                  | Euro Garages Ltd<br>Holt Road, Wrexham<br>Storm Network 1 v1 |                    |                   |              |              |  |                                                                                     |
| Date 19/12/2018 11:11<br>File Storm Net 1 v1.mdx        |                 |                |                |                  | Designed by LM<br>Checked by                                 |                    |                   |              |              |                                                                                     |                                                                                     |
| Micro Drainage                                          |                 |                |                |                  | Network 2018.1.1                                             |                    |                   |              |              |                                                                                     |                                                                                     |
| Network Design Table for STORM NET 1 V1.SWS             |                 |                |                |                  |                                                              |                    |                   |              |              |                                                                                     |                                                                                     |
| PN                                                      | Length<br>(m)   | Fall<br>(m)    | Slope<br>(1:X) | I.Area<br>(ha)   | T.E.<br>(mins)                                               | Base<br>Flow (l/s) | k<br>(mm)         | HYD<br>SECT  | DIA<br>(mm)  | Section Type                                                                        | Auto<br>Design                                                                      |
| 3.001                                                   | 21.109          | 0.211          | 100.0          | 0.000            | 0.00                                                         | 0.0                | 0.600             | o            | 150          | Pipe/Conduit                                                                        |  |
| 2.001                                                   | 4.851           | 0.049          | 99.0           | 0.000            | 0.00                                                         | 0.0                | 0.600             | o            | 150          | Pipe/Conduit                                                                        |  |
| 2.002                                                   | 12.058          | 0.121          | 99.7           | 0.054            | 0.00                                                         | 0.0                | 0.600             | o            | 150          | Pipe/Conduit                                                                        |  |
| 1.001                                                   | 38.740#         | 0.368          | 105.3          | 0.053            | 0.00                                                         | 0.0                | 0.600             | o            | 225          | Pipe/Conduit                                                                        |  |
| 1.002                                                   | 3.001           | 0.030          | 100.0          | 0.000            | 0.00                                                         | 0.0                | 0.600             | o            | 225          | Pipe/Conduit                                                                        |  |
| 4.000                                                   | 17.104          | 0.171          | 100.0          | 0.095            | 4.00                                                         | 0.0                | 0.600             | o            | 225          | Pipe/Conduit                                                                        |  |
| 4.001                                                   | 3.001           | 0.030          | 100.0          | 0.000            | 0.00                                                         | 0.0                | 0.600             | o            | 225          | Pipe/Conduit                                                                        |  |
| 1.003                                                   | 10.411#         | 0.084          | 123.9          | 0.000            | 0.00                                                         | 0.0                | 0.600             | o            | 225          | Pipe/Conduit                                                                        |  |
| 1.004                                                   | 3.000#          | 0.084          | 35.7           | 0.000            | 0.00                                                         | 0.0                | 0.600             | o            | 225          | Pipe/Conduit                                                                        |  |
| Network Results Table                                   |                 |                |                |                  |                                                              |                    |                   |              |              |                                                                                     |                                                                                     |
| PN                                                      | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m)   | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s)                                         | Foul<br>(l/s)      | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s)                                                                       |                                                                                     |
| 3.001                                                   | 44.81           | 4.84           | 75.003         | 0.033            | 0.0                                                          | 0.0                | 0.0               | 1.00         | 17.8         | 4.1                                                                                 |                                                                                     |
| 2.001                                                   | 44.51           | 4.92           | 74.792         | 0.061            | 0.0                                                          | 0.0                | 0.0               | 1.01         | 17.8         | 7.4                                                                                 |                                                                                     |
| 2.002                                                   | 43.81           | 5.12           | 74.743         | 0.115            | 0.0                                                          | 0.0                | 0.0               | 1.01         | 17.8         | 13.6                                                                                |                                                                                     |
| 1.001                                                   | 42.12           | 5.63           | 74.547         | 0.235            | 0.0                                                          | 0.0                | 0.0               | 1.27         | 50.7         | 26.8                                                                                |                                                                                     |
| 1.002                                                   | 42.00           | 5.67           | 74.179         | 0.235            | 0.0                                                          | 0.0                | 0.0               | 1.31         | 52.0         | 26.8                                                                                |                                                                                     |
| 4.000                                                   | 47.25           | 4.22           | 74.350         | 0.095            | 0.0                                                          | 0.0                | 0.0               | 1.31         | 52.0         | 12.2                                                                                |                                                                                     |
| 4.001                                                   | 47.10           | 4.26           | 74.179         | 0.095            | 0.0                                                          | 0.0                | 0.0               | 1.31         | 52.0         | 12.2                                                                                |                                                                                     |
| 1.003                                                   | 41.54           | 5.82           | 74.149         | 0.330            | 0.0                                                          | 0.0                | 0.0               | 1.17         | 46.6         | 37.1                                                                                |                                                                                     |
| 1.004                                                   | 41.47           | 5.84           | 74.065         | 0.330            | 0.0                                                          | 0.0                | 0.0               | 2.20         | 87.3         | 37.1                                                                                |                                                                                     |
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|                                                         |                                                              |                                                                                     |
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| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

