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# Housing Development at the Boylan Centre Drainage Report

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**Control Sheet**

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## 1.0 Introduction

This Drainage Report has been prepared by Curtins as part of the Part 8 Planning application for the proposed Residential and Community Development at The Boylan Centre, Dún Laoghaire.

The development will comprise the proposed demolition of community building at 11 Eblana Avenue and demolition of community and commercial building and removal of on-street parking at 10 Sussex Street. Construction of a new community facility and housing development comprising of 39nr. 1-bed apartments, 16nr. 2-bed apartments and 4nr. 3-bedroom houses and provision of 1nr. accessible parking space, an accessible drop-off area, 66nr. cycle parking spaces and all associated site works on Sussex Street and Eblana Avenue, Dún Laoghaire, Co. Dublin.

This report describes the criteria used to design the stormwater discharge, disposal of foul water, and water supply to the developed site.

## 2.0 Site Description

### 2.1 Site Location

The proposed development site is the Boylan Community Centre on Sussex Street in Dún Laoghaire, Co. Dublin and Eblana Avenue. This location is less than 100 meters from George's Street Lower and Marine Road, two busy main streets in Dun Laoghaire that are well-served by public transport and bus routes. The surrounding area is primarily a mix of residential and retail spaces.

The boundary of the proposed development site is shown below.

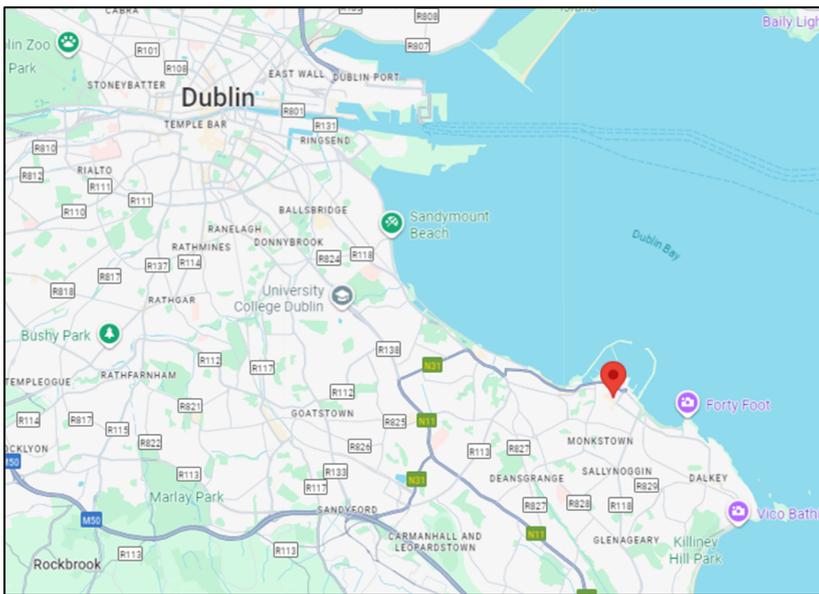


Figure 2.1 – Site Location (Source: Google Maps)

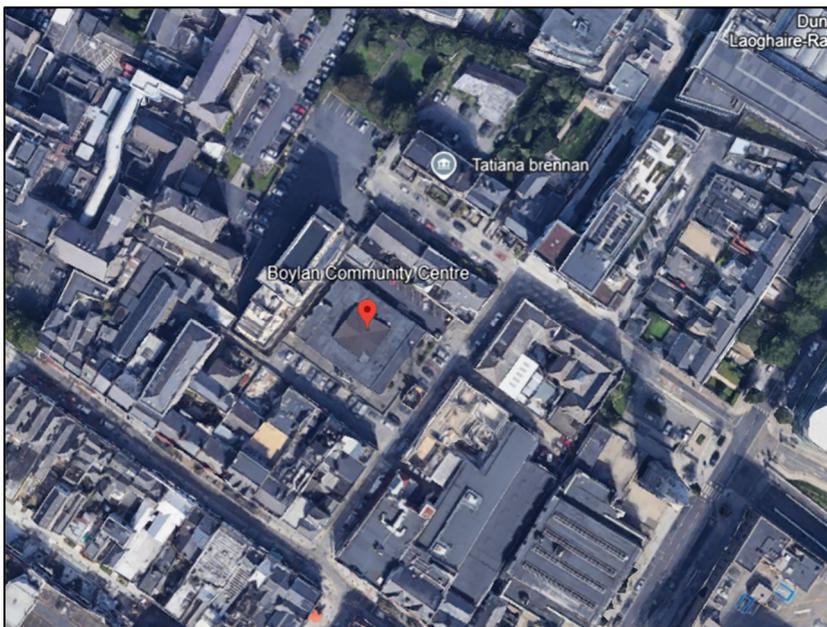


Figure 2.2 – Site Location (Source: Google Earth)

### 3.0 Proposed Development

The project site is located off Sussex Street and Eblana Avenue, Dún Laoghaire, with an approximate area of 0.25 hectares. It is bounded by:

- Sussex Street to the east.
- Eblana Avenue and neighbouring residential units to the north.
- St. Michael's Hospital grounds to the west.
- An access road to the south.

The site currently provides approx.. 30 surface car parking spaces with vehicular access from Sussex Street.

### 3.1 Proposed Works Summary

Proposed demolition of community building at 10 Eblana Avenue and demolition of community and commercial building and removal of on-street parking at 10 Sussex Street. Construction of a new community facility and housing development comprising of 39nr. 1-bed apartments, 16nr. 2-bed apartments and 4nr. 3-bedroom houses and provision of 1nr. accessible parking space, an accessible.

An initial phase of enabling works will be undertaken by Dún Laoghaire–Rathdown County Council (DLRCC) to reduce contractual risks for the main construction. These enabling works include:

- Assessment and removal of organic and chemical contaminants on-site.
- Removal of asbestos-containing materials (as identified in a December 2023 survey by About Safety Ltd.)
- Full or partial demolition of existing buildings (some forming part of a terrace of houses).
- Relocation of existing underground utilities.

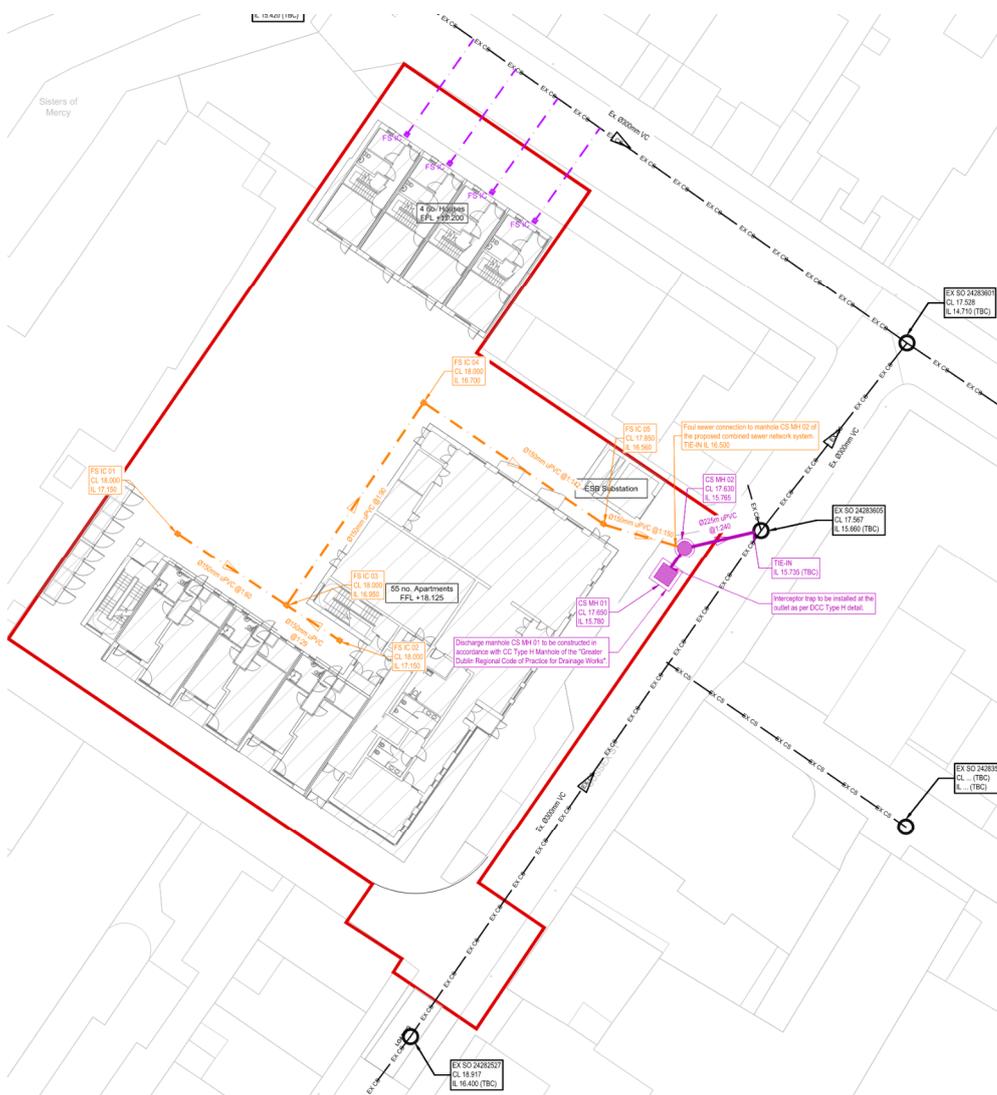
The scheme is designed to integrate with the existing urban fabric; help activate the town centre and provide a range of housing options in a sustainable location. It is consistent with the County Development Plan objectives (including SLO 73) and DLRCC's strategy for town-centre densification and compact growth.

