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## **8.7 Appendix G – Thames Water Pre-Development Enquiry**



**Mr Ben Cotterill**  
**Curtins**  
Penn River School,  
Grangewood School,  
Fore Street,  
Pinner,  
HA5 2JQ



07 November 2022

## Pre-planning enquiry: Confirmation of sufficient capacity

**Site Address: Penn River School, Grangewood School, Fore Street, HA5 2JQ**

Dear Ben

Thank you for providing information on your development.

*Existing site: Primary school: 127 pupils with 97 staff members.*  
*Proposed site: Primary school: 180 pupils with 110 staff members.*  
*Proposed foul water discharge by gravity into manhole TQ10880702 OR TQ09889501.*  
*Proposed surface water discharge at 2.9 l/s for all storm events up to and including 1:100yr+40%CC into manhole TQ10880703 OR TQ09889602.*

We have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

### Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul water sewer network to serve your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

**You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.**

### Surface Water

When developing a site, policy 5.13 of the London Plan and Policy 3.4 of the Supplementary Planning Guidance (Sustainable Design And Construction) states that every attempt should be made to use flow attenuation and SuDS/Storage to reduce the surface water discharge from the site as much as possible.

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal

methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

- 1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
- 2) rainwater infiltration to ground at or close to source
- 3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
- 4) rainwater discharge direct to a watercourse (unless not appropriate)
- 5) controlled rainwater discharge to a surface water sewer or drain
- 6) controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is required to manage surface water flows we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

If the above surface water hierarchy has been followed and if the flows are restricted to a total of 2.9 l/s then Thames Water would not have any objections to the proposal.

Please see the attached 'Planning your wastewater' leaflet for additional information.

### What happens next?

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on 07747 641 932

Yours sincerely

**Natalya Collins**

Developer Services – Adoptions Engineer

Mobile: 07747 641 932

Clearwater Court, Vastern Road, Reading, RG1 8DB

Find us online at [developers.thameswater.co.uk](http://developers.thameswater.co.uk)

Get advice on making your sewer connection correctly at [connectright.org.uk](http://connectright.org.uk)

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## **8.8 Appendix H – Causeway Flow Calculations**

### Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 0                 | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 0.900         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 5.00              | Enforce best practice design rules   | x             |

### Nodes

| Name  | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) |
|-------|--------------|------------------|-----------------------|------------------|----------------|-----------------|--------------|
| SW01  | 0.037        | 5.00             | 56.000                | 1200             | 510012.509     | 188869.174      | 0.900        |
| SW02  | 0.036        | 5.00             | 56.800                | 1200             | 509987.951     | 188887.922      | 1.803        |
| SW03  | 0.047        | 5.00             | 56.650                | 1200             | 509968.886     | 188870.546      | 1.739        |
| RWP01 | 0.036        | 5.00             | 56.600                |                  | 509935.806     | 188834.916      | 1.050        |
| SW04  |              |                  | 56.350                | 600              | 509943.872     | 188836.250      | 0.930        |
| RWP02 | 0.020        | 5.00             | 56.600                |                  | 509953.825     | 188831.533      | 1.050        |
| SW05  | 0.015        | 5.00             | 56.350                | 600              | 509951.554     | 188840.271      | 0.988        |
| SW06  | 0.005        | 5.00             | 56.580                | 1200             | 509965.944     | 188846.227      | 1.287        |
| RWP03 | 0.014        | 5.00             | 56.600                |                  | 509958.728     | 188846.665      | 1.050        |
| SW07  |              |                  | 56.500                | 1200             | 509965.031     | 188849.144      | 1.221        |
| RWP04 | 0.036        | 5.00             | 56.600                |                  | 509959.113     | 188853.959      | 1.050        |
| SW08  |              |                  | 56.400                | 1200             | 509963.205     | 188855.220      | 1.224        |
| SW09  | 0.006        | 5.00             | 56.800                | 1200             | 509961.757     | 188859.598      | 1.639        |
| SW10  | 0.008        | 5.00             | 56.950                | 1200             | 509957.955     | 188870.290      | 2.075        |
| SW11  | 0.012        | 5.00             | 56.290                | 1350             | 509932.415     | 188861.954      | 1.669        |
| SW12  | 0.011        | 5.00             | 56.260                | 1350             | 509908.921     | 188853.813      | 1.722        |
| SW13  | 0.014        | 5.00             | 56.290                | 1350             | 509892.778     | 188847.485      | 1.810        |
| SW14  | 0.010        | 5.00             | 56.270                | 1350             | 509877.037     | 188841.614      | 1.846        |
| SW15  | 0.002        | 5.00             | 56.300                | 1350             | 509876.627     | 188836.670      | 1.893        |
| SW16  | 0.006        | 5.00             | 56.200                | 1350             | 509870.874     | 188833.990      | 1.814        |
| SW17  | 0.005        | 5.00             | 56.200                | 1350             | 509873.726     | 188826.192      | 1.842        |

### Nodes

| Name         | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) |
|--------------|--------------|------------------|-----------------------|------------------|----------------|-----------------|--------------|
| SW18         |              |                  | 56.130                | 1350             | 509868.422     | 188823.462      | 1.792        |
| SW19         | 0.018        | 5.00             | 56.330                | 1350             | 509873.334     | 188808.949      | 2.043        |
| SW20         | 0.005        | 5.00             | 56.550                | 1350             | 509879.543     | 188790.182      | 2.329        |
| SW21         | 0.050        | 5.00             | 56.480                | 1350             | 509883.174     | 188787.407      | 2.340        |
| RWP05        | 0.024        | 5.00             | 56.600                |                  | 509956.955     | 188823.327      | 1.000        |
| SW22         | 0.009        | 5.00             | 56.350                | 600              | 509954.278     | 188816.784      | 0.946        |
| SW23         |              |                  | 56.350                | 600              | 509936.873     | 188810.949      | 1.068        |
| RWP06        | 0.031        | 5.00             | 56.600                |                  | 509939.505     | 188823.255      | 1.050        |
| SW24         | 0.007        | 5.00             | 56.350                | 1200             | 509933.588     | 188814.447      | 1.100        |
| RWP07        | 0.034        | 5.00             | 56.600                |                  | 509915.453     | 188838.197      | 1.000        |
| SW25         | 0.028        | 5.00             | 56.350                | 600              | 509920.824     | 188836.276      | 0.932        |
| SW26         |              |                  | 56.400                | 1200             | 509926.202     | 188818.726      | 1.282        |
| RWP08        | 0.033        | 5.00             | 56.600                |                  | 509885.664     | 188828.064      | 1.000        |
| SW27         |              |                  | 56.350                | 600              | 509888.168     | 188825.754      | 0.909        |
| RWP09        | 0.024        | 5.00             | 56.600                |                  | 509887.082     | 188819.377      | 1.000        |
| SW28         |              |                  | 56.350                | 600              | 509890.165     | 188819.314      | 0.954        |
| RWP10        | 0.044        | 5.00             | 56.600                |                  | 509907.201     | 188823.340      | 1.050        |
| SW29         | 0.022        | 5.00             | 56.350                | 600              | 509896.898     | 188818.740      | 0.950        |
| SW30         |              |                  | 56.320                | 1200             | 509895.858     | 188808.740      | 1.308        |
| RWP11        | 0.031        | 5.00             | 56.600                |                  | 509912.241     | 188808.676      | 1.050        |
| SW31         | 0.004        | 5.00             | 56.310                | 1200             | 509897.643     | 188801.511      | 1.323        |
| RWP12        | 0.032        | 5.00             | 56.600                |                  | 509893.800     | 188797.524      | 1.000        |
| SW32         |              |                  | 56.300                | 1200             | 509900.606     | 188797.807      | 2.160        |
| SW33         | 0.040        | 5.00             | 56.100                |                  | 509913.464     | 188784.215      | 1.960        |
| SW33 OUTFALL |              |                  | 56.100                | 1200             | 509914.424     | 188782.411      | 1.980        |

## Links

| Name  | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|-------|---------|---------|------------|-------------|-----------|-----------|----------|-------------|----------|---------------|--------------|
| 1.000 | SW01    | SW02    | 30.896     | 0.600       | 55.100    | 54.997    | 0.103    | 300.0       | 300      | 5.57          | 50.0         |
| 1.001 | SW02    | SW03    | 25.795     | 0.600       | 54.997    | 54.911    | 0.086    | 300.0       | 300      | 6.05          | 50.0         |
| 1.002 | SW03    | SW10    | 10.934     | 0.600       | 54.911    | 54.875    | 0.036    | 300.0       | 300      | 6.25          | 50.0         |
| 2.000 | RWP01   | SW04    | 8.176      | 0.600       | 55.550    | 55.495    | 0.055    | 150.0       | 150      | 5.17          | 50.0         |
| 2.001 | SW04    | SW05    | 8.671      | 0.600       | 55.420    | 55.362    | 0.058    | 150.0       | 225      | 5.30          | 50.0         |
| 3.000 | RWP02   | SW05    | 9.028      | 0.600       | 55.550    | 55.490    | 0.060    | 150.0       | 150      | 5.18          | 50.0         |
| 2.002 | SW05    | SW06    | 15.574     | 0.600       | 55.362    | 55.293    | 0.069    | 225.0       | 225      | 5.60          | 50.0         |
| 2.003 | SW06    | SW07    | 3.057      | 0.600       | 55.293    | 55.279    | 0.014    | 225.0       | 225      | 5.66          | 50.0         |
| 4.000 | RWP03   | SW07    | 6.773      | 0.600       | 55.550    | 55.505    | 0.045    | 150.0       | 150      | 5.14          | 50.0         |
| 2.004 | SW07    | SW08    | 6.344      | 0.600       | 55.279    | 55.251    | 0.028    | 225.0       | 225      | 5.78          | 50.0         |
| 5.000 | RWP04   | SW08    | 4.282      | 0.600       | 55.550    | 55.521    | 0.029    | 150.0       | 150      | 5.09          | 50.0         |
| 2.005 | SW08    | SW09    | 4.611      | 0.600       | 55.176    | 55.161    | 0.015    | 300.0       | 300      | 5.87          | 50.0         |
| 2.006 | SW09    | SW10    | 11.348     | 0.600       | 55.161    | 55.123    | 0.038    | 300.0       | 300      | 6.08          | 50.0         |
| 1.003 | SW10    | SW11    | 26.866     | 0.600       | 54.875    | 54.696    | 0.179    | 150.0       | 300      | 6.60          | 50.0         |

| Name  | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|-------|-----------|-----------|------------|--------------|--------------|-------------|--------------------|----------------|--------------------|
| 1.000 | 0.902     | 63.8      | 5.0        | 0.600        | 1.503        | 0.037       | 0.0                | 57             | 0.542              |
| 1.001 | 0.902     | 63.8      | 9.8        | 1.503        | 1.439        | 0.073       | 0.0                | 79             | 0.659              |
| 1.002 | 0.902     | 63.8      | 16.2       | 1.439        | 1.775        | 0.120       | 0.0                | 103            | 0.757              |
| 2.000 | 0.818     | 14.5      | 4.8        | 0.900        | 0.705        | 0.036       | 0.0                | 59             | 0.736              |
| 2.001 | 1.065     | 42.3      | 4.8        | 0.705        | 0.763        | 0.036       | 0.0                | 51             | 0.714              |
| 3.000 | 0.818     | 14.5      | 2.7        | 0.900        | 0.710        | 0.020       | 0.0                | 44             | 0.626              |
| 2.002 | 0.867     | 34.5      | 9.5        | 0.763        | 1.062        | 0.070       | 0.0                | 80             | 0.742              |
| 2.003 | 0.867     | 34.5      | 10.2       | 1.062        | 0.996        | 0.075       | 0.0                | 84             | 0.758              |
| 4.000 | 0.818     | 14.5      | 1.9        | 0.900        | 0.845        | 0.014       | 0.0                | 37             | 0.571              |
| 2.004 | 0.867     | 34.5      | 12.1       | 0.996        | 0.924        | 0.089       | 0.0                | 92             | 0.792              |
| 5.000 | 0.818     | 14.5      | 4.8        | 0.900        | 0.729        | 0.036       | 0.0                | 59             | 0.736              |
| 2.005 | 0.902     | 63.8      | 16.9       | 0.924        | 1.339        | 0.125       | 0.0                | 105            | 0.766              |
| 2.006 | 0.902     | 63.8      | 17.8       | 1.339        | 1.527        | 0.131       | 0.0                | 108            | 0.776              |
| 1.003 | 1.281     | 90.6      | 35.1       | 1.775        | 1.294        | 0.259       | 0.0                | 130            | 1.204              |