Manhole Schedules for STORM NET 1 V1.SWS

| 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) |
|---------|-----------|--------------|---------------|--------------------|-------|---------------------------|---------------|-------|---------------------------|---------------|---------------|
| 100     | 76.050    | 1.100        | Junction      |                    | 1.000 | 74.950                    | 225           |       |                           |               |               |
| 1       | 76.057    | 0.757        | Open Manhole  | 600                | 2.000 | 75.300                    | 150           |       |                           |               |               |
| 4       | 76.078    | 0.778        | Open Manhole  | 600                | 3.000 | 75.300                    | 150           |       |                           |               |               |
| 5       | 76.084    | 1.081        | Open Manhole  | 600                | 3.001 | 75.003                    | 150           | 3.000 | 75.003                    | 150           |               |
| 2       | 76.090    | 1.298        | Open Manhole  | 600                | 2.001 | 74.792                    | 150           | 2.000 | 74.792                    | 150           |               |
|         |           |              |               |                    | 3.001 | 74.792                    | 150           |       |                           |               |               |
| 3       | 76.033    | 1.290        | Open Manhole  | 1200               | 2.002 | 74.743                    | 150           | 2.001 | 74.743                    | 150           |               |
| 101     | 75.985    | 1.438        | Junction      |                    | 1.001 | 74.547                    | 225           | 1.000 | 74.547                    | 225           |               |
|         |           |              |               |                    | 2.002 | 74.622                    | 150           |       |                           |               |               |
| 102     | 75.576    | 1.397        | Junction      |                    | 1.002 | 74.179                    | 225           | 1.001 | 74.179                    | 225           |               |
| 106     | 75.459    | 1.109        | Junction      |                    | 4.000 | 74.350                    | 225           |       |                           |               |               |
| 107     | 75.559    | 1.380        | Junction      |                    | 4.001 | 74.179                    | 225           | 4.000 | 74.179                    | 225           |               |
| 103     | 75.576    | 1.427        | Open Manhole  | 1200               | 1.003 | 74.149                    | 225           | 1.002 | 74.149                    | 225           |               |
|         |           |              |               |                    | 4.001 | 74.149                    | 225           |       |                           |               |               |
| 104     | 75.065    | 1.000        | Junction      |                    | 1.004 | 74.065                    | 225           | 1.003 | 74.065                    | 225           |               |
| 105     | 75.471    | 1.490        | Open Manhole  | 0                  |       | OUTFALL                   |               | 1.004 | 73.981                    | 225           |               |

|                                                         |                                                              |                                                                                     |
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| Micro Drainage<br>Network 2018.1.1                      |                                                              |                                                                                     |