## 4.0 Foul Water Drainage

### 4.1 Introduction

It is proposed to discharge the foul water from the proposed apartment block development into the existing public combined sewer network at 1 no. connection points and each of the individual dwellings will have a single connection to the existing system.

There are existing 300mm diameter VC combined sewer lines along Sussex Street and Eblana Avenue. It is proposed that foul water from the apartment block will be discharged into the Sussex Street Sewer and the individual dwelling lines will discharge into the Eblana Avenue Line, as depicted in Figure 3- 1. Refer to Appendix A for Uisce Éireann Record Maps.



**Figure 4.1 – Proposed Foul Connection Points**

A Pre-Connection Enquiry form was submitted to Uisce Éireann for 55 Apartments & 4 Houses units, which outlined the proposals for the drainage of wastewater from the development. Uisce Éireann responded with the Confirmation of Feasibility (COF) on 27th October 2025 with a CDS reference number of CDS25006806. Based upon the details provided, Uisce Éireann have stated that a wastewater connection is feasible without any infrastructure upgrades required. Refer to Appendix B for the Uisce Eireann COF.

## 4.2 Network Design

Drains generally will consist of uPVC pipes (to IS 123) or concrete socket and spigot pipes (to IS 6). Pipes will be laid to comply with the requirement of the Building Regulations 2010, and following the recommendations contained in the Technical Guidance Documents, Section H. Foul water sewers will consist of concrete pipes (to IS 6) or uPVC capable of resisting jetting pressure of 2,600psi and laid strictly following Uisce Éireann requirements for taking in charge.

In accordance with the Uisce Éireann “Code of Practice for Wastewater Supply”, 150mm nominal internal diameter sewers have been proposed for carrying wastewater from 20 properties or less; whilst 225mm nominal internal diameter carrying Wastewater from more than 20 properties. Furthermore, where there are at least ten dwelling units connected, the 150mm diameter pipes are laid at a minimum gradient of 1:150 and they will be laid at 1:60 for up to nine connected dwelling units.

## 4.3 Foul Water Calculations

The design of the foul water drainage has been based on the “Code of Practice for Wastewater Infrastructure”, (July 2020) published by Uisce Éireann. The peak foul flow is based on Uisce Éireann's recommended peak demand/ flow factors. Pipe capacities and velocities have been calculated using the Colebrook-White formula with a roughness coefficient (Ks) of 1.5 mm.

## 4.4 Proposed Foul Water Strategy

The proposed development will consist of 59 no. residential units and Ground floor Community facility with community garden. Based on the Uisce Éireann's Code of Practice, the peak foul flow from the proposed development will be as follows:

**Table 4.2 – Calculation of proposed Foul Water**

| Description       | No. of Units | Flow (l/h/day) | Population per Unit | Infiltration Factor | Total Discharge (l/d) |
|-------------------|--------------|----------------|---------------------|---------------------|-----------------------|
| Residential Units | 59           | 150            | 2.7                 | 1.1                 | <b>26,400</b>         |
| Community         | 1            | 50             | 30                  | 1.1                 | <b>1,650</b>          |
|                   |              |                |                     | <i>Totals</i>       | <b>28,050</b>         |

| Calculation of Proposed Peak Foul Flow         |               |            |
|--|---------------|------------|
| Total Daily Discharge (from Table 1.)          | <b>28,050</b> | l/d        |
| Residential Dry Weather Flow (RDWF)            | <b>0.31</b>   | l/s        |
| Commercial Dry Weather Flow (CDWF)             | <b>0.02</b>   | l/s        |
|  |               |            |
| <b>Residential Foul Peak Flow (=6 x RDWF)</b>  | <b>1.83</b>   | <b>l/s</b> |
| <b>Commercial Foul Peak Flow (=4.5 x CDWF)</b> | <b>0.11</b>   | <b>l/s</b> |
| <b>Total Peak Foul Flow</b>                    | <b>1.94</b>   | <b>l/s</b> |

The total proposed peak outfall from development is 1.94l/s. The proposed foul water outfall from the site is a 150 mm diameter pipe laid at a minimum gradient of 1:150, giving a minimum capacity of 12.6 l/s. Therefore, the proposed outfall has adequate capacity to cater for the flow from the development.

Refer to Appendix C for the wastewater discharge calculation, completed using Curtins spreadsheets.

## 5.0 Surface Water Drainage

The following section deals with surface water drainage design including details of the SuDS measures proposed to serve the proposed development.

The surface water drainage design and SuDS Assessment carried out in the following sections has been undertaken in compliance with the requirements of the DLR County Development Plan 2022-2028 and CIRIA documents.

Surface water will be attenuated as necessary and discharged to the existing public surface water network along Sussex Street into the existing 300 mm diameter pipe VC combined sewer.

### 5.1 Site Characteristics

The following parameters have been used in greenfield run-off rate and attenuation calculations.

**Table 5.1 – Surface Water Catchment Details**

| Item                   | Catchment    |
|------------------------|--------------|
| Contributing Area – Ha | <b>0.201</b> |
| SAAR – mm              | 927          |
| SOIL Index             | 0.45         |
| Climate Change         | 20%          |

The following runoff coefficients have been applied across the development for the surface water calculations for each site.

**Table 5.2 – Total Factored Areas**

| Item                                 | CV Values |
|--------------------------------------|-----------|
| Roof Area                            | 0.95      |
| Green Roof Area                      | 0.80      |
| Hardstanding Area (Road & Footpaths) | 0.95      |
| Permeable Paving                     | 0.80      |
| Landscaped Area                      | 0.30      |

### 5.2 Greenfield Run-off Rates

In accordance with the GSDSDS it is proposed to limit the discharge from the development site to the equivalent of the pre-development Greenfield run-off for the site.

The Greenfield rate is calculated in accordance with the Institute of Hydrology report No 124 “Flood Estimation for Small Catchments” for sites less than 50 Ha, where:

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$$Q_{BAR} = 0.00108 \times (\text{Area})^{0.89} \times (\text{SAAR})^{1.17} \times (\text{SOIL})^{2.17}$$

$$\text{Greenfield Run-off} = Q_{BAR} \times (\text{"n-year" factor})$$

$$\text{Allowable Discharge} = \text{Greenfield Run-off} \times \text{Area}$$

Area = Site area in km<sup>2</sup> (Or 50 hectares if the site is less than 50 Hectares)

The  $Q_{BAR}$  calculation is thus as follows:

$$\Rightarrow Q_{BAR} = 0.00108 \times (0.50)^{0.89} \times (927)^{1.17} \times (0.45)^{2.17}$$

$$\Rightarrow Q_{BAR} = 305.11 \text{ l/s (For a 50-hectare site)}$$

$$\Rightarrow Q_{BAR} = 1.22 \text{ l/s/Ha (Adjusted linearly for 0.201 Ha)}$$

The discharge rate will be limited to the greenfield runoff rate in line with the Greater Dublin Regional Code of Practice, which stipulates that the maximum discharge rate for a site will be the  $Q_{BAR}$  or 2.00 l/s/ha, whichever is the greater.

In this case, the  $Q_{BAR}$  for the site has been calculated as 1.22 l/s.

According to the Dún Laoghaire Rathdown PAT template document, a 50 mm orifice should be considered the minimum allowable flow control. A hydrobrake with a 75 mm orifice can limit the discharge rate to 1.2 l/s, which is in line with the  $Q_{BAR}$  and above the minimum size established by the local authority.

**Table 5.3 –  $Q_{BAR}$  (l/s) for all return periods**

|                          | Area            | $Q_{BAR}$       |
|--------------------------|-----------------|-----------------|
| <b>Contributing Area</b> | <b>0.201 ha</b> | <b>1.50 l/s</b> |
| Non-Contributing Area    | 0.050 ha        |                 |
| Site subject to planning | 0.251 ha        |                 |

### 5.3 Stormwater Calculation

For the purpose of this report, the total area of the development subject to planning, including roofs, hardstanding areas, permeable paving and soft landscaping, is approximately 0.251 ha. The contributing area attenuation tank is 0.201 ha, as public areas will be non-contributing. Refer to Curtins Drawing No. 088035-CUR-00-XX-C-92003 for the surface water catchments.

It is proposed, in accordance with the recommendations of the Greater Dublin Strategic Drainage Study, that the 1 in 100-year critical design storm will be used for stormwater volumetric calculations (to establish on-site storage required) with a 20% additional allowance for climate change.

Preliminary calculations indicated that, during the 1 in 100-year storm, plus 20% allowance for climate change, 80 m<sup>3</sup> of storage is required. Refer to Appendix D for the attenuation storage calculation, completed using Curtins spreadsheets.

#### **Source Control**

Source control is the treatment and management of surface water as close to where the water falls as possible. Green Roofs on each of the apartment buildings, tree pits, permeable paving and filter drains will be used to provide treatment to surface water at source and will also reduce surface water run-off in low storm events.

### **Attenuation Tank**

An attenuation tank is proposed within the landscaping area of the subject site. The STORMTECH SC-310 attenuation tank consists of a below ground storage area with a top bank level of 18.00 m OD Malin. The bottom of the tank is set at 15.95 m OD Malin.