## Links

| Name  | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|-------|---------|---------|------------|-------------|-----------|-----------|----------|-------------|----------|---------------|--------------|
| 1.004 | SW11    | SW12    | 24.865     | 0.600       | 54.621    | 54.538    | 0.083    | 300.0       | 375      | 7.00          | 50.0         |
| 1.005 | SW12    | SW13    | 17.339     | 0.600       | 54.538    | 54.480    | 0.058    | 300.0       | 375      | 7.27          | 50.0         |
| 1.006 | SW13    | SW14    | 16.800     | 0.600       | 54.480    | 54.424    | 0.056    | 300.0       | 375      | 7.54          | 50.0         |
| 1.007 | SW14    | SW15    | 4.961      | 0.600       | 54.424    | 54.407    | 0.017    | 300.0       | 375      | 7.62          | 50.0         |
| 1.008 | SW15    | SW16    | 6.347      | 0.600       | 54.407    | 54.386    | 0.021    | 300.0       | 375      | 7.72          | 50.0         |
| 1.009 | SW16    | SW17    | 8.303      | 0.600       | 54.386    | 54.358    | 0.028    | 300.0       | 375      | 7.86          | 50.0         |
| 1.010 | SW17    | SW18    | 5.965      | 0.600       | 54.358    | 54.338    | 0.020    | 300.0       | 375      | 7.95          | 50.0         |
| 1.011 | SW18    | SW19    | 15.322     | 0.600       | 54.338    | 54.287    | 0.051    | 300.0       | 375      | 8.20          | 50.0         |
| 1.012 | SW19    | SW20    | 19.767     | 0.600       | 54.287    | 54.221    | 0.066    | 300.0       | 375      | 8.52          | 50.0         |
| 1.013 | SW20    | SW21    | 4.570      | 0.600       | 54.221    | 54.140    | 0.081    | 56.4        | 375      | 8.55          | 50.0         |
| 1.014 | SW21    | SW33    | 30.458     | 0.600       | 54.140    | 54.140    | 0.000    | 0.0         | 375      | 9.05          | 50.0         |
| 6.000 | RWP05   | SW22    | 7.069      | 0.600       | 55.600    | 55.529    | 0.071    | 100.0       | 100      | 5.15          | 50.0         |
| 6.001 | SW22    | SW23    | 18.357     | 0.600       | 55.404    | 55.282    | 0.122    | 150.0       | 225      | 5.44          | 50.0         |
| 6.002 | SW23    | SW24    | 4.799      | 0.600       | 55.282    | 55.250    | 0.032    | 150.0       | 225      | 5.52          | 50.0         |

| Name  | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|-------|-----------|-----------|------------|--------------|--------------|-------------|--------------------|----------------|--------------------|
| 1.004 | 1.041     | 114.9     | 36.8       | 1.294        | 1.347        | 0.271       | 0.0                | 145            | 0.929              |
| 1.005 | 1.041     | 114.9     | 38.2       | 1.347        | 1.435        | 0.282       | 0.0                | 148            | 0.938              |
| 1.006 | 1.041     | 114.9     | 40.1       | 1.435        | 1.471        | 0.296       | 0.0                | 153            | 0.951              |
| 1.007 | 1.041     | 114.9     | 41.4       | 1.471        | 1.518        | 0.306       | 0.0                | 156            | 0.959              |
| 1.008 | 1.041     | 114.9     | 41.7       | 1.518        | 1.439        | 0.308       | 0.0                | 156            | 0.959              |
| 1.009 | 1.041     | 114.9     | 42.5       | 1.439        | 1.467        | 0.313       | 0.0                | 158            | 0.966              |
| 1.010 | 1.041     | 114.9     | 43.1       | 1.467        | 1.417        | 0.318       | 0.0                | 159            | 0.968              |
| 1.011 | 1.041     | 114.9     | 43.1       | 1.417        | 1.668        | 0.318       | 0.0                | 159            | 0.968              |
| 1.012 | 1.041     | 114.9     | 45.6       | 1.668        | 1.954        | 0.336       | 0.0                | 164            | 0.982              |
| 1.013 | 2.416     | 266.8     | 46.3       | 1.954        | 1.965        | 0.342       | 0.0                | 105            | 1.830              |
| 1.014 | 1.000     | 110.4     | 53.1       | 1.965        | 1.585        | 0.392       | 0.0                | 0              | ∞                  |
| 6.000 | 0.769     | 6.0       | 3.3        | 0.900        | 0.721        | 0.024       | 0.0                | 53             | 0.786              |
| 6.001 | 1.065     | 42.3      | 4.6        | 0.721        | 0.843        | 0.034       | 0.0                | 50             | 0.700              |
| 6.002 | 1.065     | 42.3      | 4.6        | 0.843        | 0.875        | 0.034       | 0.0                | 50             | 0.700              |

## Links

| Name   | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|--------|---------|---------|------------|-------------|-----------|-----------|----------|-------------|----------|---------------|--------------|
| 7.000  | RWP06   | SW24    | 10.611     | 0.600       | 55.550    | 55.479    | 0.071    | 150.0       | 150      | 5.22          | 50.0         |
| 6.003  | SW24    | SW26    | 8.536      | 0.600       | 55.250    | 55.193    | 0.057    | 150.0       | 225      | 5.65          | 50.0         |
| 8.000  | RWP07   | SW25    | 5.704      | 0.600       | 55.600    | 55.543    | 0.057    | 100.0       | 100      | 5.12          | 50.0         |
| 8.001  | SW25    | SW26    | 18.356     | 0.600       | 55.418    | 55.336    | 0.082    | 225.0       | 225      | 5.48          | 50.0         |
| 6.004  | SW26    | SW30    | 31.945     | 0.600       | 55.118    | 55.012    | 0.106    | 300.0       | 300      | 6.24          | 50.0         |
| 9.000  | RWP08   | SW27    | 3.407      | 0.600       | 55.600    | 55.566    | 0.034    | 100.0       | 100      | 5.07          | 50.0         |
| 9.001  | SW27    | SW28    | 6.743      | 0.600       | 55.441    | 55.396    | 0.045    | 150.0       | 225      | 5.18          | 50.0         |
| 10.000 | RWP09   | SW28    | 3.084      | 0.600       | 55.600    | 55.569    | 0.031    | 100.0       | 100      | 5.07          | 50.0         |
| 9.002  | SW28    | SW30    | 12.009     | 0.600       | 55.396    | 55.316    | 0.080    | 150.0       | 225      | 5.37          | 50.0         |
| 11.000 | RWP10   | SW29    | 11.283     | 0.600       | 55.550    | 55.475    | 0.075    | 150.0       | 150      | 5.23          | 50.0         |
| 11.001 | SW29    | SW30    | 10.054     | 0.600       | 55.400    | 55.333    | 0.067    | 150.0       | 225      | 5.39          | 50.0         |
| 6.005  | SW30    | SW31    | 7.446      | 0.600       | 55.012    | 54.987    | 0.025    | 300.0       | 300      | 6.38          | 50.0         |
| 12.000 | RWP11   | SW31    | 16.262     | 0.600       | 55.550    | 55.387    | 0.163    | 100.0       | 150      | 5.27          | 50.0         |
| 6.006  | SW31    | SW32    | 4.743      | 0.600       | 54.987    | 54.971    | 0.016    | 300.0       | 300      | 6.46          | 50.0         |

| Name   | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|--------|-----------|-----------|------------|--------------|--------------|-------------|--------------------|----------------|--------------------|
| 7.000  | 0.818     | 14.5      | 4.2        | 0.900        | 0.721        | 0.031       | 0.0                | 55             | 0.710              |
| 6.003  | 1.065     | 42.3      | 9.8        | 0.875        | 0.982        | 0.072       | 0.0                | 73             | 0.870              |
| 8.000  | 0.769     | 6.0       | 4.6        | 0.900        | 0.707        | 0.034       | 0.0                | 65             | 0.846              |
| 8.001  | 0.867     | 34.5      | 8.3        | 0.707        | 0.839        | 0.062       | 0.0                | 75             | 0.717              |
| 6.004  | 0.902     | 63.8      | 18.1       | 0.982        | 1.008        | 0.134       | 0.0                | 109            | 0.780              |
| 9.000  | 0.769     | 6.0       | 4.5        | 0.900        | 0.684        | 0.033       | 0.0                | 64             | 0.843              |
| 9.001  | 1.065     | 42.3      | 4.5        | 0.684        | 0.729        | 0.033       | 0.0                | 50             | 0.700              |
| 10.000 | 0.769     | 6.0       | 3.3        | 0.900        | 0.681        | 0.024       | 0.0                | 53             | 0.786              |
| 9.002  | 1.065     | 42.3      | 7.8        | 0.729        | 0.779        | 0.058       | 0.0                | 65             | 0.818              |
| 11.000 | 0.818     | 14.5      | 5.9        | 0.900        | 0.725        | 0.044       | 0.0                | 67             | 0.776              |
| 11.001 | 1.065     | 42.3      | 8.9        | 0.725        | 0.762        | 0.066       | 0.0                | 70             | 0.847              |
| 6.005  | 0.902     | 63.8      | 34.8       | 1.008        | 1.023        | 0.257       | 0.0                | 158            | 0.921              |
| 12.000 | 1.005     | 17.8      | 4.1        | 0.900        | 0.773        | 0.031       | 0.0                | 49             | 0.818              |
| 6.006  | 0.902     | 63.8      | 39.5       | 1.023        | 1.029        | 0.291       | 0.0                | 171            | 0.948              |

## Links

| Name   | US Node | DS Node      | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|--------|---------|--------------|------------|-------------|-----------|-----------|----------|-------------|----------|---------------|--------------|
| 13.000 | RWP12   | SW32         | 6.812      | 0.600       | 55.600    | 55.532    | 0.068    | 100.0       | 100      | 5.15          | 50.0         |
| 6.007  | SW32    | SW33         | 18.710     | 0.600       | 54.140    | 54.140    | 0.000    | 0.0         | 300      | 6.78          | 50.0         |
| 1.015  | SW33    | SW33 OUTFALL | 2.044      | 0.600       | 54.140    | 54.120    | 0.020    | 102.2       | 150      | 9.09          | 50.0         |

| Name   | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|--------|-----------|-----------|------------|--------------|--------------|-------------|--------------------|----------------|--------------------|
| 13.000 | 0.769     | 6.0       | 4.4        | 0.900        | 0.668        | 0.032       | 0.0                | 63             | 0.837              |
| 6.007  | 1.000     | 70.7      | 43.9       | 1.860        | 1.660        | 0.324       | 0.0                | 0              | ∞                  |
| 1.015  | 0.994     | 17.6      | 102.3      | 1.810        | 1.830        | 0.755       | 0.0                | 150            | 1.012              |

## Pipeline Schedule

| Link  | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|-------|------------|-------------|----------|-----------|-----------|-----------|--------------|-----------|-----------|--------------|
| 1.000 | 30.896     | 300.0       | 300      | Circular  | 56.000    | 55.100    | 0.600        | 56.800    | 54.997    | 1.503        |
| 1.001 | 25.795     | 300.0       | 300      | Circular  | 56.800    | 54.997    | 1.503        | 56.650    | 54.911    | 1.439        |
| 1.002 | 10.934     | 300.0       | 300      | Circular  | 56.650    | 54.911    | 1.439        | 56.950    | 54.875    | 1.775        |
| 2.000 | 8.176      | 150.0       | 150      | Circular  | 56.600    | 55.550    | 0.900        | 56.350    | 55.495    | 0.705        |
| 2.001 | 8.671      | 150.0       | 225      | Circular  | 56.350    | 55.420    | 0.705        | 56.350    | 55.362    | 0.763        |
| 3.000 | 9.028      | 150.0       | 150      | Circular  | 56.600    | 55.550    | 0.900        | 56.350    | 55.490    | 0.710        |
| 2.002 | 15.574     | 225.0       | 225      | Circular  | 56.350    | 55.362    | 0.763        | 56.580    | 55.293    | 1.062        |

| Link  | US Node | Dia (mm) | Node Type | MH Type   | DS Node | Dia (mm) | Node Type | MH Type   |
|-------|---------|----------|-----------|-----------|---------|----------|-----------|-----------|
| 1.000 | SW01    | 1200     | Manhole   | Adoptable | SW02    | 1200     | Manhole   | Adoptable |
| 1.001 | SW02    | 1200     | Manhole   | Adoptable | SW03    | 1200     | Manhole   | Adoptable |
| 1.002 | SW03    | 1200     | Manhole   | Adoptable | SW10    | 1200     | Manhole   | Adoptable |
| 2.000 | RWP01   |          | Junction  |           | SW04    | 600      | Manhole   | Adoptable |
| 2.001 | SW04    | 600      | Manhole   | Adoptable | SW05    | 600      | Manhole   | Adoptable |
| 3.000 | RWP02   |          | Junction  |           | SW05    | 600      | Manhole   | Adoptable |
| 2.002 | SW05    | 600      | Manhole   | Adoptable | SW06    | 1200     | Manhole   | Adoptable |