PIPELINE SCHEDULES for STORM NET 1 V1.SWS

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) |
|-------|----------|-----------|---------|-------------|-------------|-------------|---------------|--------------------|
| 1.000 | o        | 225       | 100     | 76.050      | 74.950      | 0.875       | Junction      |                    |
| 2.000 | o        | 150       | 1       | 76.057      | 75.300      | 0.607       | Open Manhole  | 600                |
| 3.000 | o        | 150       | 4       | 76.078      | 75.300      | 0.628       | Open Manhole  | 600                |
| 3.001 | o        | 150       | 5       | 76.084      | 75.003      | 0.931       | Open Manhole  | 600                |
| 2.001 | o        | 150       | 2       | 76.090      | 74.792      | 1.148       | Open Manhole  | 600                |
| 2.002 | o        | 150       | 3       | 76.033      | 74.743      | 1.140       | Open Manhole  | 1200               |
| 1.001 | o        | 225       | 101     | 75.985      | 74.547      | 1.213       | Junction      |                    |
| 1.002 | o        | 225       | 102     | 75.576      | 74.179      | 1.172       | Junction      |                    |
| 4.000 | o        | 225       | 106     | 75.459      | 74.350      | 0.884       | Junction      |                    |
| 4.001 | o        | 225       | 107     | 75.559      | 74.179      | 1.155       | Junction      |                    |
| 1.003 | o        | 225       | 103     | 75.576      | 74.149      | 1.202       | Open Manhole  | 1200               |
| 1.004 | o        | 225       | 104     | 75.065      | 74.065      | 0.775       | Junction      |                    |

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 | 13.208     | 32.8        | 101     | 75.985      | 74.547      | 1.213       | Junction      |                    |
| 2.000 | 38.470     | 75.7        | 2       | 76.090      | 74.792      | 1.148       | Open Manhole  | 600                |
| 3.000 | 29.735     | 100.1       | 5       | 76.084      | 75.003      | 0.931       | Open Manhole  | 600                |
| 3.001 | 21.109     | 100.0       | 2       | 76.090      | 74.792      | 1.148       | Open Manhole  | 600                |
| 2.001 | 4.851      | 99.0        | 3       | 76.033      | 74.743      | 1.140       | Open Manhole  | 1200               |
| 2.002 | 12.058     | 99.7        | 101     | 75.985      | 74.622      | 1.213       | Junction      |                    |
| 1.001 | 38.740#    | 105.3       | 102     | 75.576      | 74.179      | 1.172       | Junction      |                    |
| 1.002 | 3.001      | 100.0       | 103     | 75.576      | 74.149      | 1.202       | Open Manhole  | 1200               |
| 4.000 | 17.104     | 100.0       | 107     | 75.559      | 74.179      | 1.155       | Junction      |                    |
| 4.001 | 3.001      | 100.0       | 103     | 75.576      | 74.149      | 1.202       | Open Manhole  | 1200               |
| 1.003 | 10.411#    | 123.9       | 104     | 75.065      | 74.065      | 0.775       | Junction      |                    |
| 1.004 | 3.000#     | 35.7        | 105     | 75.471      | 73.981      | 1.265       | Open Manhole  | 0                  |

|                                                         |                                                              |                                                                                     |
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| Micro Drainage                                          | Network 2018.1.1                                             |                                                                                     |

Free Flowing Outfall Details for STORM NET 1 V1.SWS

| <b>Outfall<br/>Pipe Number</b> | <b>Outfall<br/>Name</b> | <b>C. Level<br/>(m)</b> | <b>I. Level<br/>(m)</b> | <b>Min<br/>I. Level<br/>(m)</b> | <b>D,L<br/>(mm)</b> | <b>W<br/>(mm)</b> |
|--------------------------------|-------------------------|-------------------------|-------------------------|---------------------------------|---------------------|-------------------|
| 1.004                          | 105                     | 75.471                  | 73.981                  | 0.000                           | 0                   | 0                 |

|                                                                                                                                                                                                                                                    |                                                              |                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
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| Sanderson House<br>Jubilee Way<br>Huddersfield, WF4 4TD                                                                                                                                                                                            | Euro Garages Ltd<br>Holt Road, Wrexham<br>Storm Network 1 v1 |  |
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| Micro Drainage                                                                                                                                                                                                                                     |                                                              | Network 2018.1.1                                                                    |
| <p style="text-align: center;"><u>Online Controls for STORM NET 1 V1.SWS</u></p> <p style="text-align: center;"><u>Pump Manhole: 104, DS/PN: 1.004, Volume (m<sup>3</sup>): 0.4</u></p> <p style="text-align: center;">Invert Level (m) 74.065</p> |                                                              |                                                                                     |
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|                                                         |                                                              |                                                                                     |
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| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