The lowest adjacent FFL is 17.20 m. The top water level in the underground attenuation tank has been calculated using a drainage model in Flow, and has been determined to be 16.59 m. Therefore, the freeboard is 610 mm, which is greater than the required 500 mm. Refer to Appendix E for the report of the surface water drainage calculation completed using Flow.

Refer to Curtins Drawing No. 088035-CUR-00-XX-C-92001 for details of the attenuation storage facility that includes the top of water levels of the attenuation tank.

## **5.4 Taken in Charge Areas**

It is proposed to use a series of tree pits alongside the roads proposed for taking in charge. Any rainwater falling on these areas will discharge through these proposed SuDS features before discharging into a surface water network, discharging directly to the public surface water network. This will ensure that rainwater falling on the new public roads proposed as part of the development will be intercepted in line with DMURS Advice Note 5.

## **5.5 Network Design**

As described above, the proposed surface water drainage system for this development has been designed as a SUDS system and uses permeable paving, green roofs, attenuation tanks and tree pits together with a flow control device to treat run-off and remove pollutants to improve quality, restrict outflow and control quantity.

Strict separation of surface water and wastewater will be implemented within the development. Surface water local drains will be a minimum of 150mm diameter increasing to 225mm as necessary, and generally, will consist of PVC (to IS123) or concrete socket and spigot pipes (to IS 6). These drains will be laid to comply with the requirement of the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H and will be laid strictly in accordance with the requirements of Dublin City Council.

## 6.0 Sustainable Drainage System (SuDS)

### 6.1 SuDS Assessment

Sustainable Urban Drainage Systems (SuDS) have been developed and are in use to alleviate the detrimental effects of traditional urban stormwater drainage practices that typically consist of piping run-off of rainfall from developments to the nearest receiving watercourse. Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as SuDS. They are typically made up of one or more structures, built to manage surface water run-off. The use of SuDS to control run-off also provides the additional benefit of reducing pollutants in the surface water by settling out suspended solids, and in some cases providing biological treatment.

A stormwater management or treatment train approach assures that run-off quantity and quality are improved. The following objectives of the treatment train provide an integrated and balanced approach to help mitigate the changes in stormwater run-off flows that occur as land is urbanised and to help mitigate the impacts of stormwater quality on receiving systems:

- 1) **Source control:** Source control involves managing rainwater where it first lands to reduce peak flow rates and volumes, enhance infiltration, and improve water quality before runoff enters the drainage system.
- 2) **Site Control:** Site control focuses on managing the volume and quality of stormwater across a development site. It ensures that water is effectively handled and treated before being discharged into the wider drainage network, reducing the risk of flooding and pollution.

### 6.2 Green Roofs

Green Roofs have been considered and incorporated into the development proposals, in line with the Green and Blue Roof Guide 2021. The locations of the green roofs are illustrated on the accompanying Curtins SUDS Drawing No. 088035-CUR-00-XX-DR-C-92005. The total roof area of the apartment block, the area of green roof and the percentage coverage in green roof per site are shown in the Table 6.1 below.

**Table 6.1 – Green Roof Area**

| Building                                  | Roof Area            | Green Roof         | %   |
|---|----------------------|--------------------|-----|
| Apartment blocks                          | 880 m <sup>2</sup>   | 560 m <sup>2</sup> | 64% |
| Townhouses, ESB substation and bin stores | 274 m <sup>2</sup>   | -                  | -   |
| Total                                     | 1,154 m <sup>2</sup> | 560 m <sup>2</sup> | 48% |

As well as providing ecological benefits, green roofs contribute the following positive effects to surface water drainage design:

- The retention of water, through storage in the growing medium and evapotranspiration from the roof's plants and substrate, reduces run-off volumes and the burden on the drainage network.
- Due to the time for water to infiltrate and permeate the substrate, there is also a reduction in peak rates of run-off, helping to reduce the risk of flooding.

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- They improve water quality through the filtration of pollutants during the process of water infiltration. This provides treatment in line with the CIRIA SUDS Manual management train.

Although green roof space can reduce peak flow rates in the small storm events and aid in reducing the volume of run-off from the site, it operates as a conventional roof in higher storm events. Therefore, green roofs cannot be considered in the surface water drainage run-off calculations for the development. As stated in CIRIA C697, “although green roofs absorb most of the rainfall that they receive during ordinary events, there is still the need to discharge excess water to the building’s drainage system. This is because their hydraulic performance during extreme events tends to be fairly similar to standard roofs.”

The applicant has considered the use of all appropriate SUDS measures as part of the site SUDS strategy, details are outlined in Table 6.2 below. Refer to drawing 088035-CUR-00-XX-DR-C-92005 showing the proposed SuDS measures on-site.

**Table 6.2 – SuDS Measures**

| SUDS Stage     | SUDS Measure        | Measure Outline  | Use on-site   |
|----------------|---------------------|--|---|
| Source Control | Permeable Pavements | Permeable pavements are alternative paving surfaces to standard finishes that allow stormwater run-off to filter through voids in the pavement surface into an underlying stone reservoir, where it is temporarily stored and/or infiltrated.  | Permeable paving will be utilised for the car parking areas, located in Sussex Street, to provide treatment and storage of rainwater falling on these areas in line with the Dun Laoghaire Rathdown County Development Plan (2022 – 2028) |
| Source Control | Green Roofs         | Green Roofs are roofs with a vegetated surface that can provide attenuation and treatment of rainwater. They also provide evapotranspiration from the roof’s plants and substrate, reducing run-off volumes and the burden on the drainage network.  | It is proposed to use green roofs on the roofs of the proposed apartment blocks for both treatment and interception storage in line with the policy of the Dun Laoghaire Rathdown County Development Plan (2022 – 2028)                   |
|                | Tree pits           | Tree pits are designed to support urban tree health and integrate with SuDS. They provide sufficient soil volume, promote water infiltration through permeable surfaces, and protect roots from compaction. Their integration with drainage systems helps manage run-off, improve water quality, and enhance urban biodiversity. | It is proposed to use tree pits to treat surface water falling on the footpaths at source where possible before conveying it to a downstream attenuation system.  |

**Table 6.3 – SUDS Measures**

| SUDS Stage   | SUDS Measure | Measure Outline  | Use on-site   |
|--------------|--------------|--|---|
| Site Control | Hydrobrake   | Hydrobrakes are used to restrict the outfall from the development to the equivalent of the existing run-off. This ensures the development will not give rise to any impact downstream of the site. | Reduction of flow rate of discharge from site to allowable limits |

In accordance with the SUDS Manual CIRIA C753, the pollution prevention guidelines have been followed to ensure appropriate levels of treatment are provided before attenuated run-off from the site is discharged into the ordinary watercourse.

### 6.3 SuDS Maintenance

For the SUDS strategy to work as designed, the entire drainage system must be well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained. Maintenance and cleaning of gullies, manholes (including catch pits) and SuDS features will ensure adequate performance. The recommended program is outlined in the tables below.

**Table 6.4 – Permeable Paving Maintenance Schedule**

| SUDS Element     | Maintenance        |   |   |
|------------------|--------------------|---|---|
|                  | Maintenance period | Maintenance Task  | Frequency   |
| Permeable Paving | Regular            | Brushing and vacuuming (standard cosmetic sweep over the whole surface)   | Once a year, after autumn leaf fall, or as required, based on site-specific observations of clogging or the manufacturers' recommendations. |
|                  | Occasional         | Removal of weeds  | As required   |
|                  | Remedial work      | Remediation work to any depressions, rutting and cracked or broken blocks considered detrimental to structural performance or a hazard to users | As required   |
|                  | Monitoring         | Inspect silt accumulation rates and establish appropriate brushing frequencies  | Annually  |
|                  |                    | Monitor inspection chambers   | Annually  |

**Table 6.5 – Tree Pits**

| SUDS Element      | Maintenance        |   |   |
|-------------------|--------------------|---|---|
|                   | Maintenance period | Maintenance Task  | Frequency   |
| Swale/ Raingarden | Regular            | Remove the litter and debris  | Monthly, or as required   |
|                   |                    | Cut grass – to retain height within specified design range.   | Monthly (during the growing season), or as required                             |
|                   |                    | Manage other vegetation and remove nuisance plants.   | Monthly at the start and then as required                                       |
|                   |                    | Inspect inlets, outlets and overflows for blockages, and clear if required.                               | Monthly   |
|                   |                    | Inspect infiltration coverage   | Monthly for 6 months, quarterly for 2 years, then half-yearly                   |
|                   |                    | Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies | Half-yearly   |
|                   | Occasional         | Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required          | As required or if the soil is exposed to over 10% or more of the treatment area |
|                   | Remedial actions   | Repair erosion or other damage by re-turfing or re-seeding  | As required   |
|                   |                    | Re-level uneven surfaces and reinstate design levels  | As required   |
|                   |                    | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of the filter strip        | As required   |
|                   |                    | Remove and dispose of oils or petrol residues using safe standards practices                              | As required   |

Table 6.6 – Green Roof Maintenance Schedule

| SUDS Element  | Maintenance        |   |  |  |
|---|--------------------|---|--|--|
| Green Roof*   | Maintenance Issues | Vegetation becoming either overgrown or dying   |  |  |
|   | Maintenance Period | Maintenance Task  | Frequency                              |  |
|   | Regular            | Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability                 | Annually and after severe storms       |  |
|   |                    | Inspect soil substrates for evidence of erosion channels and identify any sediment source   | Annually and after severe storms       |  |
|   |                    | Inspect drain inlets to ensure unrestricted run-off from the drainage layer to conveyance or roof drain system.   | Annually and after severe storms       |  |
|   |                    | Inspect the underside of the roof for evidence of leakage.  | Annually and after severe storms       |  |
|   |                    | Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.  | Six months and annually or as required |  |
|   |                    | During establishment (i.e. year one), replace dead plants as required.  | Monthly                                |  |
|   |                    | Post-establishment, replace dead plants as required (where >5% of coverage)   | Annually (in autumn)                   |  |
|   |                    | Remove fallen leaves and debris from deciduous plant foliage  | Six months or as required              |  |
|   |                    | Remove nuisance and invasive vegetation, including weeds  | Six months or as required              |  |
|   |                    | Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate.   | Six months or as required              |  |
|   | Remedial Work      | If erosion channels are evident, these should be established with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled. | As required                            |  |
| If the drain inlet has settled, cracked or moved, investigate and repair as appropriate |                    | As required   |  |  |

\*Note: Please refer to the architect's plans/documents for access strategy for green roofs.