### Pipeline Schedule

| Link  | Length<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | US CL<br>(m) | US IL<br>(m) | US Depth<br>(m) | DS CL<br>(m) | DS IL<br>(m) | DS Depth<br>(m) |
|-------|---------------|----------------|-------------|--------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
| 2.003 | 3.057         | 225.0          | 225         | Circular     | 56.580       | 55.293       | 1.062           | 56.500       | 55.279       | 0.996           |
| 4.000 | 6.773         | 150.0          | 150         | Circular     | 56.600       | 55.550       | 0.900           | 56.500       | 55.505       | 0.845           |
| 2.004 | 6.344         | 225.0          | 225         | Circular     | 56.500       | 55.279       | 0.996           | 56.400       | 55.251       | 0.924           |
| 5.000 | 4.282         | 150.0          | 150         | Circular     | 56.600       | 55.550       | 0.900           | 56.400       | 55.521       | 0.729           |
| 2.005 | 4.611         | 300.0          | 300         | Circular     | 56.400       | 55.176       | 0.924           | 56.800       | 55.161       | 1.339           |
| 2.006 | 11.348        | 300.0          | 300         | Circular     | 56.800       | 55.161       | 1.339           | 56.950       | 55.123       | 1.527           |
| 1.003 | 26.866        | 150.0          | 300         | Circular     | 56.950       | 54.875       | 1.775           | 56.290       | 54.696       | 1.294           |
| 1.004 | 24.865        | 300.0          | 375         | Circular     | 56.290       | 54.621       | 1.294           | 56.260       | 54.538       | 1.347           |
| 1.005 | 17.339        | 300.0          | 375         | Circular     | 56.260       | 54.538       | 1.347           | 56.290       | 54.480       | 1.435           |
| 1.006 | 16.800        | 300.0          | 375         | Circular     | 56.290       | 54.480       | 1.435           | 56.270       | 54.424       | 1.471           |
| 1.007 | 4.961         | 300.0          | 375         | Circular     | 56.270       | 54.424       | 1.471           | 56.300       | 54.407       | 1.518           |
| 1.008 | 6.347         | 300.0          | 375         | Circular     | 56.300       | 54.407       | 1.518           | 56.200       | 54.386       | 1.439           |
| 1.009 | 8.303         | 300.0          | 375         | Circular     | 56.200       | 54.386       | 1.439           | 56.200       | 54.358       | 1.467           |
| 1.010 | 5.965         | 300.0          | 375         | Circular     | 56.200       | 54.358       | 1.467           | 56.130       | 54.338       | 1.417           |
| 1.011 | 15.322        | 300.0          | 375         | Circular     | 56.130       | 54.338       | 1.417           | 56.330       | 54.287       | 1.668           |

| Link  | US<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type | DS<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type |
|-------|------------|-------------|--------------|------------|------------|-------------|--------------|------------|
| 2.003 | SW06       | 1200        | Manhole      | Adoptable  | SW07       | 1200        | Manhole      | Adoptable  |
| 4.000 | RWP03      |             | Junction     |            | SW07       | 1200        | Manhole      | Adoptable  |
| 2.004 | SW07       | 1200        | Manhole      | Adoptable  | SW08       | 1200        | Manhole      | Adoptable  |
| 5.000 | RWP04      |             | Junction     |            | SW08       | 1200        | Manhole      | Adoptable  |
| 2.005 | SW08       | 1200        | Manhole      | Adoptable  | SW09       | 1200        | Manhole      | Adoptable  |
| 2.006 | SW09       | 1200        | Manhole      | Adoptable  | SW10       | 1200        | Manhole      | Adoptable  |
| 1.003 | SW10       | 1200        | Manhole      | Adoptable  | SW11       | 1350        | Manhole      | Adoptable  |
| 1.004 | SW11       | 1350        | Manhole      | Adoptable  | SW12       | 1350        | Manhole      | Adoptable  |
| 1.005 | SW12       | 1350        | Manhole      | Adoptable  | SW13       | 1350        | Manhole      | Adoptable  |
| 1.006 | SW13       | 1350        | Manhole      | Adoptable  | SW14       | 1350        | Manhole      | Adoptable  |
| 1.007 | SW14       | 1350        | Manhole      | Adoptable  | SW15       | 1350        | Manhole      | Adoptable  |
| 1.008 | SW15       | 1350        | Manhole      | Adoptable  | SW16       | 1350        | Manhole      | Adoptable  |
| 1.009 | SW16       | 1350        | Manhole      | Adoptable  | SW17       | 1350        | Manhole      | Adoptable  |
| 1.010 | SW17       | 1350        | Manhole      | Adoptable  | SW18       | 1350        | Manhole      | Adoptable  |
| 1.011 | SW18       | 1350        | Manhole      | Adoptable  | SW19       | 1350        | Manhole      | Adoptable  |

## Pipeline Schedule

| Link   | Length<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | US CL<br>(m) | US IL<br>(m) | US Depth<br>(m) | DS CL<br>(m) | DS IL<br>(m) | DS Depth<br>(m) |
|--------|---------------|----------------|-------------|--------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
| 1.012  | 19.767        | 300.0          | 375         | Circular     | 56.330       | 54.287       | 1.668           | 56.550       | 54.221       | 1.954           |
| 1.013  | 4.570         | 56.4           | 375         | Circular     | 56.550       | 54.221       | 1.954           | 56.480       | 54.140       | 1.965           |
| 1.014  | 30.458        | 0.0            | 375         | Circular     | 56.480       | 54.140       | 1.965           | 56.100       | 54.140       | 1.585           |
| 6.000  | 7.069         | 100.0          | 100         | Circular     | 56.600       | 55.600       | 0.900           | 56.350       | 55.529       | 0.721           |
| 6.001  | 18.357        | 150.0          | 225         | Circular     | 56.350       | 55.404       | 0.721           | 56.350       | 55.282       | 0.843           |
| 6.002  | 4.799         | 150.0          | 225         | Circular     | 56.350       | 55.282       | 0.843           | 56.350       | 55.250       | 0.875           |
| 7.000  | 10.611        | 150.0          | 150         | Circular     | 56.600       | 55.550       | 0.900           | 56.350       | 55.479       | 0.721           |
| 6.003  | 8.536         | 150.0          | 225         | Circular     | 56.350       | 55.250       | 0.875           | 56.400       | 55.193       | 0.982           |
| 8.000  | 5.704         | 100.0          | 100         | Circular     | 56.600       | 55.600       | 0.900           | 56.350       | 55.543       | 0.707           |
| 8.001  | 18.356        | 225.0          | 225         | Circular     | 56.350       | 55.418       | 0.707           | 56.400       | 55.336       | 0.839           |
| 6.004  | 31.945        | 300.0          | 300         | Circular     | 56.400       | 55.118       | 0.982           | 56.320       | 55.012       | 1.008           |
| 9.000  | 3.407         | 100.0          | 100         | Circular     | 56.600       | 55.600       | 0.900           | 56.350       | 55.566       | 0.684           |
| 9.001  | 6.743         | 150.0          | 225         | Circular     | 56.350       | 55.441       | 0.684           | 56.350       | 55.396       | 0.729           |
| 10.000 | 3.084         | 100.0          | 100         | Circular     | 56.600       | 55.600       | 0.900           | 56.350       | 55.569       | 0.681           |
| 9.002  | 12.009        | 150.0          | 225         | Circular     | 56.350       | 55.396       | 0.729           | 56.320       | 55.316       | 0.779           |

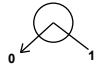
| Link   | US<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type | DS<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type |
|--------|------------|-------------|--------------|------------|------------|-------------|--------------|------------|
| 1.012  | SW19       | 1350        | Manhole      | Adoptable  | SW20       | 1350        | Manhole      | Adoptable  |
| 1.013  | SW20       | 1350        | Manhole      | Adoptable  | SW21       | 1350        | Manhole      | Adoptable  |
| 1.014  | SW21       | 1350        | Manhole      | Adoptable  | SW33       |             | Junction     |            |
| 6.000  | RWP05      |             | Junction     |            | SW22       | 600         | Manhole      | Adoptable  |
| 6.001  | SW22       | 600         | Manhole      | Adoptable  | SW23       | 600         | Manhole      | Adoptable  |
| 6.002  | SW23       | 600         | Manhole      | Adoptable  | SW24       | 1200        | Manhole      | Adoptable  |
| 7.000  | RWP06      |             | Junction     |            | SW24       | 1200        | Manhole      | Adoptable  |
| 6.003  | SW24       | 1200        | Manhole      | Adoptable  | SW26       | 1200        | Manhole      | Adoptable  |
| 8.000  | RWP07      |             | Junction     |            | SW25       | 600         | Manhole      | Adoptable  |
| 8.001  | SW25       | 600         | Manhole      | Adoptable  | SW26       | 1200        | Manhole      | Adoptable  |
| 6.004  | SW26       | 1200        | Manhole      | Adoptable  | SW30       | 1200        | Manhole      | Adoptable  |
| 9.000  | RWP08      |             | Junction     |            | SW27       | 600         | Manhole      | Adoptable  |
| 9.001  | SW27       | 600         | Manhole      | Adoptable  | SW28       | 600         | Manhole      | Adoptable  |
| 10.000 | RWP09      |             | Junction     |            | SW28       | 600         | Manhole      | Adoptable  |
| 9.002  | SW28       | 600         | Manhole      | Adoptable  | SW30       | 1200        | Manhole      | Adoptable  |

## Pipeline Schedule

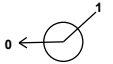
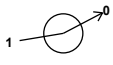
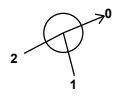
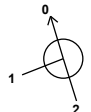
| Link   | Length<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | US CL<br>(m) | US IL<br>(m) | US Depth<br>(m) | DS CL<br>(m) | DS IL<br>(m) | DS Depth<br>(m) |
|--------|---------------|----------------|-------------|--------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
| 11.000 | 11.283        | 150.0          | 150         | Circular     | 56.600       | 55.550       | 0.900           | 56.350       | 55.475       | 0.725           |
| 11.001 | 10.054        | 150.0          | 225         | Circular     | 56.350       | 55.400       | 0.725           | 56.320       | 55.333       | 0.762           |
| 6.005  | 7.446         | 300.0          | 300         | Circular     | 56.320       | 55.012       | 1.008           | 56.310       | 54.987       | 1.023           |
| 12.000 | 16.262        | 100.0          | 150         | Circular     | 56.600       | 55.550       | 0.900           | 56.310       | 55.387       | 0.773           |
| 6.006  | 4.743         | 300.0          | 300         | Circular     | 56.310       | 54.987       | 1.023           | 56.300       | 54.971       | 1.029           |
| 13.000 | 6.812         | 100.0          | 100         | Circular     | 56.600       | 55.600       | 0.900           | 56.300       | 55.532       | 0.668           |
| 6.007  | 18.710        | 0.0            | 300         | Circular     | 56.300       | 54.140       | 1.860           | 56.100       | 54.140       | 1.660           |
| 1.015  | 2.044         | 102.2          | 150         | Circular     | 56.100       | 54.140       | 1.810           | 56.100       | 54.120       | 1.830           |

| Link   | US<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type | DS<br>Node   | Dia<br>(mm) | Node<br>Type | MH<br>Type |
|--------|------------|-------------|--------------|------------|--------------|-------------|--------------|------------|
| 11.000 | RWP10      |             | Junction     |            | SW29         | 600         | Manhole      | Adoptable  |
| 11.001 | SW29       | 600         | Manhole      | Adoptable  | SW30         | 1200        | Manhole      | Adoptable  |
| 6.005  | SW30       | 1200        | Manhole      | Adoptable  | SW31         | 1200        | Manhole      | Adoptable  |
| 12.000 | RWP11      |             | Junction     |            | SW31         | 1200        | Manhole      | Adoptable  |
| 6.006  | SW31       | 1200        | Manhole      | Adoptable  | SW32         | 1200        | Manhole      | Adoptable  |
| 13.000 | RWP12      |             | Junction     |            | SW32         | 1200        | Manhole      | Adoptable  |
| 6.007  | SW32       | 1200        | Manhole      | Adoptable  | SW33         |             | Junction     |            |
| 1.015  | SW33       |             | Junction     |            | SW33 OUTFALL | 1200        | Manhole      | Adoptable  |