### Storage Structures for STORM NET 1 V1.SWS

#### Filter Drain Manhole: 101, DS/PN: 1.001

|                                      |         |                             |       |
|--------------------------------------|---------|-----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Pipe Diameter (m)           | 0.225 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Pipe Depth above Invert (m) | 0.850 |
| Safety Factor                        | 2.0     | Number of Pipes             | 1     |
| Porosity                             | 0.30    | Slope (1:X)                 | 32.8  |
| Invert Level (m)                     | 74.547  | Cap Volume Depth (m)        | 0.000 |
| Trench Width (m)                     | 0.6     | Cap Infiltration Depth (m)  | 0.000 |
| Trench Length (m)                    | 13.2    |                             |       |

#### Filter Drain Manhole: 102, DS/PN: 1.002

|                                      |         |                             |       |
|--------------------------------------|---------|-----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Pipe Diameter (m)           | 0.225 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Pipe Depth above Invert (m) | 1.172 |
| Safety Factor                        | 2.0     | Number of Pipes             | 1     |
| Porosity                             | 0.30    | Slope (1:X)                 | 105.2 |
| Invert Level (m)                     | 74.179  | Cap Volume Depth (m)        | 0.000 |
| Trench Width (m)                     | 0.6     | Cap Infiltration Depth (m)  | 0.000 |
| Trench Length (m)                    | 38.7    |                             |       |

#### Filter Drain Manhole: 107, DS/PN: 4.001

|                                      |         |                             |       |
|--------------------------------------|---------|-----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Pipe Diameter (m)           | 0.225 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Pipe Depth above Invert (m) | 0.884 |
| Safety Factor                        | 2.0     | Number of Pipes             | 1     |
| Porosity                             | 0.30    | Slope (1:X)                 | 100.0 |
| Invert Level (m)                     | 74.179  | Cap Volume Depth (m)        | 0.000 |
| Trench Width (m)                     | 0.6     | Cap Infiltration Depth (m)  | 0.000 |
| Trench Length (m)                    | 17.1    |                             |       |

#### Infiltration Basin Manhole: 104, DS/PN: 1.004

|                                      |         |               |      |
|--------------------------------------|---------|---------------|------|
| Invert Level (m)                     | 74.065  | Safety Factor | 2.0  |
| Infiltration Coefficient Base (m/hr) | 0.07920 | Porosity      | 1.00 |
| Infiltration Coefficient Side (m/hr) | 0.07920 |               |      |

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|
| 0.000     | 105.0                  | 1.000     | 290.0                  |

**CRITICAL STORM EVENT**  
**(1 in 100yr + 30% c/c)**

Sanderson Associates

Sanderson House

Jubilee Way

Huddersfield, WF4 4TD

Date 19/12/2018 11:15

File Storm Net 1 v1.mdx

Euro Garages Ltd

Holt Road, Wrexham

Storm Network 1 v1

Designed by LM

Checked by

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Micro Drainage

Network 2018.1.1

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

V1.SWS

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 4

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 0.322

Return Period (years)

100 Cv (Summer)

0.750

Region England and Wales

Cv (Winter)

0.840

M5-60 (mm)

18.000

Margin for Flood Risk Warning (mm)

300.0

Analysis Timestep 2.5

Second Increment (Extended)

DTS Status

OFF

DVD Status

ON

Inertia Status

ON

Profile(s)

Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720

Sensitivity flows(s) (%) 0, +30

| PN    | US/MH Name | Storm      | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|-------|------------|------------|----------------|-----------------|-----------------|--------------------|---------------|-----------------|
| 1.000 | 100        | 60 Summer  | +30%           |                 |                 |                    |               | 75.175          |
| 2.000 | 1          | 15 Winter  | +30%           | +0%/15 Summer   |                 |                    |               | 76.053          |
| 3.000 | 4          | 15 Winter  | +30%           | +0%/15 Summer   |                 |                    |               | 76.076          |
| 3.001 | 5          | 15 Summer  | +30%           | +0%/15 Summer   |                 |                    |               | 76.061          |
| 2.001 | 2          | 15 Winter  | +30%           | +0%/15 Summer   |                 |                    |               | 76.042          |
| 2.002 | 3          | 15 Winter  | +30%           | +0%/15 Summer   | +30%/15 Winter  |                    |               | 76.033          |
| 1.001 | 101        | 15 Winter  | +30%           | +0%/15 Summer   |                 |                    |               | 75.600          |
| 1.002 | 102        | 30 Winter  | +30%           | +0%/15 Summer   |                 |                    |               | 74.984          |
| 4.000 | 106        | 360 Winter | +0%            |                 |                 |                    |               | 74.575          |
| 4.001 | 107        | 480 Winter | +30%           | +0%/15 Summer   |                 |                    |               | 74.912          |
| 1.003 | 103        | 480 Winter | +30%           | +0%/15 Summer   |                 |                    |               | 74.912          |
| 1.004 | 104        | 480 Winter | +30%           | +0%/15 Summer   |                 |                    |               | 74.905          |

| PN    | US/MH Name | Depth (m) | Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status      | Level Exceeded |
|-------|------------|-----------|-------------|-------------|----------------|-----------------|-------------|----------------|
| 1.000 | 100        | 0.000     | 0.000       | 0.24        |                | 21.1            | SURCHARGED* |                |

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|                                                         |                                                              |                                                                                     |
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| Date 19/12/2018 11:15<br>File Storm Net 1 v1.mdx        | Designed by LM<br>Checked by                                 |                                                                                     |
| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

Summary of Critical Results by Maximum Level (Rank 1) for STORM NET 1  
V1.SWS

| PN    | US/MH<br>Name | Surcharged   | Flooded        | Flow /<br>Cap. | Overflow<br>(l/s) | Pipe          | Status      | Level<br>Exceeded |
|-------|---------------|--------------|----------------|----------------|-------------------|---------------|-------------|-------------------|
|       |               | Depth<br>(m) | Volume<br>(m³) |                |                   | Flow<br>(l/s) |             |                   |
| 2.000 | 1             | 0.603        | 0.000          | 0.54           |                   | 10.7          | FLOOD RISK  |                   |
| 3.000 | 4             | 0.626        | 0.000          | 0.70           |                   | 11.8          | FLOOD RISK  |                   |
| 3.001 | 5             | 0.908        | 0.000          | 0.63           |                   | 10.5          | FLOOD RISK  |                   |
| 2.001 | 2             | 1.100        | 0.000          | 1.53           |                   | 21.2          | FLOOD RISK  |                   |
| 2.002 | 3             | 1.140        | 0.044          | 1.98           |                   | 31.9          | FLOOD       | 1                 |
| 1.001 | 101           | 0.828        | 0.000          | 1.35           |                   | 68.2          | SURCHARGED* |                   |
| 1.002 | 102           | 0.580        | 0.000          | 2.00           |                   | 59.8          | SURCHARGED* |                   |
| 4.000 | 106           | 0.000        | 0.000          | 0.11           |                   | 5.5           | SURCHARGED* |                   |
| 4.001 | 107           | 0.508        | 0.000          | 0.18           |                   | 5.5           | SURCHARGED* |                   |
| 1.003 | 103           | 0.538        | 0.000          | 0.50           |                   | 19.5          | SURCHARGED  |                   |
| 1.004 | 104           | 0.615        | 0.000          | 0.00           |                   | 0.0           | FLOOD RISK* |                   |

# **STORM WATER DESIGN NETWORK 2**

|                                                         |                                                              |                                                                                     |
|---------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Sanderson Associates                                    |                                                              | Page 0                                                                              |
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| Date 19/12/2018 11:22                                   | Designed by LM                                               |                                                                                     |
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| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