## 7.0 Water Supply

There is an existing 110mm diameter HDPE watermain along Sussex Street and a 90mm diameter HDPE watermain along Eblana Avenue. It is proposed to connect this development to these watermains at connection points as shown in the drawing 088035-CUR-00-XX-DR-C-92007.

A Pre-Connection Enquiry form was submitted to Uisce Éireann for 55 Apartments & 4 Houses units, which outlined the proposals for the drainage of wastewater from the development. Uisce Éireann responded with the Confirmation of Feasibility (COF) on 27th October 2025 with a CDS reference number of CDS25006806. Based upon the details provided, Uisce Éireann have stated that a water connection is feasible without any infrastructure upgrades required. Refer to Appendix B for the Uisce Éireann COF.

**Table 7.1 – Total Water Demand**

| Description       | No. of Units | Flow (l/h/day) | Population per Unit | Total Demand (l/d) |
|-------------------|--------------|----------------|---------------------|--------------------|
| Residential Units | 59           | 150            | 2.7                 | <b>24,000</b>      |
| Community         | 1            | 50             | 30                  | <b>1,500</b>       |
|                   |              |                | <i>Totals</i>       | <b>25,500</b>      |

The total water requirement from the public supply, for the development, is estimated at 25.5 m<sup>3</sup>/day.

Refer to Appendix F for the water demand calculation, completed using Curtins spreadsheets.

The proposed watermain network can be seen on drawing 088035-CUR-00-XX-DR-C-92007.

## Appendix A - Irish Water Maps

# Boylan Center



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|   |   |   |  |   |
|---|---|---|--|---|
| <b>Water Distribution Network</b><br>Water Treatment Plant<br>Water Pump Station<br>Storage Cell/Tower<br>Dosing Point<br>Meter Station<br>Abstraction Point<br>Telemetry Kiosk<br><b>Reservoir</b><br>Potable<br>Raw Water<br><b>Water Distribution Mains</b><br>Irish Water<br>Private<br><b>Trunk Water Mains</b><br>Irish Water<br>Private<br><b>Water Lateral Lines</b><br>Irish Water<br>Non IW<br>Water Casings<br>Water Abandoned Lines<br>Boundary Meter<br>Bulk/Check Meter<br>Group Scheme<br>Source Meter<br>Waste Meter<br>Unknown Meter ; Other Meter<br>Non-Return<br>PRV<br>PSV<br>Sluice Line Valve Open/Closed<br>Butterfly Line Valve Open/Closed<br>Sluice Boundary Valve Open/Closed<br>Butterfly Boundary Valve Open/Closed<br>Scour Valves | Single Air Control Valve<br>Double Air Control Valve<br>Water Stop Valves<br>Water Service Connections<br>Water Distribution Chambers<br>Water Network Junctions<br>Pressure Monitoring Point<br>Fire Hydrant<br>Fire Hydrant/Washout<br><b>Water Fittings</b><br>Cap<br>Reducer<br>Tap<br>Other Fittings<br><b>Sewer Foul Combined Network</b><br>Waste Water Treatment Plant<br>Waste Water Pump station<br><b>Sewer Mains Irish Water</b><br>Gravity - Combined<br>Gravity - Foul<br>Gravity - Unknown<br>Pumping - Combined<br>Pumping - Foul<br>Pumping - Unknown<br>Syphon - Combined<br>Syphon - Foul<br>Syphon - Unknown<br><b>Sewer Mains Private</b><br>Gravity - Combined<br>Gravity - Foul<br>Gravity - Unknown<br>Pumping - Combined<br>Pumping - Foul<br>Pumping - Unknown<br>Syphon - Combined<br>Syphon - Foul<br>Syphon - Unknown<br>Overflow<br>Sewer Lateral Lines<br>Sewer Casings<br><b>Sewer Manholes</b><br>Standard<br>Backdrop<br>Cascade<br>Catchpit<br>Bifurcation<br>Hatchbox<br>Lamphole<br>Hydrobrake<br>Other; Unknown | <b>Discharge Type</b><br>Outfall<br>Overflow<br>Soakaway<br>Standard Outlet<br>Other; Unknown<br><b>Cleanout Type</b><br>Rodding Eye<br>Flushing Structure<br>Other; Unknown<br><b>Sewer Inlets</b><br>Catchpit<br>Gully<br>Standard<br>Other; Unknown<br><b>Sewer Fittings</b><br>Vent/Col<br>Other; Unknown | <b>Storm Water Network</b><br><b>Surface Water Mains</b><br>Surface Gravity Mains<br>Surface Gravity Mains Private<br>Surface Water Pressurised Mains<br>Surface Water Pressurised Mains Private<br><b>Inlet Type</b><br>Gully<br>Standard<br>Other; Unknown<br><b>Storm Manholes</b><br>Standard<br>Backdrop<br>Cascade<br>Catchpit<br>Bifurcation<br>Hatchbox<br>Lamphole<br>Hydrobrake<br>Other; Unknown<br>Storm Culverts<br>Storm Clean Outs<br>Stormwater Chambers<br><b>Discharge Type</b><br>Outfall<br>Overflow<br>Soakaway<br>Other; Unknown | <b>Gas Networks Ireland</b><br>Transmission High Pressure Gasline<br>Distribution Medium Pressure Gasline<br>Distribution Low Pressure Gasline<br><b>ESB Networks</b><br><b>ESB HV Lines</b><br>HV Underground<br>HV Overhead<br>HV Abandoned<br><b>ESB MVLV Lines</b><br>MV Overhead Three Phase<br>MV Overhead Single Phase<br>LV Overhead Three Phase<br>LV Overhead Single Phase<br>MVLV Underground<br>Abandoned<br><b>Non Service Categories</b><br>Proposed<br>Under Construction<br>Out of Service<br>Decommissioned<br><b>Water Non Service Assets</b><br>Water Point Feature<br>Water Pipe<br>Water Structure<br><b>Waste Non Service Assets</b><br>Waste Point Feature<br>Sewer<br>Waste Structure |
|---|---|---|--|---|

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2. Whilst every care has been taken in its compilation, Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

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NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at [www.hsa.ie](http://www.hsa.ie).



Print Date: 27/10/2022

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Printed by: Irish Water

## Appendix B – Uisce Éireann Confirmation of Feasibility

## CONFIRMATION OF FEASIBILITY

Pablo M Bussi  
Curtins  
11 Pembroke Lane  
Dublin  
D02CX82

27 October 2025

**Uisce Éireann**  
Bosca OP 448  
Oifig Sheachadta na  
Cathrach Theas  
Cathair Chorcaí

**Uisce Éireann**  
PO Box 448  
South City  
Delivery Office  
Cork City

[www.water.ie](http://www.water.ie)

**Our Ref: CDS25006806 Pre-Connection Enquiry The Boylan Centre, Dun Laoghaire, Dublin**

Dear Applicant/Agent,

### **We have completed the review of the Pre-Connection Enquiry.**

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 59 unit(s) at The Boylan Centre, Dun Laoghaire, Dublin, (the **Development**).

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann
- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann
- The Development has to incorporate Sustainable Drainage Systems/ Attenuation in the management of storm water and to reduce surface water inflow into the receiving combined sewer. Full details of these have to be agreed with the LA Drainage Division.

**Stiúthóirí / Directors:** Niall Gleeson (POF / CEO), Jerry Grant (Cathaoirleach / Chairperson), Gerard Britchfield, Liz Joyce, Michael Nolan, Patricia King, Eileen Maher, Cathy Mannion, Paul Reid, Michael Walsh.

**Oifig Chláraithe / Registered Office:** Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin, Ireland D01NP86

Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Uisce Éireann is a designated activity company, limited by shares.

Cláraithe in Éirinn Uimh.: 530363 / Registered in Ireland No.: 530363.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at [www.water.ie/connections/get-connected/](http://www.water.ie/connections/get-connected/)

### Where can you find more information?

- **Section A** - What is important to know?
- **Section B** - Details of Uisce Éireann's Network(s)

**This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.**

For any further information, visit [www.water.ie/connections](http://www.water.ie/connections), email [newconnections@water.ie](mailto:newconnections@water.ie) or contact 1800 278 278.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'D. Phelan', is written over a horizontal line.