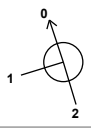
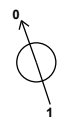
## Manhole Schedule

| Node | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                           | Link  | IL<br>(m) | Dia<br>(mm) |
|------|----------------|-----------------|-----------|--------------|-------------|---------------------------------------------------------------------------------------|-------|-----------|-------------|
| SW01 | 510012.509     | 188869.174      | 56.000    | 0.900        | 1200        |  |       |           |             |
|      |                |                 |           |              |             | 0                                                                                     | 1.000 | 55.100    | 300         |
| SW02 | 509987.951     | 188887.922      | 56.800    | 1.803        | 1200        |  |       |           |             |
|      |                |                 |           |              |             | 1                                                                                     | 1.000 | 54.997    | 300         |
|      |                |                 |           |              |             | 0                                                                                     | 1.001 | 54.997    | 300         |

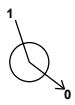
## Manhole Schedule

| Node  | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                           | Link | IL<br>(m) | Dia<br>(mm) |     |
|-------|----------------|-----------------|-----------|--------------|-------------|---------------------------------------------------------------------------------------|------|-----------|-------------|-----|
| SW03  | 509968.886     | 188870.546      | 56.650    | 1.739        | 1200        |    | 1    | 1.001     | 54.911      | 300 |
|       |                |                 |           |              |             |                                                                                       | 0    | 1.002     | 54.911      | 300 |
| RWP01 | 509935.806     | 188834.916      | 56.600    | 1.050        |             |    |      |           |             |     |
|       |                |                 |           |              |             |                                                                                       | 0    | 2.000     | 55.550      | 150 |
| SW04  | 509943.872     | 188836.250      | 56.350    | 0.930        | 600         |    | 1    | 2.000     | 55.495      | 150 |
|       |                |                 |           |              |             |                                                                                       | 0    | 2.001     | 55.420      | 225 |
| RWP02 | 509953.825     | 188831.533      | 56.600    | 1.050        |             |    |      |           |             |     |
|       |                |                 |           |              |             |                                                                                       | 0    | 3.000     | 55.550      | 150 |
| SW05  | 509951.554     | 188840.271      | 56.350    | 0.988        | 600         |   | 1    | 3.000     | 55.490      | 150 |
|       |                |                 |           |              |             |                                                                                       | 2    | 2.001     | 55.362      | 225 |
|       |                |                 |           |              |             |                                                                                       | 0    | 2.002     | 55.362      | 225 |
| SW06  | 509965.944     | 188846.227      | 56.580    | 1.287        | 1200        |  | 1    | 2.002     | 55.293      | 225 |
|       |                |                 |           |              |             |                                                                                       | 0    | 2.003     | 55.293      | 225 |
| RWP03 | 509958.728     | 188846.665      | 56.600    | 1.050        |             |  |      |           |             |     |
|       |                |                 |           |              |             |                                                                                       | 0    | 4.000     | 55.550      | 150 |
| SW07  | 509965.031     | 188849.144      | 56.500    | 1.221        | 1200        |  | 1    | 4.000     | 55.505      | 150 |
|       |                |                 |           |              |             |                                                                                       | 2    | 2.003     | 55.279      | 225 |
|       |                |                 |           |              |             |                                                                                       | 0    | 2.004     | 55.279      | 225 |

## Manhole Schedule

| Node  | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                           | Link   | IL<br>(m)      | Dia<br>(mm)      |            |
|-------|----------------|-----------------|-----------|--------------|-------------|---------------------------------------------------------------------------------------|--------|----------------|------------------|------------|
| RWP04 | 509959.113     | 188853.959      | 56.600    | 1.050        |             |    | 0      | 5.000          | 55.550           | 150        |
| SW08  | 509963.205     | 188855.220      | 56.400    | 1.224        | 1200        |    | 1<br>2 | 5.000<br>2.004 | 55.521<br>55.251 | 150<br>225 |
| SW09  | 509961.757     | 188859.598      | 56.800    | 1.639        | 1200        |    | 0<br>1 | 2.005<br>2.005 | 55.176<br>55.161 | 300<br>300 |
| SW10  | 509957.955     | 188870.290      | 56.950    | 2.075        | 1200        |    | 1<br>2 | 2.006<br>1.002 | 55.161<br>54.875 | 300<br>300 |
| SW11  | 509932.415     | 188861.954      | 56.290    | 1.669        | 1350        |    | 0<br>1 | 1.003<br>1.003 | 54.875<br>54.696 | 300<br>300 |
| SW12  | 509908.921     | 188853.813      | 56.260    | 1.722        | 1350        |  | 0<br>1 | 1.004<br>1.004 | 54.621<br>54.538 | 375<br>375 |
| SW13  | 509892.778     | 188847.485      | 56.290    | 1.810        | 1350        |  | 0<br>1 | 1.005<br>1.005 | 54.538<br>54.480 | 375<br>375 |
| SW14  | 509877.037     | 188841.614      | 56.270    | 1.846        | 1350        |  | 0<br>1 | 1.006<br>1.006 | 54.480<br>54.424 | 375<br>375 |
|       |                |                 |           |              |             |                                                                                       | 0      | 1.007          | 54.424           | 375        |

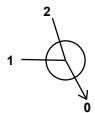
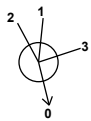
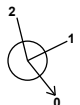
## Manhole Schedule

| Node  | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                             | Link  | IL<br>(m) | Dia<br>(mm) |
|-------|----------------|-----------------|-----------|--------------|-------------|-----------------------------------------------------------------------------------------|-------|-----------|-------------|
| SW15  | 509876.627     | 188836.670      | 56.300    | 1.893        | 1350        |  1   | 1.007 | 54.407    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.008 | 54.407    | 375         |
| SW16  | 509870.874     | 188833.990      | 56.200    | 1.814        | 1350        |  1   | 1.008 | 54.386    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.009 | 54.386    | 375         |
| SW17  | 509873.726     | 188826.192      | 56.200    | 1.842        | 1350        |  1   | 1.009 | 54.358    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.010 | 54.358    | 375         |
| SW18  | 509868.422     | 188823.462      | 56.130    | 1.792        | 1350        |  1   | 1.010 | 54.338    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.011 | 54.338    | 375         |
| SW19  | 509873.334     | 188808.949      | 56.330    | 2.043        | 1350        |  1  | 1.011 | 54.287    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.012 | 54.287    | 375         |
| SW20  | 509879.543     | 188790.182      | 56.550    | 2.329        | 1350        |  1 | 1.012 | 54.221    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.013 | 54.221    | 375         |
| SW21  | 509883.174     | 188787.407      | 56.480    | 2.340        | 1350        |  1 | 1.013 | 54.140    | 375         |
|       |                |                 |           |              |             | 0                                                                                       | 1.014 | 54.140    | 375         |
| RWP05 | 509956.955     | 188823.327      | 56.600    | 1.000        |             |  0 | 6.000 | 55.600    | 100         |

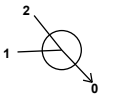
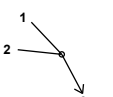
## Manhole Schedule

| Node  | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                           | Link | IL<br>(m) | Dia<br>(mm) |     |
|-------|----------------|-----------------|-----------|--------------|-------------|---------------------------------------------------------------------------------------|------|-----------|-------------|-----|
| SW22  | 509954.278     | 188816.784      | 56.350    | 0.946        | 600         |    | 1    | 6.000     | 55.529      | 100 |
|       |                |                 |           |              |             |                                                                                       | 0    | 6.001     | 55.404      | 225 |
| SW23  | 509936.873     | 188810.949      | 56.350    | 1.068        | 600         |    | 1    | 6.001     | 55.282      | 225 |
|       |                |                 |           |              |             |                                                                                       | 0    | 6.002     | 55.282      | 225 |
| RWP06 | 509939.505     | 188823.255      | 56.600    | 1.050        |             |    | 0    | 7.000     | 55.550      | 150 |
| SW24  | 509933.588     | 188814.447      | 56.350    | 1.100        | 1200        |    | 1    | 7.000     | 55.479      | 150 |
|       |                |                 |           |              |             |                                                                                       | 2    | 6.002     | 55.250      | 225 |
|       |                |                 |           |              |             |                                                                                       | 0    | 6.003     | 55.250      | 225 |
| RWP07 | 509915.453     | 188838.197      | 56.600    | 1.000        |             |    | 0    | 8.000     | 55.600      | 100 |
| SW25  | 509920.824     | 188836.276      | 56.350    | 0.932        | 600         |  | 1    | 8.000     | 55.543      | 100 |
|       |                |                 |           |              |             |                                                                                       | 0    | 8.001     | 55.418      | 225 |
| SW26  | 509926.202     | 188818.726      | 56.400    | 1.282        | 1200        |  | 1    | 8.001     | 55.336      | 225 |
|       |                |                 |           |              |             |                                                                                       | 2    | 6.003     | 55.193      | 225 |
|       |                |                 |           |              |             |                                                                                       | 0    | 6.004     | 55.118      | 300 |
| RWP08 | 509885.664     | 188828.064      | 56.600    | 1.000        |             |  | 0    | 9.000     | 55.600      | 100 |

## Manhole Schedule

| Node  | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections                                                                              | Link        | IL (m) | Dia (mm) |
|-------|-------------|--------------|--------|-----------|----------|------------------------------------------------------------------------------------------|-------------|--------|----------|
| SW27  | 509888.168  | 188825.754   | 56.350 | 0.909     | 600      |       | 1<br>9.000  | 55.566 | 100      |
|       |             |              |        |           |          | 0<br> | 0<br>9.001  | 55.441 | 225      |
| RWP09 | 509887.082  | 188819.377   | 56.600 | 1.000     |          |                                                                                          | 0<br>10.000 | 55.600 | 100      |
| SW28  | 509890.165  | 188819.314   | 56.350 | 0.954     | 600      |       | 1<br>10.000 | 55.569 | 100      |
|       |             |              |        |           |          | 2<br>9.001                                                                               | 2<br>55.396 | 225    |          |
|       |             |              |        |           |          | 0<br>9.002                                                                               | 0<br>55.396 | 225    |          |
| RWP10 | 509907.201  | 188823.340   | 56.600 | 1.050     |          |       | 0<br>11.000 | 55.550 | 150      |
| SW29  | 509896.898  | 188818.740   | 56.350 | 0.950     | 600      |      | 1<br>11.000 | 55.475 | 150      |
|       |             |              |        |           |          | 0<br>11.001                                                                              | 0<br>55.400 | 225    |          |
| SW30  | 509895.858  | 188808.740   | 56.320 | 1.308     | 1200     |     | 1<br>11.001 | 55.333 | 225      |
|       |             |              |        |           |          | 2<br>9.002                                                                               | 2<br>55.316 | 225    |          |
|       |             |              |        |           |          | 3<br>6.004                                                                               | 3<br>55.012 | 300    |          |
|       |             |              |        |           |          | 0<br>6.005                                                                               | 0<br>55.012 | 300    |          |
| RWP11 | 509912.241  | 188808.676   | 56.600 | 1.050     |          |     | 0<br>12.000 | 55.550 | 150      |
| SW31  | 509897.643  | 188801.511   | 56.310 | 1.323     | 1200     |     | 1<br>12.000 | 55.387 | 150      |
|       |             |              |        |           |          | 2<br>6.005                                                                               | 2<br>54.987 | 300    |          |
|       |             |              |        |           |          | 0<br>6.006                                                                               | 0<br>54.987 | 300    |          |

## Manhole Schedule

| Node         | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                         | Link        | IL<br>(m)                 | Dia<br>(mm)      |            |
|--------------|----------------|-----------------|-----------|--------------|-------------|-------------------------------------------------------------------------------------|-------------|---------------------------|------------------|------------|
| RWP12        | 509893.800     | 188797.524      | 56.600    | 1.000        |             |  | 0           | 13.000                    | 55.600           | 100        |
| SW32         | 509900.606     | 188797.807      | 56.300    | 2.160        | 1200        |  | 1<br>2<br>0 | 13.000<br>6.006<br>54.971 | 55.532<br>54.971 | 100<br>300 |
| SW33         | 509913.464     | 188784.215      | 56.100    | 1.960        |             |  | 1<br>2<br>0 | 6.007<br>1.014<br>54.140  | 54.140<br>54.140 | 300<br>375 |
| SW33 OUTFALL | 509914.424     | 188782.411      | 56.100    | 1.980        | 1200        |  | 1           | 1.015                     | 54.120           | 150        |