### STORM SEWER DESIGN by the Modified Rational Method

#### Design Criteria for STORM NET 2 V1.SWS

Pipe Sizes STORM NET 2 V1 Manhole Sizes STORM NET 2 V1

|                                        |        |                                       |       |
|----------------------------------------|--------|---------------------------------------|-------|
| FSR Rainfall Model - England and Wales |        |                                       |       |
| Return Period (years)                  | 1      | PIMP (%)                              | 100   |
| M5-60 (mm)                             | 18.000 | Add Flow / Climate Change (%)         | 0     |
| Ratio R                                | 0.322  | Minimum Backdrop Height (m)           | 0.000 |
| Maximum Rainfall (mm/hr)               | 75     | Maximum Backdrop Height (m)           | 0.000 |
| 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

#### Time Area Diagram for STORM NET 2 V1.SWS

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|
| 0-4            | 0.094        | 4-8            | 0.012        |

Total Area Contributing (ha) = 0.106

Total Pipe Volume (m<sup>3</sup>) = 0.934

#### Network Design Table for STORM NET 2 V1.SWS

# - Indicates pipe length does not match coordinates

| PN    | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                        |
|-------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|-------------|-------------|--------------|---------------------------------------------------------------------------------------|
| 1.000 | 26.612        | 0.491       | 54.2           | 0.093          | 4.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |
| 1.001 | 3.065         | 0.030       | 102.2          | 0.000          | 0.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |
| 2.000 | 14.055        | 0.141       | 99.7           | 0.013          | 4.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |
| 2.001 | 3.001         | 0.030       | 100.0          | 0.000          | 0.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |

#### Network Results Table

| PN    | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|-------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| 1.000 | 46.82           | 4.32           | 74.600       | 0.093            | 0.0                  | 0.0           | 0.0               | 1.37         | 24.2         | 11.8          |
| 1.001 | 46.61           | 4.38           | 74.109       | 0.093            | 0.0                  | 0.0           | 0.0               | 0.99         | 17.6         | 11.8          |
| 2.000 | 47.19           | 4.23           | 74.250       | 0.013            | 0.0                  | 0.0           | 0.0               | 1.01         | 17.8         | 1.7           |
| 2.001 | 46.99           | 4.28           | 74.109       | 0.013            | 0.0                  | 0.0           | 0.0               | 1.00         | 17.8         | 1.7           |

|                                                         |                                                              |                                                                                     |
|---------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
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| Date 19/12/2018 11:22<br>File Storm Net 2 v1.mdx        | Designed by LM<br>Checked by                                 |                                                                                     |
| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

Network Design Table for STORM NET 2 V1.SWS

| PN    | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                      |
|-------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|-------------|-------------|--------------|-------------------------------------------------------------------------------------|
| 1.002 | 3.100         | 0.031       | 100.0          | 0.000          | 0.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |
| 1.003 | 3.000#        | 0.041       | 73.2           | 0.000          | 0.00           | 0.0                | 0.600     | o           | 150         | Pipe/Conduit |  |

Network Results Table

| PN    | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|-------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| 1.002 | 46.40           | 4.43           | 74.079       | 0.106            | 0.0                  | 0.0           | 0.0               | 1.00         | 17.8         | 13.3          |
| 1.003 | 46.23           | 4.47           | 74.048       | 0.106            | 0.0                  | 0.0           | 0.0               | 1.18         | 20.8         | 13.3          |

|                                                         |                                                              |                                                                                     |
|---------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
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| File Storm Net 2 v1.mdx                                 | Checked by                                                   |                                                                                     |
| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

Manhole Schedules for STORM NET 2 V1.SWS

| 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) |
|---------|-----------|--------------|---------------|--------------------|-------|---------------------------|---------------|-------|---------------------------|---------------|---------------|
| 200     | 75.700    | 1.100        | Junction      |                    | 1.000 | 74.600                    | 150           |       |                           |               |               |
| 201     | 75.403    | 1.294        | Junction      |                    | 1.001 | 74.109                    | 150           | 1.000 | 74.109                    | 150           |               |
| 205     | 75.350    | 1.100        | Junction      |                    | 2.000 | 74.250                    | 150           |       |                           |               |               |
| 206     | 75.404    | 1.295        | Junction      |                    | 2.001 | 74.109                    | 150           | 2.000 | 74.109                    | 150           |               |
| 202     | 75.410    | 1.331        | Open Manhole  | 1200               | 1.002 | 74.079                    | 150           | 1.001 | 74.079                    | 150           |               |
|         |           |              |               |                    |       |                           |               | 2.001 | 74.079                    | 150           |               |
| 203     | 75.048    | 1.000        | Junction      |                    | 1.003 | 74.048                    | 150           | 1.002 | 74.048                    | 150           |               |
| 204     | 75.254    | 1.247        | Open Manhole  | 0                  |       | OUTFALL                   |               | 1.003 | 74.007                    | 150           |               |