**Dermot Phelan**  
**Connections Delivery Manager**

## Section A - What is important to know?

| What is important to know?                                    | Why is this important?  |
|---|---|
| <b>Do you need a contract to connect?</b>                     | <ul style="list-style-type: none"> <li>• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s).</li> <li>• Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application <u>and be granted and sign</u> a connection agreement with Uisce Éireann.</li> </ul> |
| <b>When should I submit a Connection Application?</b>         | <ul style="list-style-type: none"> <li>• A connection application should only be submitted after planning permission has been granted.</li> </ul>   |
| <b>Where can I find information on connection charges?</b>    | <ul style="list-style-type: none"> <li>• Uisce Éireann connection charges can be found at: <a href="https://www.water.ie/connections/information/charges/">https://www.water.ie/connections/information/charges/</a></li> </ul>   |
| <b>Who will carry out the connection work?</b>                | <ul style="list-style-type: none"> <li>• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*.</li> </ul> <p>*Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works</p>  |
| <b>Fire flow Requirements</b>                                 | <ul style="list-style-type: none"> <li>• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine.</li> <li>• <b>What to do?</b> - Contact the relevant Local Fire Authority</li> </ul>  |
| <b>Plan for disposal of storm water</b>                       | <ul style="list-style-type: none"> <li>• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters.</li> <li>• <b>What to do?</b> - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.</li> </ul>   |
| <b>Where do I find details of Uisce Éireann's network(s)?</b> | <ul style="list-style-type: none"> <li>• Requests for maps showing Uisce Éireann's network(s) can be submitted to: <a href="mailto:datarequests@water.ie">datarequests@water.ie</a></li> </ul>  |

|   |   |
|---|---|
| <p><b>What are the design requirements for the connection(s)?</b></p> | <ul style="list-style-type: none"> <li>The design and construction of the Water &amp; Wastewater pipes and related infrastructure to be installed in this Development shall comply with <b><i>the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice</i></b>, available at <a href="http://www.water.ie/connections">www.water.ie/connections</a></li> </ul>   |
| <p><b>Trade Effluent Licensing</b></p>                                | <ul style="list-style-type: none"> <li>Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended).</li> <li>More information and an application form for a Trade Effluent License can be found at the following link: <a href="https://www.water.ie/business/trade-effluent/about/">https://www.water.ie/business/trade-effluent/about/</a></li> </ul> <p>**trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)</p> |

## Section B – Details of Uisce Éireann’s Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email

[datarequests@water.ie](mailto:datarequests@water.ie)



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**Note:** The information provided on the included maps as to the position of Uisce Éireann’s underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann’s network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann’s underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann’s underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

## Appendix C – Foul Water Calculations

# Boylan Centre Development



## Wastewater Discharge

Calculations by: **PB**

Checked by: **KF**

Date: 25/10/2025

### Calculation

| Residential Unit Type        | Unit   |
|------------------------------|--------|
| Average Occupancy Per Unit   | 2.70   |
| Number of Units              | 59.00  |
| Average Occupancy (PE)       | 160.00 |
| Average Usage (l/person/day) | 150.00 |

| Hotel Unit Type              | Room   |
|------------------------------|--------|
| Average Occupancy Per Room   | 1.50   |
| Number of Rooms              | 0.00   |
| Average Occupancy (PE)       | 0.00   |
| Average Usage (l/person/day) | 250.00 |

|   |          |
|---|----------|
| Residential Dry Weather Flow (l/day)      | 26400.00 |
| Average Residential Daily Discharge (l/s) | 0.31     |
| Peak Hour Residential Discharge (l/s)     | 1.83     |

|                                     |      |
|-------------------------------------|------|
| Hotel Dry Weather Flow (l/day)      | 0.00 |
| Average Hotel Daily Discharge (l/s) | 0.00 |
| Peak Hour Hotel Discharge (l/s)     | 0.00 |

| Commercial Unit Type                     |  | Shopping | Commercial | Pub / Restaurant | Gym   | Community | WC    |
|--|--|----------|------------|------------------|-------|-----------|-------|
| Average Occupancy m <sup>2</sup> /Person |  | 18.00    | 25.00      | 5.00             | 5.00  | 5.00      | -     |
| Area / Frequency use m <sup>2</sup>      |  | 0.00     | 0.00       | 0.00             | 0.00  | 150.00    | 0.00  |
| Average Occupancy / No. of WC (PE)       |  | 0.00     | 0.00       | 0.00             | 0.00  | 30.00     | 0.00  |
| Average Usage (l/person/day)             |  | 25.00    | 100.00     | 60.00            | 60.00 | 50.00     | 10.00 |
| Average Daily Demand (l/day)             |  | 0.00     | 0.00       | 0.00             | 0.00  | 1650.00   | 0.00  |

|  |         |
|--|---------|
| Commercial Dry Weather Flow (l/day)      | 1650.00 |
| Average Commercial Daily Discharge (l/s) | 0.02    |
| Peak Hour Wastewater Discharge (l/s)     | 0.11    |

### Wastewater Discharge

|                                      | Residential | Hotel | Commercial | Total |
|--------------------------------------|-------------|-------|------------|-------|
| Average Daily Discharge (l/s)        | 0.31        | 0.00  | 0.02       | 0.32  |
| Peak Hour Wastewater Discharge (l/s) | 1.83        | 0.00  | 0.11       | 1.95  |

### NOTES:

1. Wastewater flow 150 l/person as per IW Wastewater Code of Practice (3.6 Hydraulic Design for Gravity Sewers)
2. Average Occupancy ratio of 2,7 persons as per IW Wastewater Code of Practice (3.6 Hydraulic Design for Gravity Sewers)
3. Flow Rates for Design as per IW Wastewater Code of Practice (Appendix D)
4. 10% Unit consumption allowance as per IW Wastewater Code of Practice (Appendix C)
5. DWF Peak factor is 6 as per IW Wastewater Code of Practice (3.6 Hydraulic Design for Gravity Sewers)
6. Dry Weather Flow = Number of Residential Units x Average Occupancy Ratio x Waste Water Flow x UCA
7. Peak Discharge = Average Daily Discharge x DWF Peak Factor

## Appendix D – Surface Water Calculations

## The Boylan Centre, Dun Laoghaire - Stormwater Attenuation Storage Design in accordance with the GSDS

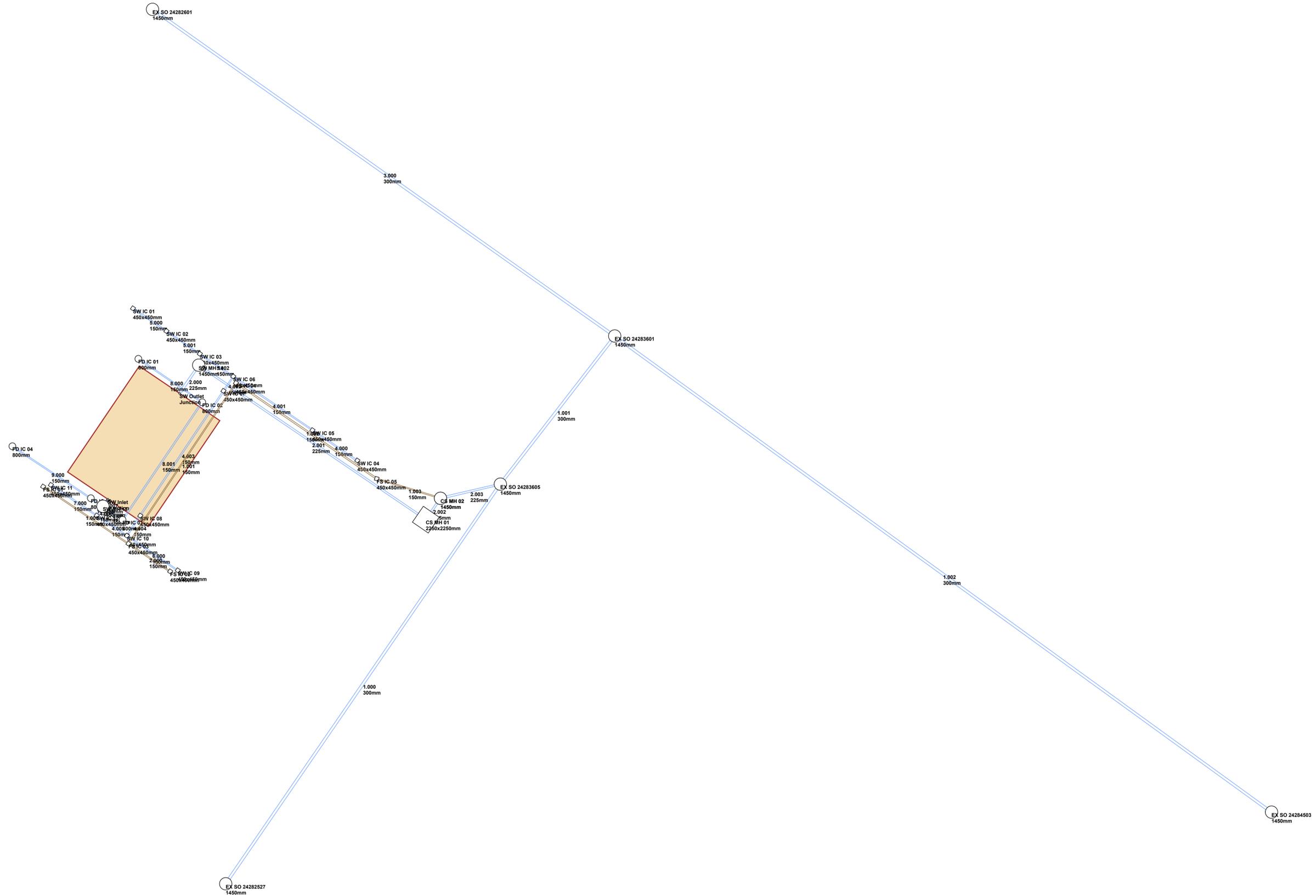
### Method 1: $Q_{BAR}$ limited to Greenfield Runoff Rate with Growth Factor Applied