## Simulation Settings

|                      |                   |                   |          |                            |      |
|----------------------|-------------------|-------------------|----------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750    | Drain Down Time (mins)     | 240  |
| FSR Region           | England and Wales | Winter CV         | 0.840    | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Detailed | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | ✓        | Check Discharge Volume     | x    |

## Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) | Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1                     | 0                     | 0                     | 0                     | 100                   | 40                    | 0                     | 0                     |
| 30                    | 35                    | 0                     | 0                     |                       |                       |                       |                       |

### Node SW33 OUTFALL Online Hydro-Brake® Control

|                          |        |                         |                                |
|--------------------------|--------|-------------------------|--------------------------------|
| Flap Valve               | ✓      | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓      | Sump Available          | x                              |
| Invert Level (m)         | 54.120 | Product Number          | CTL-CHE-0066-2900-1900-2900    |
| Design Depth (m)         | 1.900  | Min Outlet Diameter (m) | 0.100                          |
| Design Flow (l/s)        | 2.9    | Min Node Diameter (mm)  | 1200                           |

### Node SW33 Depth/Area Storage Structure

|                             |         |               |      |                           |        |
|-----------------------------|---------|---------------|------|---------------------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0  | Invert Level (m)          | 54.140 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity      | 0.95 | Time to half empty (mins) |        |

| Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Inf Area<br>(m <sup>2</sup> ) | Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Inf Area<br>(m <sup>2</sup> ) | Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Inf Area<br>(m <sup>2</sup> ) |
|--------------|---------------------------|-------------------------------|--------------|---------------------------|-------------------------------|--------------|---------------------------|-------------------------------|
| 0.000        | 456.5                     | 0.0                           | 1.125        | 456.5                     | 0.0                           | 1.126        | 0.0                       | 0.0                           |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event       | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|--------|
| 15 minute winter | SW01    | 11          | 55.156    | 0.056     | 5.2          | 0.1098        | 0.0000     | OK     |
| 15 minute winter | SW02    | 11          | 55.075    | 0.078     | 10.0         | 0.1196        | 0.0000     | OK     |
| 15 minute winter | SW03    | 11          | 55.029    | 0.118     | 16.1         | 0.1972        | 0.0000     | OK     |
| 15 minute winter | RWP01   | 10          | 55.612    | 0.062     | 5.0          | 0.0421        | 0.0000     | OK     |
| 15 minute winter | SW04    | 10          | 55.471    | 0.051     | 4.9          | 0.0145        | 0.0000     | OK     |
| 15 minute winter | RWP02   | 10          | 55.595    | 0.045     | 2.8          | 0.0169        | 0.0000     | OK     |
| 15 minute winter | SW05    | 10          | 55.446    | 0.084     | 9.7          | 0.0496        | 0.0000     | OK     |
| 15 minute winter | SW06    | 11          | 55.395    | 0.102     | 10.3         | 0.1232        | 0.0000     | OK     |
| 15 minute winter | RWP03   | 10          | 55.588    | 0.038     | 2.0          | 0.0104        | 0.0000     | OK     |
| 15 minute winter | SW07    | 11          | 55.379    | 0.100     | 12.2         | 0.1135        | 0.0000     | OK     |
| 15 minute winter | RWP04   | 10          | 55.613    | 0.063     | 5.0          | 0.0427        | 0.0000     | OK     |
| 15 minute winter | SW08    | 11          | 55.297    | 0.121     | 17.0         | 0.1372        | 0.0000     | OK     |
| 15 minute winter | SW09    | 11          | 55.274    | 0.113     | 17.8         | 0.1370        | 0.0000     | OK     |
| 15 minute winter | SW10    | 11          | 55.009    | 0.134     | 34.7         | 0.1622        | 0.0000     | OK     |
| 15 minute winter | SW11    | 12          | 54.773    | 0.152     | 35.7         | 0.2390        | 0.0000     | OK     |

| Link Event<br>(Upstream Depth) | US Node | Link  | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|-------|---------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter               | SW01    | 1.000 | SW02    | 5.0           | 0.432          | 0.078    | 0.3667        |                    |
| 15 minute winter               | SW02    | 1.001 | SW03    | 9.8           | 0.491          | 0.153    | 0.5194        |                    |
| 15 minute winter               | SW03    | 1.002 | SW10    | 15.9          | 0.571          | 0.249    | 0.3064        |                    |
| 15 minute winter               | RWP01   | 2.000 | SW04    | 4.9           | 0.733          | 0.341    | 0.0549        |                    |
| 15 minute winter               | SW04    | 2.001 | SW05    | 4.9           | 0.487          | 0.115    | 0.0878        |                    |
| 15 minute winter               | RWP02   | 3.000 | SW05    | 2.7           | 0.623          | 0.189    | 0.0396        |                    |
| 15 minute winter               | SW05    | 2.002 | SW06    | 9.7           | 0.627          | 0.280    | 0.2419        |                    |
| 15 minute winter               | SW06    | 2.003 | SW07    | 10.3          | 0.593          | 0.298    | 0.0530        |                    |
| 15 minute winter               | RWP03   | 4.000 | SW07    | 2.0           | 0.567          | 0.136    | 0.0235        |                    |
| 15 minute winter               | SW07    | 2.004 | SW08    | 12.2          | 0.762          | 0.354    | 0.1017        |                    |
| 15 minute winter               | RWP04   | 5.000 | SW08    | 4.9           | 0.728          | 0.342    | 0.0291        |                    |
| 15 minute winter               | SW08    | 2.005 | SW09    | 17.0          | 0.665          | 0.266    | 0.1178        |                    |
| 15 minute winter               | SW09    | 2.006 | SW10    | 17.7          | 0.785          | 0.278    | 0.2564        |                    |
| 15 minute winter               | SW10    | 1.003 | SW11    | 34.1          | 1.174          | 0.377    | 0.7859        |                    |
| 15 minute winter               | SW11    | 1.004 | SW12    | 35.9          | 0.832          | 0.312    | 1.0781        |                    |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|--------|
| 15 minute winter  | SW12    | 12          | 54.698    | 0.160     | 37.1         | 0.2494        | 0.0000     | OK     |
| 15 minute winter  | SW13    | 12          | 54.647    | 0.167     | 38.5         | 0.2650        | 0.0000     | OK     |
| 15 minute winter  | SW14    | 13          | 54.611    | 0.187     | 39.1         | 0.2878        | 0.0000     | OK     |
| 15 minute winter  | SW15    | 13          | 54.590    | 0.183     | 38.7         | 0.2651        | 0.0000     | OK     |
| 15 minute winter  | SW16    | 13          | 54.564    | 0.178     | 39.2         | 0.2662        | 0.0000     | OK     |
| 15 minute winter  | SW17    | 13          | 54.535    | 0.177     | 39.7         | 0.2615        | 0.0000     | OK     |
| 15 minute winter  | SW18    | 13          | 54.503    | 0.165     | 39.6         | 0.2359        | 0.0000     | OK     |
| 15 minute winter  | SW19    | 13          | 54.444    | 0.157     | 41.0         | 0.2528        | 0.0000     | OK     |
| 720 minute winter | SW20    | 690         | 54.405    | 0.184     | 12.1         | 0.2723        | 0.0000     | OK     |
| 720 minute winter | SW21    | 705         | 54.405    | 0.265     | 12.2         | 0.4931        | 0.0000     | OK     |
| 15 minute winter  | RWP05   | 10          | 55.655    | 0.055     | 3.4          | 0.0267        | 0.0000     | OK     |
| 15 minute winter  | SW22    | 10          | 55.455    | 0.051     | 4.6          | 0.0243        | 0.0000     | OK     |
| 15 minute winter  | SW23    | 11          | 55.339    | 0.057     | 4.6          | 0.0160        | 0.0000     | OK     |
| 15 minute winter  | RWP06   | 10          | 55.607    | 0.057     | 4.4          | 0.0340        | 0.0000     | OK     |
| 15 minute winter  | SW24    | 11          | 55.329    | 0.079     | 9.8          | 0.0995        | 0.0000     | OK     |

| Link Event<br>(Upstream Depth) | US Node | Link  | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|-------|---------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter               | SW12    | 1.005 | SW13    | 37.0          | 0.802          | 0.322    | 0.8024        |                    |
| 15 minute winter               | SW13    | 1.006 | SW14    | 38.0          | 0.750          | 0.330    | 0.8553        |                    |
| 15 minute winter               | SW14    | 1.007 | SW15    | 38.5          | 0.724          | 0.335    | 0.2679        |                    |
| 15 minute winter               | SW15    | 1.008 | SW16    | 38.8          | 0.745          | 0.338    | 0.3329        |                    |
| 15 minute winter               | SW16    | 1.009 | SW17    | 39.3          | 0.766          | 0.342    | 0.4261        |                    |
| 15 minute winter               | SW17    | 1.010 | SW18    | 39.6          | 0.812          | 0.345    | 0.2910        |                    |
| 15 minute winter               | SW18    | 1.011 | SW19    | 39.5          | 0.875          | 0.344    | 0.6918        |                    |
| 15 minute winter               | SW19    | 1.012 | SW20    | 40.6          | 1.034          | 0.353    | 0.7770        |                    |
| 720 minute winter              | SW20    | 1.013 | SW21    | 11.7          | 0.296          | 0.044    | 0.3129        |                    |
| 720 minute winter              | SW21    | 1.014 | SW33    | 8.1           | 0.229          | 0.073    | 2.5370        |                    |
| 15 minute winter               | RWP05   | 6.000 | SW22    | 3.3           | 0.777          | 0.553    | 0.0304        |                    |
| 15 minute winter               | SW22    | 6.001 | SW23    | 4.6           | 0.645          | 0.108    | 0.1318        |                    |
| 15 minute winter               | SW23    | 6.002 | SW24    | 4.6           | 0.460          | 0.108    | 0.0483        |                    |
| 15 minute winter               | RWP06   | 7.000 | SW24    | 4.3           | 0.708          | 0.298    | 0.0645        |                    |
| 15 minute winter               | SW24    | 6.003 | SW26    | 9.8           | 0.837          | 0.233    | 0.1004        |                    |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute winter  | RWP07   | 10          | 55.670    | 0.070     | 4.8          | 0.0471        | 0.0000     | OK         |
| 15 minute winter  | SW25    | 10          | 55.496    | 0.078     | 8.6          | 0.0689        | 0.0000     | OK         |
| 15 minute winter  | SW26    | 11          | 55.227    | 0.109     | 18.3         | 0.1229        | 0.0000     | OK         |
| 15 minute winter  | RWP08   | 10          | 55.670    | 0.070     | 4.7          | 0.0464        | 0.0000     | OK         |
| 15 minute winter  | SW27    | 10          | 55.494    | 0.053     | 4.6          | 0.0149        | 0.0000     | OK         |
| 15 minute winter  | RWP09   | 10          | 55.657    | 0.057     | 3.5          | 0.0281        | 0.0000     | OK         |
| 15 minute winter  | SW28    | 11          | 55.465    | 0.069     | 8.0          | 0.0196        | 0.0000     | OK         |
| 15 minute winter  | RWP10   | 10          | 55.619    | 0.069     | 6.1          | 0.0575        | 0.0000     | OK         |
| 15 minute winter  | SW29    | 10          | 55.475    | 0.075     | 9.1          | 0.0557        | 0.0000     | OK         |
| 15 minute winter  | SW30    | 11          | 55.199    | 0.187     | 35.2         | 0.2120        | 0.0000     | OK         |
| 15 minute winter  | RWP11   | 10          | 55.601    | 0.051     | 4.3          | 0.0294        | 0.0000     | OK         |
| 15 minute winter  | SW31    | 11          | 55.168    | 0.181     | 39.7         | 0.2150        | 0.0000     | OK         |
| 15 minute winter  | RWP12   | 10          | 55.666    | 0.066     | 4.5          | 0.0428        | 0.0000     | OK         |
| 720 minute winter | SW32    | 705         | 54.405    | 0.265     | 4.2          | 0.2996        | 0.0000     | OK         |
| 720 minute winter | SW33    | 705         | 54.405    | 0.265     | 12.4         | 115.0055      | 0.0000     | SURCHARGED |