|                                                         |                                                              |                                                                                     |
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| Sanderson Associates                                    |                                                              | Page 3                                                                              |
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| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

PIPELINE SCHEDULES for STORM NET 2 V1.SWS

Upstream Manhole

# - Indicates pipe length does not match coordinates

| PN    | Hyd<br>Sect | Diam<br>(mm) | MH<br>Name | C.Level<br>(m) | I.Level<br>(m) | D.Depth<br>(m) | MH<br>Connection | MH DIAM., L*W<br>(mm) |
|-------|-------------|--------------|------------|----------------|----------------|----------------|------------------|-----------------------|
| 1.000 | o           | 150          | 200        | 75.700         | 74.600         | 0.950          | Junction         |                       |
| 1.001 | o           | 150          | 201        | 75.403         | 74.109         | 1.144          | Junction         |                       |
| 2.000 | o           | 150          | 205        | 75.350         | 74.250         | 0.950          | Junction         |                       |
| 2.001 | o           | 150          | 206        | 75.404         | 74.109         | 1.145          | Junction         |                       |
| 1.002 | o           | 150          | 202        | 75.410         | 74.079         | 1.181          | Open Manhole     | 1200                  |
| 1.003 | o           | 150          | 203        | 75.048         | 74.048         | 0.850          | Junction         |                       |

Downstream Manhole

| PN    | Length<br>(m) | Slope<br>(1:X) | MH<br>Name | C.Level<br>(m) | I.Level<br>(m) | D.Depth<br>(m) | MH<br>Connection | MH DIAM., L*W<br>(mm) |
|-------|---------------|----------------|------------|----------------|----------------|----------------|------------------|-----------------------|
| 1.000 | 26.612        | 54.2           | 201        | 75.403         | 74.109         | 1.144          | Junction         |                       |
| 1.001 | 3.065         | 102.2          | 202        | 75.410         | 74.079         | 1.181          | Open Manhole     | 1200                  |
| 2.000 | 14.055        | 99.7           | 206        | 75.404         | 74.109         | 1.145          | Junction         |                       |
| 2.001 | 3.001         | 100.0          | 202        | 75.410         | 74.079         | 1.181          | Open Manhole     | 1200                  |
| 1.002 | 3.100         | 100.0          | 203        | 75.048         | 74.048         | 0.850          | Junction         |                       |
| 1.003 | 3.000#        | 73.2           | 204        | 75.254         | 74.007         | 1.097          | Open Manhole     | 0                     |

Free Flowing Outfall Details for STORM NET 2 V1.SWS

| Outfall<br>Pipe Number | Outfall<br>Name | C. Level<br>(m) | I. Level<br>(m) | Min<br>I. Level<br>(m) | D,L<br>(mm) | W<br>(mm) |
|------------------------|-----------------|-----------------|-----------------|------------------------|-------------|-----------|
| 1.003                  | 204             | 75.254          | 74.007          | 0.000                  | 0           | 0         |

|                                                                                                                                                   |                                                              |                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Sanderson Associates                                                                                                                              |                                                              | Page 4                                                                              |
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| Date 19/12/2018 11:22<br>File Storm Net 2 v1.mdx                                                                                                  | Designed by LM<br>Checked by                                 |                                                                                     |
| Micro Drainage<br>Network 2018.1.1                                                                                                                |                                                              |                                                                                     |
| <div>Online Controls for STORM NET 2 V1.SWS</div> <div>Pump Manhole: 203, DS/PN: 1.003, Volume (m³): 0.0</div> <div>Invert Level (m) 74.048</div> |                                                              |                                                                                     |
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|                                                         |                                                              |                                                                                     |
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| Date 19/12/2018 11:22                                   | Designed by LM                                               |                                                                                     |
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| Micro Drainage                                          |                                                              | Network 2018.1.1                                                                    |