| Site Characteristics  | Criterion 1: River Water Quality Protection   | Criterion 3: Level of Service (Attenuation storage)  |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
|---|---|--|------------------------------|---------------------------------|--------------------------------|------------------------------|---------------------------------|------|------|---------------------------------------|-------------|-------------|-------------|--|-----|-------|------|------|------|-----|------|------|-------|------|-------|------|----------|-------|------|---------|------|------|-------|------|------|------|-----|-------|------|------|------|------|--------|------|------|------|-------|----------|-------------------|--------------------------------|------------------------------|---------------------------------|------|------|-----|------|------|------|------|-----|------|------|------|------|-----|------|------|-------|------|------|------|------|-------|------|------|------|------|-------|------|------|------|------|-------|------|-------|------|-------|--------|------|-------|-------|--------|----------|-------------------|--------------------------------|------------------------------|---------------------------------|------|------|-----|------|------|------|------|-----|------|------|------|------|------|------|------|-------|------|------|------|------|-------|------|------|------|------|-------|------|------|------|------|-------|------|-------|-------|-------|--------|------|-------|-------|--------|
| Total Area = 2,003 m <sup>2</sup><br>Landscaped Area = 866 m <sup>2</sup><br>Hard Area (Roof+Road) = 1,137 m <sup>2</sup><br>SAAR = 927 mm<br>Percentage of Each Soil Type...FSR Fig 1 4.18(1)<br>G1 % = 0<br>G2 % = 0<br>G3 % = 0<br>G4 % = 100<br>G5 % = 0<br>Therefore:<br>Soil Index = 0.450<br>Climate Change Factor = 1.2 | <b>Criterion 1.1: Interception Storage (Infiltration Only)</b><br>Area of Paved Surface connected to drainage system = 1,137 m <sup>2</sup><br>Paved Surface Runoff Factor = 95 %<br>Rainfall Depth For Interception = 5 mm<br><b>Interception Storage Volume = 6 m<sup>3</sup></b><br>NOT APPLICABLE<br><b>Criterion 1.2: Treatment Volume (Pond Pool Vol Only)</b><br>Area of Paved Surface outfalling to a watercourse = 1,137 m <sup>2</sup><br>Paved Surface Runoff Factor = 95 %<br>Rainfall Depth For Treatment = 15 mm<br><b>Additional Treatment Storage Volume = 13 m<sup>3</sup></b><br>NOT APPLICABLE | <b>% Runoff for Hard Areas = 95 %</b><br><b>% Runoff for Landscaped Areas = 30 %</b><br><b>1 in 1 year Attenuation Storage Design</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Time min</th> <th>Rainfall Depth mm</th> <th>Greenfield Flow m<sup>3</sup></th> <th>New Site Flow m<sup>3</sup></th> <th>New - Greenfield m<sup>3</sup></th> </tr> </thead> <tbody> <tr><td>15.0</td><td>5.8</td><td>0.9</td><td>9.3</td><td>8.4</td></tr> <tr><td>30.0</td><td>7.6</td><td>1.9</td><td>12.2</td><td>10.4</td></tr> <tr><td>60.0</td><td>9.9</td><td>3.7</td><td>15.9</td><td>12.2</td></tr> <tr><td>120.0</td><td>12.9</td><td>7.5</td><td>20.7</td><td>13.3</td></tr> <tr><td>240.0</td><td>16.8</td><td>15.0</td><td>27.0</td><td>12.1</td></tr> <tr><td>360.0</td><td>19.6</td><td>22.4</td><td>31.5</td><td>9.1</td></tr> <tr><td>720.0</td><td>25.6</td><td>44.9</td><td>41.2</td><td>-3.7</td></tr> <tr><td>1440.0</td><td>33.4</td><td>89.8</td><td>53.7</td><td>-36.1</td></tr> </tbody> </table> 1 year Attenuation Storage Volume x 1.25 = 17 m <sup>3</sup><br><b>1 in 30 year Attenuation Storage Design</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Time min</th> <th>Rainfall Depth mm</th> <th>Greenfield Flow m<sup>3</sup></th> <th>New Site Flow m<sup>3</sup></th> <th>New - Greenfield m<sup>3</sup></th> </tr> </thead> <tbody> <tr><td>15.0</td><td>16.2</td><td>2.3</td><td>26.0</td><td>23.7</td></tr> <tr><td>30.0</td><td>20.2</td><td>4.6</td><td>32.5</td><td>27.9</td></tr> <tr><td>60.0</td><td>25.3</td><td>9.2</td><td>40.7</td><td>31.4</td></tr> <tr><td>120.0</td><td>31.7</td><td>18.5</td><td>51.0</td><td>32.5</td></tr> <tr><td>240.0</td><td>39.7</td><td>37.0</td><td>63.8</td><td>26.9</td></tr> <tr><td>360.0</td><td>45.3</td><td>55.4</td><td>72.8</td><td>17.4</td></tr> <tr><td>720.0</td><td>56.8</td><td>110.9</td><td>91.3</td><td>-19.6</td></tr> <tr><td>1440.0</td><td>71.1</td><td>221.8</td><td>114.3</td><td>-107.4</td></tr> </tbody> </table> 30 year Attenuation Storage Volume = 32 m <sup>3</sup><br><b>1 in 100 year Attenuation Storage Design</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Time min</th> <th>Rainfall Depth mm</th> <th>Greenfield Flow m<sup>3</sup></th> <th>New Site Flow m<sup>3</sup></th> <th>New - Greenfield m<sup>3</sup></th> </tr> </thead> <tbody> <tr><td>15.0</td><td>22.3</td><td>2.9</td><td>35.9</td><td>33.0</td></tr> <tr><td>30.0</td><td>27.5</td><td>5.7</td><td>44.2</td><td>38.5</td></tr> <tr><td>60.0</td><td>34.1</td><td>11.4</td><td>54.8</td><td>43.4</td></tr> <tr><td>120.0</td><td>42.1</td><td>22.9</td><td>67.7</td><td>44.8</td></tr> <tr><td>240.0</td><td>52.1</td><td>45.8</td><td>83.8</td><td>38.0</td></tr> <tr><td>360.0</td><td>58.9</td><td>68.6</td><td>94.7</td><td>26.1</td></tr> <tr><td>720.0</td><td>72.9</td><td>137.3</td><td>117.2</td><td>-20.1</td></tr> <tr><td>1440.0</td><td>90.1</td><td>274.6</td><td>144.9</td><td>-129.7</td></tr> </tbody> </table> 100 year Attenuation Storage Volume = 45 m <sup>3</sup> | Time min                     | Rainfall Depth mm               | Greenfield Flow m <sup>3</sup> | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> | 15.0 | 5.8  | 0.9                                   | 9.3         | 8.4         | 30.0        | 7.6  | 1.9 | 12.2  | 10.4 | 60.0 | 9.9  | 3.7 | 15.9 | 12.2 | 120.0 | 12.9 | 7.5   | 20.7 | 13.3     | 240.0 | 16.8 | 15.0    | 27.0 | 12.1 | 360.0 | 19.6 | 22.4 | 31.5 | 9.1 | 720.0 | 25.6 | 44.9 | 41.2 | -3.7 | 1440.0 | 33.4 | 89.8 | 53.7 | -36.1 | Time min | Rainfall Depth mm | Greenfield Flow m <sup>3</sup> | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> | 15.0 | 16.2 | 2.3 | 26.0 | 23.7 | 30.0 | 20.2 | 4.6 | 32.5 | 27.9 | 60.0 | 25.3 | 9.2 | 40.7 | 31.4 | 120.0 | 31.7 | 18.5 | 51.0 | 32.5 | 240.0 | 39.7 | 37.0 | 63.8 | 26.9 | 360.0 | 45.3 | 55.4 | 72.8 | 17.4 | 720.0 | 56.8 | 110.9 | 91.3 | -19.6 | 1440.0 | 71.1 | 221.8 | 114.3 | -107.4 | Time min | Rainfall Depth mm | Greenfield Flow m <sup>3</sup> | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> | 15.0 | 22.3 | 2.9 | 35.9 | 33.0 | 30.0 | 27.5 | 5.7 | 44.2 | 38.5 | 60.0 | 34.1 | 11.4 | 54.8 | 43.4 | 120.0 | 42.1 | 22.9 | 67.7 | 44.8 | 240.0 | 52.1 | 45.8 | 83.8 | 38.0 | 360.0 | 58.9 | 68.6 | 94.7 | 26.1 | 720.0 | 72.9 | 137.3 | 117.2 | -20.1 | 1440.0 | 90.1 | 274.6 | 144.9 | -129.7 |
| Time min  | Rainfall Depth mm   | Greenfield Flow m <sup>3</sup>   | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 15.0  | 5.8   | 0.9  | 9.3                          | 8.4                             |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 30.0  | 7.6   | 1.9  | 12.2                         | 10.4                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 60.0  | 9.9   | 3.7  | 15.9                         | 12.2                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 120.0   | 12.9  | 7.5  | 20.7                         | 13.3                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 240.0   | 16.8  | 15.0   | 27.0                         | 12.1                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 360.0   | 19.6  | 22.4   | 31.5                         | 9.1                             |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 720.0   | 25.6  | 44.9   | 41.2                         | -3.7                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 1440.0  | 33.4  | 89.8   | 53.7                         | -36.1                           |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| Time min  | Rainfall Depth mm   | Greenfield Flow m <sup>3</sup>   | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 15.0  | 16.2  | 2.3  | 26.0                         | 23.7                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 30.0  | 20.2  | 4.6  | 32.5                         | 27.9                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 60.0  | 25.3  | 9.2  | 40.7                         | 31.4                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 120.0   | 31.7  | 18.5   | 51.0                         | 32.5                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 240.0   | 39.7  | 37.0   | 63.8                         | 26.9                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 360.0   | 45.3  | 55.4   | 72.8                         | 17.4                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 720.0   | 56.8  | 110.9  | 91.3                         | -19.6                           |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 1440.0  | 71.1  | 221.8  | 114.3                        | -107.4                          |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| Time min  | Rainfall Depth mm   | Greenfield Flow m <sup>3</sup>   | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 15.0  | 22.3  | 2.9  | 35.9                         | 33.0                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 30.0  | 27.5  | 5.7  | 44.2                         | 38.5                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 60.0  | 34.1  | 11.4   | 54.8                         | 43.4                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 120.0   | 42.1  | 22.9   | 67.7                         | 44.8                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 240.0   | 52.1  | 45.8   | 83.8                         | 38.0                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 360.0   | 58.9  | 68.6   | 94.7                         | 26.1                            |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 720.0   | 72.9  | 137.3  | 117.2                        | -20.1                           |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| 1440.0  | 90.1  | 274.6  | 144.9                        | -129.7                          |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| <b>Calculation of Greenfield Runoff</b><br>$Q_{BAR} = 1000 \times 0.00108 \times A^{0.99} \times SAAR^{1.17} \times SOIL^{2.17}$ l/sec<br>$Q_{BAR} (50Ha site) = 305.11$ l/sec<br>Adjusted linearly for sites less than 50ha<br><b><math>Q_{BAR} = 1.22</math> l/sec</b>  | <b>Criterion 2: Maximum Allowable Discharge</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Return Period</th> <th>1 year</th> <th>30 Year</th> <th>100 year</th> </tr> </thead> <tbody> <tr> <td>Growth Factor</td> <td>0.85</td> <td>2.10</td> <td>2.60</td> </tr> <tr> <td><b>Max. Allowable Discharge (l/s)</b></td> <td><b>1.04</b></td> <td><b>2.57</b></td> <td><b>3.18</b></td> </tr> </tbody> </table>  | Return Period  | 1 year                       | 30 Year                         | 100 year                       | Growth Factor                | 0.85                            | 2.10 | 2.60 | <b>Max. Allowable Discharge (l/s)</b> | <b>1.04</b> | <b>2.57</b> | <b>3.18</b> | <b>Criterion 4: River Regime Protection</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr><td>Rd</td><td>58.90</td><td>mm</td></tr> <tr><td>A</td><td>0.20</td><td>ha</td></tr> <tr><td>PIMP</td><td>57</td><td>%</td></tr> <tr><td>SOIL</td><td>0.450</td><td></td></tr> <tr><td><math>\alpha</math></td><td>1.0</td><td></td></tr> <tr><td><math>\beta</math></td><td>0.50</td><td></td></tr> </tbody> </table> Vol <sub>res</sub> = 12 m <sup>3</sup> | Rd  | 58.90 | mm   | A    | 0.20 | ha  | PIMP | 57   | %     | SOIL | 0.450 |      | $\alpha$ | 1.0   |      | $\beta$ | 0.50 |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| Return Period   | 1 year  | 30 Year  | 100 year                     |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| Growth Factor   | 0.85  | 2.10   | 2.60                         |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| <b>Max. Allowable Discharge (l/s)</b>   | <b>1.04</b>   | <b>2.57</b>  | <b>3.18</b>                  |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| Rd  | 58.90   | mm   |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| A   | 0.20  | ha   |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| PIMP  | 57  | %  |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| SOIL  | 0.450   |  |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| $\alpha$  | 1.0   |  |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |
| $\beta$   | 0.50  |  |                              |                                 |                                |                              |                                 |      |      |                                       |             |             |             |  |     |       |      |      |      |     |      |      |       |      |       |      |          |       |      |         |      |      |       |      |      |      |     |       |      |      |      |      |        |      |      |      |       |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |     |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |      |       |        |      |       |       |        |          |                   |                                |                              |                                 |      |      |     |      |      |      |      |     |      |      |      |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |      |      |      |       |      |       |       |       |        |      |       |       |        |