| Link Event<br>(Upstream Depth) | US Node | Link   | DS Node      | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|--------|--------------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter               | RWP07   | 8.000  | SW25         | 4.7           | 0.831          | 0.781    | 0.0324        |                    |
| 15 minute winter               | SW25    | 8.001  | SW26         | 8.5           | 0.713          | 0.245    | 0.2180        |                    |
| 15 minute winter               | SW26    | 6.004  | SW30         | 18.3          | 0.529          | 0.287    | 1.1072        |                    |
| 15 minute winter               | RWP08   | 9.000  | SW27         | 4.6           | 0.820          | 0.766    | 0.0192        |                    |
| 15 minute winter               | SW27    | 9.001  | SW28         | 4.6           | 0.529          | 0.108    | 0.0585        |                    |
| 15 minute winter               | RWP09   | 10.000 | SW28         | 3.5           | 0.771          | 0.572    | 0.0138        |                    |
| 15 minute winter               | SW28    | 9.002  | SW30         | 8.0           | 0.801          | 0.189    | 0.1200        |                    |
| 15 minute winter               | RWP10   | 11.000 | SW29         | 6.0           | 0.772          | 0.416    | 0.0879        |                    |
| 15 minute winter               | SW29    | 11.001 | SW30         | 9.0           | 0.820          | 0.212    | 0.1104        |                    |
| 15 minute winter               | SW30    | 6.005  | SW31         | 35.0          | 0.772          | 0.549    | 0.3375        |                    |
| 15 minute winter               | RWP11   | 12.000 | SW31         | 4.2           | 0.820          | 0.238    | 0.0838        |                    |
| 15 minute winter               | SW31    | 6.006  | SW32         | 39.5          | 0.981          | 0.620    | 0.1910        |                    |
| 15 minute winter               | RWP12   | 13.000 | SW32         | 4.4           | 0.824          | 0.736    | 0.0367        |                    |
| 720 minute winter              | SW32    | 6.007  | SW33         | 4.1           | 0.451          | 0.059    | 1.2319        |                    |
| 720 minute winter              | SW33    | 1.015  | SW33 OUTFALL | 3.2           | 0.374          | 0.184    | 0.0360        |                    |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event        | US<br>Node   | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|-------------------|--------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 720 minute winter | SW33 OUTFALL | 705            | 54.405       | 0.285        | 3.2             | 0.3221           | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node   | Link         | DS<br>Node | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap | Link<br>Vol (m³) | Discharge<br>Vol (m³) |
|--------------------------------|--------------|--------------|------------|------------------|-------------------|----------|------------------|-----------------------|
| 720 minute winter              | SW33 OUTFALL | Hydro-Brake® |            |                  | 1.8               |          |                  | 56.3                  |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event       | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute winter | SW01    | 12          | 55.368    | 0.268     | 17.3         | 0.5241        | 0.0000     | OK         |
| 15 minute winter | SW02    | 12          | 55.366    | 0.369     | 32.6         | 0.5630        | 0.0000     | SURCHARGED |
| 15 minute winter | SW03    | 12          | 55.337    | 0.426     | 46.4         | 0.7128        | 0.0000     | SURCHARGED |
| 15 minute winter | RWP01   | 10          | 55.696    | 0.146     | 16.6         | 0.0988        | 0.0000     | OK         |
| 15 minute winter | SW04    | 11          | 55.609    | 0.189     | 16.2         | 0.0535        | 0.0000     | OK         |
| 15 minute winter | RWP02   | 10          | 55.639    | 0.089     | 9.1          | 0.0332        | 0.0000     | OK         |
| 15 minute winter | SW05    | 11          | 55.600    | 0.238     | 31.2         | 0.1409        | 0.0000     | SURCHARGED |
| 15 minute winter | SW06    | 11          | 55.529    | 0.236     | 32.9         | 0.2839        | 0.0000     | SURCHARGED |
| 15 minute winter | RWP03   | 10          | 55.624    | 0.074     | 6.7          | 0.0202        | 0.0000     | OK         |
| 15 minute winter | SW07    | 11          | 55.499    | 0.220     | 39.1         | 0.2493        | 0.0000     | OK         |
| 15 minute winter | RWP04   | 10          | 55.692    | 0.142     | 16.6         | 0.0964        | 0.0000     | OK         |
| 15 minute winter | SW08    | 11          | 55.427    | 0.251     | 54.8         | 0.2841        | 0.0000     | OK         |
| 15 minute winter | SW09    | 11          | 55.388    | 0.227     | 57.5         | 0.2741        | 0.0000     | OK         |
| 15 minute winter | SW10    | 12          | 55.312    | 0.437     | 99.4         | 0.5292        | 0.0000     | SURCHARGED |
| 15 minute winter | SW11    | 13          | 55.078    | 0.457     | 100.4        | 0.7196        | 0.0000     | SURCHARGED |

| Link Event<br>(Upstream Depth) | US Node | Link  | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|-------|---------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter               | SW01    | 1.000 | SW02    | 16.4          | 0.551          | 0.258    | 2.1148        |                    |
| 15 minute winter               | SW02    | 1.001 | SW03    | 32.4          | 0.575          | 0.508    | 1.8165        |                    |
| 15 minute winter               | SW03    | 1.002 | SW10    | 45.3          | 0.738          | 0.710    | 0.7700        |                    |
| 15 minute winter               | RWP01   | 2.000 | SW04    | 16.2          | 0.992          | 1.123    | 0.1321        |                    |
| 15 minute winter               | SW04    | 2.001 | SW05    | 15.7          | 0.529          | 0.370    | 0.3269        |                    |
| 15 minute winter               | RWP02   | 3.000 | SW05    | 9.0           | 0.847          | 0.621    | 0.1114        |                    |
| 15 minute winter               | SW05    | 2.002 | SW06    | 30.9          | 0.776          | 0.895    | 0.6194        |                    |
| 15 minute winter               | SW06    | 2.003 | SW07    | 32.7          | 0.823          | 0.949    | 0.1212        |                    |
| 15 minute winter               | RWP03   | 4.000 | SW07    | 6.6           | 0.784          | 0.457    | 0.0571        |                    |
| 15 minute winter               | SW07    | 2.004 | SW08    | 39.0          | 1.069          | 1.131    | 0.2312        |                    |
| 15 minute winter               | RWP04   | 5.000 | SW08    | 16.4          | 1.009          | 1.134    | 0.0689        |                    |
| 15 minute winter               | SW08    | 2.005 | SW09    | 54.8          | 0.909          | 0.859    | 0.2772        |                    |
| 15 minute winter               | SW09    | 2.006 | SW10    | 57.4          | 1.108          | 0.900    | 0.5857        |                    |
| 15 minute winter               | SW10    | 1.003 | SW11    | 94.8          | 1.403          | 1.047    | 1.8919        |                    |
| 15 minute winter               | SW11    | 1.004 | SW12    | 96.6          | 0.977          | 0.840    | 2.7425        |                    |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 960 minute winter | SW12    | 930         | 55.039    | 0.501     | 8.6          | 0.7785        | 0.0000     | SURCHARGED |
| 960 minute winter | SW13    | 930         | 55.039    | 0.559     | 8.9          | 0.8849        | 0.0000     | SURCHARGED |
| 960 minute winter | SW14    | 930         | 55.039    | 0.615     | 8.9          | 0.9477        | 0.0000     | SURCHARGED |
| 960 minute winter | SW15    | 930         | 55.039    | 0.632     | 8.7          | 0.9176        | 0.0000     | SURCHARGED |
| 960 minute winter | SW16    | 930         | 55.039    | 0.653     | 8.8          | 0.9743        | 0.0000     | SURCHARGED |
| 960 minute winter | SW17    | 930         | 55.039    | 0.681     | 8.7          | 1.0085        | 0.0000     | SURCHARGED |
| 960 minute winter | SW18    | 930         | 55.039    | 0.701     | 8.5          | 1.0031        | 0.0000     | SURCHARGED |
| 960 minute winter | SW19    | 930         | 55.039    | 0.752     | 8.8          | 1.2107        | 0.0000     | SURCHARGED |
| 960 minute winter | SW20    | 930         | 55.039    | 0.818     | 13.0         | 1.2090        | 0.0000     | SURCHARGED |
| 960 minute winter | SW21    | 930         | 55.039    | 0.899     | 18.9         | 1.6712        | 0.0000     | SURCHARGED |
| 15 minute winter  | RWP05   | 11          | 55.912    | 0.312     | 11.4         | 0.1518        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW22    | 12          | 55.678    | 0.274     | 15.0         | 0.1308        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW23    | 12          | 55.661    | 0.379     | 16.4         | 0.1073        | 0.0000     | SURCHARGED |
| 15 minute winter  | RWP06   | 12          | 55.712    | 0.162     | 14.5         | 0.0961        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW24    | 12          | 55.654    | 0.404     | 29.1         | 0.5111        | 0.0000     | SURCHARGED |