### Storage Structures for STORM NET 2 V1.SWS

#### Filter Drain Manhole: 201, DS/PN: 1.001

|                                      |         |                             |       |
|--------------------------------------|---------|-----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Pipe Diameter (m)           | 0.150 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Pipe Depth above Invert (m) | 1.144 |
| Safety Factor                        | 2.0     | Number of Pipes             | 1     |
| Porosity                             | 0.30    | Slope (1:X)                 | 54.2  |
| Invert Level (m)                     | 74.109  | Cap Volume Depth (m)        | 0.000 |
| Trench Width (m)                     | 0.6     | Cap Infiltration Depth (m)  | 0.000 |
| Trench Length (m)                    | 26.6    |                             |       |

#### Filter Drain Manhole: 206, DS/PN: 2.001

|                                      |         |                             |       |
|--------------------------------------|---------|-----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Pipe Diameter (m)           | 0.150 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | Pipe Depth above Invert (m) | 1.145 |
| Safety Factor                        | 2.0     | Number of Pipes             | 1     |
| Porosity                             | 0.30    | Slope (1:X)                 | 100.0 |
| Invert Level (m)                     | 74.109  | Cap Volume Depth (m)        | 0.000 |
| Trench Width (m)                     | 0.6     | Cap Infiltration Depth (m)  | 0.000 |
| Trench Length (m)                    | 14.1    |                             |       |

#### Infiltration Basin Manhole: 203, DS/PN: 1.003

|                                      |         |               |      |
|--------------------------------------|---------|---------------|------|
| Invert Level (m)                     | 74.048  | Safety Factor | 2.0  |
| Infiltration Coefficient Base (m/hr) | 0.07920 | Porosity      | 1.00 |
| Infiltration Coefficient Side (m/hr) | 0.07920 |               |      |

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|
| 0.000     | 16.0                   | 1.000     | 157.0                  |

**CRITICAL STORM EVENT**  
**(1 in 100yr + 30% c/c)**

Sanderson Associates

Sanderson House

Jubilee Way

Huddersfield, WF4 4TD

Date 19/12/2018 11:23

File Storm Net 2 v1.mdx

Euro Garages Ltd

Holt Road, Wrexham

Storm Network 2 v1

Designed by LM

Checked by

Page 0



Micro Drainage

Network 2018.1.1

Summary of Critical Results by Maximum Level (Rank 1) for STORM NET 2

V1.SWS

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 3

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 0.332

Return Period (years) 100

Cv (Summer) 0.750

Region England and Wales Cv (Winter) 0.840

M5-60 (mm) 18.000

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5

Second Increment (Extended)

DTS Status OFF

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720

Sensitivity flows(s) (%) 0, +30

PN

US/MH Name

Storm

Climate Change

First (X) Surge

First (Y) Flood

First (Z) Overflow

Overflow Act.

Water Level (m)

1.000

200 180 Summer

+30%

74.750

1.001

201 30 Winter

+30%

+0%/15 Summer

74.829

2.000

205 360 Winter

+0%

74.400

2.001

206 240 Winter

+30%

+0%/15 Summer

74.762

1.002

202 240 Winter

+30%

+0%/15 Summer

74.762

1.003

203 240 Winter

+30%

+0%/15 Summer

74.759

PN

US/MH Name

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Pipe Flow (l/s)

Status

Level Exceeded

1.000

200

0.000

0.000

0.64

15.5

SURCHARGED\*

1.001

201

0.570

0.000

2.42

26.2

SURCHARGED\*

2.000

205

0.000

0.000

0.04

0.7

SURCHARGED\*

2.001

206

0.503

0.000

0.08

0.9

SURCHARGED\*

1.002

202

0.533

0.000

0.88

9.7

SURCHARGED

1.003

203

0.561

0.000

0.00

0.0

FLOOD RISK\*

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