### Method 2: $Q_{BAR}$ limited to 2 l/s/ha (No River Protection Storage Required)

| Site Characteristics   | Criterion 1: River Water Quality Protection  | Criterion 3: Level of Service   |                              |                                 |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
|--|--|---|------------------------------|---------------------------------|--------------------------------|------------------------------|---------------------------------|------|---------------------------------------|-------------|-------------|-------------|--|------|-----|------|------|------|------|-----|------|------|-------|-------|-----|------|------|-------|-------|------|------|-----|-------|-------|------|------|-----|-------|-------|------|------|-------|--------|-------|-------|------|-------|----------|-------------------|--------------------------------|------------------------------|---------------------------------|------|-------|-----|------|------|------|-------|-----|------|------|------|-------|-----|------|------|-------|-------|-----|------|------|-------|-------|------|------|------|-------|-------|------|------|------|-------|-------|------|------|------|--------|-------|-------|-------|------|----------|-------------------|--------------------------------|------------------------------|---------------------------------|------|-------|-----|------|------|------|-------|-----|------|------|------|-------|-----|------|------|-------|-------|-----|------|------|-------|-------|------|------|------|-------|-------|------|------|------|-------|-------|------|-------|------|--------|-------|-------|-------|------|
| Total Site Area = 2,003 m <sup>2</sup><br>Landscaped Area = 866 m <sup>2</sup><br>Hard Area = 1,137 m <sup>2</sup><br>SAAR = 927 mm<br>Percentage of Each Soil Type...FSR Fig 1 4.18(1)<br>G1 % = 0<br>G2 % = 0<br>G3 % = 0<br>G4 % = 100<br>G5 % = 0<br>Therefore:<br>Soil Index = 0.450<br>Climate Change Factor = 1.2<br>(Minimum flow rate set to 1.20 l/sec)<br><b><math>Q_{BAR} = 1.20</math> l/sec</b>  | <b>Criterion 1.1: Interception Volume</b><br>Area of Paved Surface connected to drainage system = 1,137 m <sup>2</sup><br>Paved Surface Runoff Factor = 100 %<br>Rainfall Depth For Interception = 5 mm<br><b>Interception Storage Volume = 7 m<sup>3</sup></b><br>NOT APPLICABLE<br><b>Criterion 1.2: Treatment Volume</b><br>Area of Paved Surface outfalling to a watercourse = 1,137 m <sup>2</sup><br>Paved Surface Runoff Factor = 80 %<br>Rainfall Depth For Treatment = 15 mm<br><b>Additional Treatment Storage Volume = 10 m<sup>3</sup></b><br>NOT APPLICABLE | <b>% Runoff for Paved Areas = 95 %</b><br><b>% Runoff for Landscaped Areas = 30 %</b><br><b>1 in 1 year Attenuation Storage Design</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Time min</th> <th>Rainfall Depth mm</th> <th>Greenfield Flow m<sup>3</sup></th> <th>New Site Flow m<sup>3</sup></th> <th>New - Greenfield m<sup>3</sup></th> </tr> </thead> <tbody> <tr><td>15.0</td><td>5.80</td><td>1.1</td><td>9.3</td><td>8.2</td></tr> <tr><td>30.0</td><td>7.60</td><td>2.2</td><td>12.2</td><td>10.1</td></tr> <tr><td>60.0</td><td>9.90</td><td>4.3</td><td>15.9</td><td>11.6</td></tr> <tr><td>120.0</td><td>12.90</td><td>8.6</td><td>20.7</td><td>12.1</td></tr> <tr><td>240.0</td><td>16.80</td><td>17.3</td><td>27.0</td><td>9.7</td></tr> <tr><td>360.0</td><td>19.60</td><td>25.9</td><td>31.5</td><td>5.6</td></tr> <tr><td>720.0</td><td>25.60</td><td>51.8</td><td>41.2</td><td>-10.7</td></tr> <tr><td>1440.0</td><td>33.40</td><td>103.7</td><td>53.7</td><td>-50.0</td></tr> </tbody> </table> 1 year Attenuation Storage Volume x 1.25 = 15 m <sup>3</sup><br><b>1 in 30 year Attenuation Storage Design</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Time min</th> <th>Rainfall Depth mm</th> <th>Greenfield Flow m<sup>3</sup></th> <th>New Site Flow m<sup>3</sup></th> <th>New - Greenfield m<sup>3</sup></th> </tr> </thead> <tbody> <tr><td>15.0</td><td>16.20</td><td>1.1</td><td>26.0</td><td>25.0</td></tr> <tr><td>30.0</td><td>20.20</td><td>2.2</td><td>32.5</td><td>30.3</td></tr> <tr><td>60.0</td><td>25.30</td><td>4.3</td><td>40.7</td><td>36.4</td></tr> <tr><td>120.0</td><td>31.70</td><td>8.6</td><td>51.0</td><td>42.3</td></tr> <tr><td>240.0</td><td>39.70</td><td>17.3</td><td>63.8</td><td>46.6</td></tr> <tr><td>360.0</td><td>45.30</td><td>25.9</td><td>72.8</td><td>46.9</td></tr> <tr><td>720.0</td><td>56.80</td><td>51.8</td><td>91.3</td><td>39.5</td></tr> <tr><td>1440.0</td><td>71.10</td><td>103.7</td><td>114.3</td><td>10.6</td></tr> </tbody> </table> 30 year Attenuation Storage Volume = 47 m <sup>3</sup><br><b>1 in 100 year Attenuation Storage Design</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Time min</th> <th>Rainfall Depth mm</th> <th>Greenfield Flow m<sup>3</sup></th> <th>New Site Flow m<sup>3</sup></th> <th>New - Greenfield m<sup>3</sup></th> </tr> </thead> <tbody> <tr><td>15.0</td><td>22.30</td><td>1.1</td><td>35.9</td><td>34.8</td></tr> <tr><td>30.0</td><td>27.50</td><td>2.2</td><td>44.2</td><td>42.1</td></tr> <tr><td>60.0</td><td>34.10</td><td>4.3</td><td>54.8</td><td>50.5</td></tr> <tr><td>120.0</td><td>42.10</td><td>8.6</td><td>67.7</td><td>59.1</td></tr> <tr><td>240.0</td><td>52.10</td><td>17.3</td><td>83.8</td><td>66.5</td></tr> <tr><td>360.0</td><td>58.90</td><td>25.9</td><td>94.7</td><td>68.8</td></tr> <tr><td>720.0</td><td>72.90</td><td>51.8</td><td>117.2</td><td>65.4</td></tr> <tr><td>1440.0</td><td>90.10</td><td>103.7</td><td>144.9</td><td>41.2</td></tr> </tbody> </table> 100 year Attenuation Storage Volume = 69 m <sup>3</sup> | Time min                     | Rainfall Depth mm               | Greenfield Flow m <sup>3</sup> | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> | 15.0 | 5.80                                  | 1.1         | 9.3         | 8.2         | 30.0   | 7.60 | 2.2 | 12.2 | 10.1 | 60.0 | 9.90 | 4.3 | 15.9 | 11.6 | 120.0 | 12.90 | 8.6 | 20.7 | 12.1 | 240.0 | 16.80 | 17.3 | 27.0 | 9.7 | 360.0 | 19.60 | 25.9 | 31.5 | 5.6 | 720.0 | 25.60 | 51.8 | 41.2 | -10.7 | 1440.0 | 33.40 | 103.7 | 53.7 | -50.0 | Time min | Rainfall Depth mm | Greenfield Flow m <sup>3</sup> | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> | 15.0 | 16.20 | 1.1 | 26.0 | 25.0 | 30.0 | 20.20 | 2.2 | 32.5 | 30.3 | 60.0 | 25.30 | 4.3 | 40.7 | 36.4 | 120.0 | 31.70 | 8.6 | 51.0 | 42.3 | 240.0 | 39.70 | 17.3 | 63.8 | 46.6 | 360.0 | 45.30 | 25.9 | 72.8 | 46.9 | 720.0 | 56.80 | 51.8 | 91.3 | 39.5 | 1440.0 | 71.10 | 103.7 | 114.3 | 10.6 | Time min | Rainfall Depth mm | Greenfield Flow m <sup>3</sup> | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> | 15.0 | 22.30 | 1.1 | 35.9 | 34.8 | 30.0 | 27.50 | 2.2 | 44.2 | 42.1 | 60.0 | 34.10 | 4.3 | 54.8 | 50.5 | 120.0 | 42.10 | 8.6 | 67.7 | 59.1 | 240.0 | 52.10 | 17.3 | 83.8 | 66.5 | 360.0 | 58.90 | 25.9 | 94.7 | 68.8 | 720.0 | 72.90 | 51.8 | 117.2 | 65.4 | 1440.0 | 90.10 | 103.7 | 144.9 | 41.2 |