| Link Event<br>(Upstream Depth) | US Node | Link  | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|-------|---------|---------------|----------------|----------|---------------|--------------------|
| 960 minute winter              | SW12    | 1.005 | SW13    | 8.5           | 0.578          | 0.074    | 1.9124        |                    |
| 960 minute winter              | SW13    | 1.006 | SW14    | 8.6           | 0.532          | 0.075    | 1.8530        |                    |
| 960 minute winter              | SW14    | 1.007 | SW15    | 8.6           | 0.516          | 0.075    | 0.5472        |                    |
| 960 minute winter              | SW15    | 1.008 | SW16    | 8.6           | 0.516          | 0.075    | 0.7001        |                    |
| 960 minute winter              | SW16    | 1.009 | SW17    | 8.6           | 0.519          | 0.075    | 0.9158        |                    |
| 960 minute winter              | SW17    | 1.010 | SW18    | 8.5           | 0.550          | 0.074    | 0.6579        |                    |
| 960 minute winter              | SW18    | 1.011 | SW19    | 8.3           | 0.508          | 0.072    | 1.6900        |                    |
| 960 minute winter              | SW19    | 1.012 | SW20    | 8.5           | 0.579          | 0.074    | 2.1802        |                    |
| 960 minute winter              | SW20    | 1.013 | SW21    | 18.0          | 0.500          | 0.068    | 0.5041        |                    |
| 960 minute winter              | SW21    | 1.014 | SW33    | 10.3          | 0.542          | 0.093    | 3.3594        |                    |
| 15 minute winter               | RWP05   | 6.000 | SW22    | 10.7          | 1.363          | 1.766    | 0.0553        |                    |
| 15 minute winter               | SW22    | 6.001 | SW23    | 13.7          | 0.723          | 0.324    | 0.7301        |                    |
| 15 minute winter               | SW23    | 6.002 | SW24    | 18.1          | 0.531          | 0.428    | 0.1909        |                    |
| 15 minute winter               | RWP06   | 7.000 | SW24    | 14.3          | 0.958          | 0.986    | 0.1868        |                    |
| 15 minute winter               | SW24    | 6.003 | SW26    | 29.8          | 0.918          | 0.703    | 0.3395        |                    |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute winter  | RWP07   | 11          | 56.067    | 0.467     | 15.8         | 0.3150        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW25    | 11          | 55.675    | 0.257     | 27.7         | 0.2266        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW26    | 11          | 55.613    | 0.495     | 54.6         | 0.5603        | 0.0000     | SURCHARGED |
| 15 minute winter  | RWP08   | 11          | 55.926    | 0.326     | 15.5         | 0.2167        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW27    | 11          | 55.559    | 0.118     | 14.9         | 0.0334        | 0.0000     | OK         |
| 15 minute winter  | RWP09   | 10          | 55.801    | 0.201     | 11.4         | 0.0984        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW28    | 11          | 55.547    | 0.151     | 25.8         | 0.0429        | 0.0000     | OK         |
| 15 minute winter  | RWP10   | 10          | 55.761    | 0.211     | 20.3         | 0.1755        | 0.0000     | SURCHARGED |
| 15 minute winter  | SW29    | 11          | 55.565    | 0.165     | 30.2         | 0.1231        | 0.0000     | OK         |
| 15 minute winter  | SW30    | 11          | 55.517    | 0.505     | 108.1        | 0.5715        | 0.0000     | SURCHARGED |
| 15 minute winter  | RWP11   | 10          | 55.654    | 0.104     | 14.3         | 0.0605        | 0.0000     | OK         |
| 15 minute winter  | SW31    | 11          | 55.386    | 0.399     | 122.0        | 0.4751        | 0.0000     | SURCHARGED |
| 15 minute winter  | RWP12   | 11          | 56.061    | 0.461     | 15.0         | 0.2969        | 0.0000     | SURCHARGED |
| 960 minute winter | SW32    | 930         | 55.039    | 0.899     | 9.6          | 1.0168        | 0.0000     | SURCHARGED |
| 960 minute winter | SW33    | 930         | 55.039    | 0.899     | 20.7         | 390.2376      | 0.0000     | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link   | DS Node      | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|-----------------------------|---------|--------|--------------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter            | RWP07   | 8.000  | SW25         | 14.7          | 1.873          | 2.428    | 0.0446        |                    |
| 15 minute winter            | SW25    | 8.001  | SW26         | 26.6          | 0.935          | 0.771    | 0.7300        |                    |
| 15 minute winter            | SW26    | 6.004  | SW30         | 55.3          | 0.785          | 0.866    | 2.2495        |                    |
| 15 minute winter            | RWP08   | 9.000  | SW27         | 14.9          | 1.909          | 2.474    | 0.0264        |                    |
| 15 minute winter            | SW27    | 9.001  | SW28         | 14.8          | 0.646          | 0.350    | 0.1669        |                    |
| 15 minute winter            | RWP09   | 10.000 | SW28         | 11.1          | 1.423          | 1.844    | 0.0239        |                    |
| 15 minute winter            | SW28    | 9.002  | SW30         | 25.3          | 1.025          | 0.598    | 0.3958        |                    |
| 15 minute winter            | RWP10   | 11.000 | SW29         | 19.9          | 1.135          | 1.375    | 0.1901        |                    |
| 15 minute winter            | SW29    | 11.001 | SW30         | 29.8          | 1.088          | 0.703    | 0.3317        |                    |
| 15 minute winter            | SW30    | 6.005  | SW31         | 107.0         | 1.520          | 1.678    | 0.5243        |                    |
| 15 minute winter            | RWP11   | 12.000 | SW31         | 14.0          | 1.100          | 0.790    | 0.2075        |                    |
| 15 minute winter            | SW31    | 6.006  | SW32         | 121.6         | 1.729          | 1.907    | 0.3234        |                    |
| 15 minute winter            | RWP12   | 13.000 | SW32         | 14.2          | 1.821          | 2.360    | 0.0528        |                    |
| 960 minute winter           | SW32    | 6.007  | SW33         | 9.6           | 0.507          | 0.135    | 1.3175        |                    |
| 960 minute winter           | SW33    | 1.015  | SW33 OUTFALL | 3.1           | 0.359          | 0.179    | 0.0360        |                    |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event        | US<br>Node   | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|-------------------|--------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 960 minute winter | SW33 OUTFALL | 930            | 55.039       | 0.919        | 3.1             | 1.0389           | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node   | Link         | DS<br>Node | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap | Link<br>Vol (m³) | Discharge<br>Vol (m³) |
|--------------------------------|--------------|--------------|------------|------------------|-------------------|----------|------------------|-----------------------|
| 960 minute winter              | SW33 OUTFALL | Hydro-Brake® |            |                  | 2.0               |          |                  | 113.9                 |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event         | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|--------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 1440 minute winter | SW01    | 1380        | 55.987    | 0.887     | 1.0          | 1.7332        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW02    | 1380        | 55.987    | 0.990     | 2.0          | 1.5114        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW03    | 1380        | 55.988    | 1.077     | 3.3          | 1.8021        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP01   | 12          | 56.086    | 0.536     | 22.4         | 0.3634        | 0.0000     | SURCHARGED |
| 15 minute winter   | SW04    | 13          | 56.005    | 0.585     | 20.5         | 0.1657        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP02   | 13          | 56.016    | 0.466     | 12.3         | 0.1739        | 0.0000     | SURCHARGED |
| 15 minute winter   | SW05    | 13          | 55.995    | 0.633     | 39.4         | 0.3741        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW06    | 1380        | 55.988    | 0.695     | 2.1          | 0.8350        | 0.0000     | SURCHARGED |
| 1440 minute winter | RWP03   | 1380        | 55.988    | 0.438     | 0.4          | 0.1195        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW07    | 1380        | 55.988    | 0.709     | 2.5          | 0.8015        | 0.0000     | SURCHARGED |
| 1440 minute winter | RWP04   | 1380        | 55.988    | 0.438     | 1.0          | 0.2967        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW08    | 1380        | 55.988    | 0.812     | 3.5          | 0.9180        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW09    | 1380        | 55.988    | 0.827     | 3.7          | 0.9977        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW10    | 1380        | 55.988    | 1.113     | 7.2          | 1.3485        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW11    | 1380        | 55.988    | 1.367     | 7.5          | 2.1538        | 0.0000     | SURCHARGED |

| Link Event<br>(Upstream Depth) | US Node | Link  | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|-------|---------|---------------|----------------|----------|---------------|--------------------|
| 1440 minute winter             | SW01    | 1.000 | SW02    | 1.0           | 0.260          | 0.016    | 2.1757        |                    |
| 1440 minute winter             | SW02    | 1.001 | SW03    | 2.0           | 0.342          | 0.031    | 1.8165        |                    |
| 1440 minute winter             | SW03    | 1.002 | SW10    | 3.3           | 0.410          | 0.052    | 0.7700        |                    |
| 15 minute winter               | RWP01   | 2.000 | SW04    | 20.5          | 1.167          | 1.421    | 0.1439        |                    |
| 15 minute winter               | SW04    | 2.001 | SW05    | 19.0          | 0.527          | 0.448    | 0.3449        |                    |
| 15 minute winter               | RWP02   | 3.000 | SW05    | 10.8          | 0.841          | 0.746    | 0.1589        |                    |
| 15 minute winter               | SW05    | 2.002 | SW06    | 37.8          | 0.950          | 1.095    | 0.6194        |                    |
| 1440 minute winter             | SW06    | 2.003 | SW07    | 2.1           | 0.410          | 0.061    | 0.1216        |                    |
| 1440 minute winter             | RWP03   | 4.000 | SW07    | 0.4           | 0.357          | 0.028    | 0.1192        |                    |
| 1440 minute winter             | SW07    | 2.004 | SW08    | 2.5           | 0.499          | 0.072    | 0.2523        |                    |
| 1440 minute winter             | RWP04   | 5.000 | SW08    | 1.0           | 0.468          | 0.069    | 0.0754        |                    |
| 1440 minute winter             | SW08    | 2.005 | SW09    | 3.5           | 0.442          | 0.055    | 0.3247        |                    |
| 1440 minute winter             | SW09    | 2.006 | SW10    | 3.7           | 0.516          | 0.058    | 0.7991        |                    |
| 1440 minute winter             | SW10    | 1.003 | SW11    | 7.2           | 0.763          | 0.080    | 1.8919        |                    |
| 1440 minute winter             | SW11    | 1.004 | SW12    | 7.2           | 0.555          | 0.062    | 2.7425        |                    |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event         | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|--------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 1440 minute winter | SW12    | 1380        | 55.988    | 1.450     | 7.5          | 2.2528        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW13    | 1380        | 55.988    | 1.508     | 7.6          | 2.3867        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW14    | 1380        | 55.988    | 1.564     | 7.8          | 2.4097        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW15    | 1380        | 55.988    | 1.581     | 7.9          | 2.2952        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW16    | 1380        | 55.988    | 1.602     | 8.0          | 2.3898        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW17    | 1380        | 55.988    | 1.630     | 8.1          | 2.4136        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW18    | 1380        | 55.988    | 1.650     | 8.0          | 2.3607        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW19    | 1380        | 55.988    | 1.701     | 8.4          | 2.7382        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW20    | 1380        | 55.988    | 1.767     | 9.1          | 2.6112        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW21    | 1380        | 55.988    | 1.848     | 9.8          | 3.4349        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP05   | 12          | 56.346    | 0.746     | 15.3         | 0.3635        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW22    | 1380        | 55.988    | 0.584     | 1.0          | 0.2791        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW23    | 1380        | 55.988    | 0.706     | 1.0          | 0.1997        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP06   | 12          | 56.043    | 0.493     | 19.6         | 0.2924        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW24    | 1380        | 55.988    | 0.738     | 2.1          | 0.9333        | 0.0000     | SURCHARGED |

| Link Event<br>(Upstream Depth) | US Node | Link  | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|-------|---------|---------------|----------------|----------|---------------|--------------------|
| 1440 minute winter             | SW12    | 1.005 | SW13    | 7.2           | 0.542          | 0.063    | 1.9124        |                    |
| 1440 minute winter             | SW13    | 1.006 | SW14    | 7.5           | 0.501          | 0.066    | 1.8530        |                    |
| 1440 minute winter             | SW14    | 1.007 | SW15    | 7.8           | 0.482          | 0.068    | 0.5472        |                    |
| 1440 minute winter             | SW15    | 1.008 | SW16    | 7.8           | 0.480          | 0.068    | 0.7001        |                    |
| 1440 minute winter             | SW16    | 1.009 | SW17    | 8.0           | 0.472          | 0.069    | 0.9158        |                    |
| 1440 minute winter             | SW17    | 1.010 | SW18    | 8.0           | 0.493          | 0.070    | 0.6579        |                    |
| 1440 minute winter             | SW18    | 1.011 | SW19    | 7.9           | 0.464          | 0.069    | 1.6900        |                    |
| 1440 minute winter             | SW19    | 1.012 | SW20    | 8.4           | 0.497          | 0.073    | 2.1802        |                    |
| 1440 minute winter             | SW20    | 1.013 | SW21    | 8.4           | 0.261          | 0.032    | 0.5041        |                    |
| 1440 minute winter             | SW21    | 1.014 | SW33    | 9.7           | 0.255          | 0.088    | 3.3594        |                    |
| 15 minute winter               | RWP05   | 6.000 | SW22    | 12.6          | 1.615          | 2.093    | 0.0553        |                    |
| 1440 minute winter             | SW22    | 6.001 | SW23    | 1.0           | 0.444          | 0.024    | 0.7301        |                    |
| 1440 minute winter             | SW23    | 6.002 | SW24    | 1.0           | 0.335          | 0.024    | 0.1909        |                    |
| 15 minute winter               | RWP06   | 7.000 | SW24    | 17.2          | 0.976          | 1.189    | 0.1868        |                    |
| 1440 minute winter             | SW24    | 6.003 | SW26    | 2.1           | 0.548          | 0.050    | 0.3395        |                    |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event         | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|--------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute winter   | RWP07   | 12          | 56.583    | 0.983     | 21.2         | 0.6637        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW25    | 1380        | 55.988    | 0.570     | 1.8          | 0.5020        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW26    | 1380        | 55.988    | 0.870     | 3.9          | 0.9837        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP08   | 11          | 56.215    | 0.615     | 20.9         | 0.4085        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW27    | 1380        | 55.988    | 0.547     | 0.9          | 0.1547        | 0.0000     | SURCHARGED |
| 1440 minute winter | RWP09   | 1380        | 55.988    | 0.388     | 0.7          | 0.1900        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW28    | 1380        | 55.988    | 0.592     | 1.6          | 0.1675        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP10   | 11          | 56.052    | 0.502     | 27.4         | 0.4165        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW29    | 1380        | 55.988    | 0.588     | 1.8          | 0.4391        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW30    | 1380        | 55.988    | 0.976     | 7.3          | 1.1036        | 0.0000     | SURCHARGED |
| 1440 minute winter | RWP11   | 1380        | 55.988    | 0.438     | 0.9          | 0.2544        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW31    | 1380        | 55.988    | 1.001     | 8.3          | 1.1909        | 0.0000     | SURCHARGED |
| 15 minute winter   | RWP12   | 11          | 56.386    | 0.786     | 20.2         | 0.5060        | 0.0000     | FLOOD RISK |
| 1440 minute winter | SW32    | 1380        | 55.988    | 1.848     | 9.2          | 2.0898        | 0.0000     | SURCHARGED |
| 1440 minute winter | SW33    | 1380        | 55.988    | 1.848     | 19.8         | 488.8532      | 0.0000     | FLOOD RISK |

| Link Event<br>(Upstream Depth) | US Node | Link   | DS Node      | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|--------|--------------|---------------|----------------|----------|---------------|--------------------|
| 15 minute winter               | RWP07   | 8.000  | SW25         | 18.2          | 2.327          | 3.015    | 0.0446        |                    |
| 1440 minute winter             | SW25    | 8.001  | SW26         | 1.8           | 0.468          | 0.052    | 0.7300        |                    |
| 1440 minute winter             | SW26    | 6.004  | SW30         | 3.9           | 0.370          | 0.061    | 2.2495        |                    |
| 15 minute winter               | RWP08   | 9.000  | SW27         | 19.0          | 2.427          | 3.145    | 0.0267        |                    |
| 1440 minute winter             | SW27    | 9.001  | SW28         | 0.9           | 0.344          | 0.021    | 0.2682        |                    |
| 1440 minute winter             | RWP09   | 10.000 | SW28         | 0.7           | 0.507          | 0.116    | 0.0241        |                    |
| 1440 minute winter             | SW28    | 9.002  | SW30         | 1.6           | 0.509          | 0.038    | 0.4776        |                    |
| 15 minute winter               | RWP10   | 11.000 | SW29         | 25.3          | 1.440          | 1.753    | 0.1986        |                    |
| 1440 minute winter             | SW29    | 11.001 | SW30         | 1.8           | 0.525          | 0.043    | 0.3999        |                    |
| 1440 minute winter             | SW30    | 6.005  | SW31         | 7.3           | 0.523          | 0.114    | 0.5243        |                    |
| 1440 minute winter             | RWP11   | 12.000 | SW31         | 0.9           | 0.528          | 0.051    | 0.2863        |                    |
| 1440 minute winter             | SW31    | 6.006  | SW32         | 8.3           | 0.632          | 0.130    | 0.3340        |                    |
| 15 minute winter               | RWP12   | 13.000 | SW32         | 18.8          | 2.406          | 3.118    | 0.0528        |                    |
| 1440 minute winter             | SW32    | 6.007  | SW33         | 9.2           | 0.484          | 0.129    | 1.3175        |                    |
| 1440 minute winter             | SW33    | 1.015  | SW33 OUTFALL | 3.1           | 0.341          | 0.178    | 0.0360        |                    |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.47%**

| Node Event         | US<br>Node   | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|--------------------|--------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 1440 minute winter | SW33 OUTFALL | 1380           | 55.987       | 1.867        | 3.1             | 2.1113           | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node   | Link         | DS<br>Node | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap | Link<br>Vol (m³) | Discharge<br>Vol (m³) |
|--------------------------------|--------------|--------------|------------|------------------|-------------------|----------|------------------|-----------------------|
| 1440 minute winter             | SW33 OUTFALL | Hydro-Brake® |            | 2.9              |                   |          |                  | 192.3                 |

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## 8.9 Appendix I – O&M Manual

# Pinn River School

## SuDS Drainage Operations and Maintenance Manual

Curtins Ref: 080522-CUR-XX-XX-T-C-92001

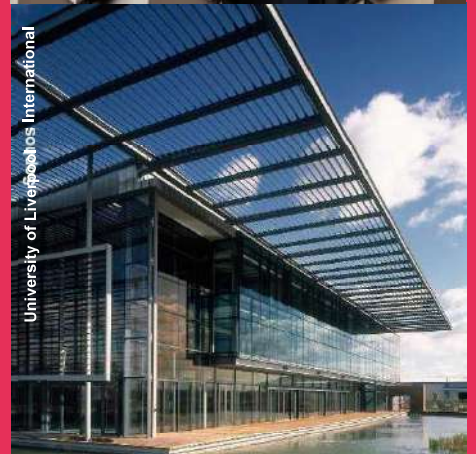
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This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

| Author                                               | Signature                                                                          | Date       |
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## 1.0 Introduction

### 1.1 Project Background

Curtins Consulting Limited has been appointed by Kier to prepare a SuDS Drainage Operations and Maintenance Manual to supplement the Drainage Strategy Addendum produced by Curtins; document reference: 080522-CUR-XX-XX-T-C-92000

Particular reference is paid to the inspection, aftercare and maintenance of SuDs drainage features as part of this manual in order to demonstrate to the LLFA or adopting authority the effectiveness and longevity of the SuDs features designed within the scheme as opposed to the standard Building Regulations local and domestic drainage and/or the main discharge drainage connections to 'Sewerage Sector Guidance (SSG)' standards.

This report is based on current best practice guidance as described in the SuDS Manual, CIRIA C753.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

### 1.2 Scope of O&M Manual

This manual is intended to give an overview of the operation and maintenance for SuDS features included with the drainage strategy and in relation to typical details only. Where proprietary products are specified by the manufacturer's instructions and recommendations, priority should be given to the manufacturer's instructions and recommendations over this document, unless specifically noted otherwise due to project constraints.

The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and thereafter, adjusted to suit the site requirements.

## 2.0 Geocellular Units

### 2.1 Location and Description

A geocellular tank is proposed for use and is located in the south-west of the site, as shown on drainage drawing 'FS0728-CUR-XX-XX-DR-C-0500'.

Geocellular units are proprietary products and therefore manufacturer's specific recommendations should also be taken into consideration above what has been prepared in this document. Additionally, different manufacturers may have different connection types and arrangements which will need to be taken into consideration.

### 2.2 Operation

The geocellular units, along with permeable paving, are intended to attenuate the discharge from the site up to and including the 1 in 100 year plus 40% climate change event.

Access for maintenance has been provided through inspection chambers.

### 2.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of geocellular units as designed. As the feature is buried, a regular inspection regime is important to ensure the correct functionality of the surface water drainage network. Maintenance responsibility for the geocellular units and their surrounding areas should be placed with Kier as noted in section 1.1.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

| Maintenance Schedule                                                                                     | Required Action                                                                                                                                                                      | Frequency                                             |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required) | Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.                                               | Monthly and after large storms.                       |
|                                                                                                          | Check penstocks and other mechanical devices (if present).                                                                                                                           | Half yearly.                                          |
|                                                                                                          | Inspect ventilation cowl (if present)                                                                                                                                                | Monthly and after large storms.                       |
| Regular maintenance\inspection                                                                           | Inspect and identify any areas that are not operating correctly. If required, take remedial action.                                                                                  | Monthly for 3 months, then six monthly                |
|                                                                                                          | Debris removal from catchment surface (where may cause risks to performance)                                                                                                         | Monthly                                               |
|                                                                                                          | Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary. | Monthly (and after large storms)                      |
|                                                                                                          | Remove sediment from pre-treatment structures                                                                                                                                        | Annually (or as required after heavy rainfall events) |
| Remedial actions                                                                                         | Repair/rehabilitation of inlets, outlet, overflows and vents.                                                                                                                        | As required.                                          |

## 3.0 Permeable Pavements

### 3.1 Location and Description

The permeable pavement is located is proposed for use across the site, as shown on drainage drawing 'FS0728-CUR-XX-XX-DR-C-0500'.

The permeable pavement has been designed in accordance with CIRIA C753.

Permeable pavements contain proprietary products and as such, the manufacturer's recommendations should be followed where used.

### 3.2 Operation

Permeable pavements are an efficient mean of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium.

The surface has been designed to be porous or to contain gaps where rain can flow through the upper construction layers into the voided stone which makes up the sub-base.

### 3.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of the pervious pavement. Maintenance responsibility for the pavement and its surrounding area should be placed with Kier as noted in section 1.1.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

| Maintenance Schedule                                                                                     | Required Action                                                                                                                                                                        | Frequency                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required) | Initial inspection.                                                                                                                                                                    | Monthly for three months after installation.                                                                                                                             |
|                                                                                                          | Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.                                                                                          | 3-monthly, 48 hours after large storms in first six months.                                                                                                              |
|                                                                                                          | Inspect silt accumulation rates and establish appropriate brushing frequencies.                                                                                                        | Annually.                                                                                                                                                                |
|                                                                                                          | Monitor inspection chambers.                                                                                                                                                           | Annually.                                                                                                                                                                |
| Regular maintenance/inspection                                                                           | Brushing and vacuuming.                                                                                                                                                                | Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations. |
| Occasional maintenance                                                                                   | Removal of weed or management using glyphosate applied directly into the weeds by an applicator rather than spraying.                                                                  | As required – one per year on less frequently used pavements.                                                                                                            |
|                                                                                                          | Stabilise and mow contributing and adjacent areas.                                                                                                                                     | As required.                                                                                                                                                             |
| Remedial Actions                                                                                         | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.                                              | As required.                                                                                                                                                             |
|                                                                                                          | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing materials. | As required.                                                                                                                                                             |
|                                                                                                          | Rehabilitation of surface and upper substructure by remedial sweeping.                                                                                                                 | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).                                                                |

## 4.0 Pipes (Including Oversized)

### 4.1 Location and Description

Pipes are the main conveyance across the site with the network as shown on drainage drawing 'FS0728-CUR-XX-XX-DR-C-0500'.

Pipes are proprietary products and the materials can vary across the site and as such, where used the manufacturer's recommendations should be followed. Regardless of the product used, the pipes will be fully compliant with the Curtins' drainage specification.

### 4.2 Operation

They are intended to be dry except for during rainfall events. These have been designed to be self-cleansing for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.

### 4.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be draining correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with Kier.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

| Maintenance Schedule                                                                                     | Required Action                                                                                        | Frequency                                          |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required) | Initial inspection should be provided as post construction CCTV survey.                                | N/A                                                |
|                                                                                                          | Inspect for evidence of poor operation via water level in chambers. If required, take remedial action. | 3-monthly, 48 hours after large storms.            |
| Occasional maintenance                                                                                   | Check and remove large vegetation growth near pipe runs.                                               | 6 monthly                                          |
| Remedial actions                                                                                         | Rod through poorly performing runs as initial remediation.                                             | As required.                                       |
|                                                                                                          | If continued poor performance jet and CCTV survey poorly performing runs.                              | As required.                                       |
|                                                                                                          | Seek advice as to remediation techniques suitable for the type of performance issue and location.      | As required If above does not improve performance. |

## 5.0 Vortex Flow Control

Typically, little maintenance is required as there are no moving parts within vortex flow control devices. Experience has shown that if blockages occur they do so at the intake and the cause on such occasions has been due to a lack of attention to engineering detail, such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. Vortex flow controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. The smaller type conical units, below the minimum recommended size, are also supplied with roding facilities or vortex suppressor pipes as standard. Following installation of the vortex flow control it is vitally important that any extraneous material i.e. Building materials are removed from the unit and the chamber. After the system is made live, it is recommended that each unit be inspected monthly for three months and thereafter, at six monthly intervals with hose down if required. If problems are experienced, the vortex flow control supplier is to be contacted so that an investigation may be made. Vortex flow controls are typically manufactured from grade 304 Stainless Steel which has an estimated life span in excess of the design life of drainage systems.

### **COSHH**

Vortex flow controls are manufactured from Stainless Steel, which is not regarded as hazardous to health and exhibits no chemical hazard when used under normal circumstances for the stated applications.

### **MANUAL HANDLING**

The handling of vortex flow controls should be in accordance with current legislation and regulations:

- The Health and Safety at Work Act 1972.
- The Management of Health and Safety at Work Regulations 1992.
- The Manual Handling Operations Regulations 1992.
- All published and printed by the Health and Safety Executive.

## 6.0 Slot Drains/Channel Drains

### 6.1 Location and Description

Slot drains and channel drains are likely to be introduced to the drainage strategy following the receipt of the levels plan.

Slot drains and channel drains are proprietary products and the materials can vary across the site. As such, the manufacturer's specific recommendations should be taken into consideration above what has been prepared in this document. Regardless of the product used, the slot drains and channel drains will be fully compliant with the Curtins drainage specification.

### 6.2 Operation

Slot drains and channel drains have been designed so that they are self-cleansing where possible to reduce the regularity of maintenance on these items. Rodding and access points have been provided at the start of all runs, changes in sizes of channel and half-way points.

Access for maintenance is provided through the units themselves.

### 6.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be draining correctly, thus exposing the development to a greater level of flood risk. Maintenance responsibility for the slot drains/gulleys should be placed with Kier.

| Maintenance Schedule                                                                                     | Required Action                                                                                                 | Frequency                                          |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required) | Initial inspection should be provided as post construction CCTV survey.                                         | N/A                                                |
|                                                                                                          | Inspect for evidence of poor operation via water level in gulleys/sump units. If required take remedial action. | 3-monthly, 48 hours after large storms.            |
| Occasional maintenance                                                                                   | Check and remove large vegetation growth near slot drain/channel drain catchment areas.                         | 6 monthly                                          |
| Remedial actions                                                                                         | Rod through poorly performing runs as initial remediation.                                                      | As required.                                       |
|                                                                                                          | If continued poor performance jet and CCTV survey poorly performing runs.                                       | As required.                                       |
|                                                                                                          | Seek advice as to remediation techniques suitable for the type of performance issue and location.               | As required If above does not improve performance. |

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