| Time min   | Rainfall Depth mm  | Greenfield Flow m <sup>3</sup>  | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 15.0   | 5.80   | 1.1   | 9.3                          | 8.2                             |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 30.0   | 7.60   | 2.2   | 12.2                         | 10.1                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 60.0   | 9.90   | 4.3   | 15.9                         | 11.6                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 120.0  | 12.90  | 8.6   | 20.7                         | 12.1                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 240.0  | 16.80  | 17.3  | 27.0                         | 9.7                             |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 360.0  | 19.60  | 25.9  | 31.5                         | 5.6                             |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 720.0  | 25.60  | 51.8  | 41.2                         | -10.7                           |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 1440.0   | 33.40  | 103.7   | 53.7                         | -50.0                           |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| Time min   | Rainfall Depth mm  | Greenfield Flow m <sup>3</sup>  | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 15.0   | 16.20  | 1.1   | 26.0                         | 25.0                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 30.0   | 20.20  | 2.2   | 32.5                         | 30.3                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 60.0   | 25.30  | 4.3   | 40.7                         | 36.4                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 120.0  | 31.70  | 8.6   | 51.0                         | 42.3                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 240.0  | 39.70  | 17.3  | 63.8                         | 46.6                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 360.0  | 45.30  | 25.9  | 72.8                         | 46.9                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 720.0  | 56.80  | 51.8  | 91.3                         | 39.5                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 1440.0   | 71.10  | 103.7   | 114.3                        | 10.6                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| Time min   | Rainfall Depth mm  | Greenfield Flow m <sup>3</sup>  | New Site Flow m <sup>3</sup> | New - Greenfield m <sup>3</sup> |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 15.0   | 22.30  | 1.1   | 35.9                         | 34.8                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 30.0   | 27.50  | 2.2   | 44.2                         | 42.1                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 60.0   | 34.10  | 4.3   | 54.8                         | 50.5                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 120.0  | 42.10  | 8.6   | 67.7                         | 59.1                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 240.0  | 52.10  | 17.3  | 83.8                         | 66.5                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 360.0  | 58.90  | 25.9  | 94.7                         | 68.8                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 720.0  | 72.90  | 51.8  | 117.2                        | 65.4                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| 1440.0   | 90.10  | 103.7   | 144.9                        | 41.2                            |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| <b>Criterion 2: Maximum Allowable Discharge</b><br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Return Period</th> <th>1 year</th> <th>30 Year</th> <th>100 year</th> </tr> </thead> <tbody> <tr> <td>Growth curve factor</td> <td>1.00</td> <td>1.00</td> <td>1.00</td> </tr> <tr> <td><b>Max. Allowable Discharge (l/s)</b></td> <td><b>1.20</b></td> <td><b>1.20</b></td> <td><b>1.20</b></td> </tr> </tbody> </table> | Return Period  | 1 year  | 30 Year                      | 100 year                        | Growth curve factor            | 1.00                         | 1.00                            | 1.00 | <b>Max. Allowable Discharge (l/s)</b> | <b>1.20</b> | <b>1.20</b> | <b>1.20</b> | <b>=&gt; TOTAL STORAGE REQUIRED = 69 m<sup>3</sup></b> |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| Return Period  | 1 year   | 30 Year   | 100 year                     |                                 |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| Growth curve factor  | 1.00   | 1.00  | 1.00                         |                                 |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |
| <b>Max. Allowable Discharge (l/s)</b>  | <b>1.20</b>  | <b>1.20</b>   | <b>1.20</b>                  |                                 |                                |                              |                                 |      |                                       |             |             |             |  |      |     |      |      |      |      |     |      |      |       |       |     |      |      |       |       |      |      |     |       |       |      |      |     |       |       |      |      |       |        |       |       |      |       |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |      |      |        |       |       |       |      |          |                   |                                |                              |                                 |      |       |     |      |      |      |       |     |      |      |      |       |     |      |      |       |       |     |      |      |       |       |      |      |      |       |       |      |      |      |       |       |      |       |      |        |       |       |       |      |

## Appendix E – Flow Drainage Report



### Design Settings

|  |  |
|--|--|
| Rainfall Methodology    FSR<br>Return Period (years)    2<br>Additional Flow (%)    0<br>FSR Region    Scotland and Ireland<br>M5-60 (mm)    15.700<br>Ratio-R    0.271<br>CV    0.750<br>Time of Entry (mins)    5.00 | Maximum Time of Concentration (mins)    30.00<br>Maximum Rainfall (mm/hr)    50.0<br>Minimum Velocity (m/s)    1.00<br>Connection Type    Level Soffits<br>Minimum Backdrop Height (m)    0.200<br>Preferred Cover Depth (m)    0.700<br>Include Intermediate Ground    ✓<br>Enforce best practice design rules    ✓ |
|--|--|

### Nodes

| Name           | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Width<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) |
|----------------|--------------|------------------|-----------------------|------------------|---------------|----------------|-----------------|--------------|
| SW IC 01       | 0.005        | 5.00             | 18.000                | 450              | 450           | 724192.467     | 728660.531      | 1.300        |
| SW IC 02       | 0.005        | 5.00             | 18.000                | 450              | 450           | 724196.376     | 728657.877      | 1.335        |
| SW IC 03       | 0.005        | 5.00             | 18.000                | 450              | 450           | 724200.285     | 728655.218      | 1.370        |
| SW IC 04       | 0.008        | 5.00             | 17.850                | 450              | 450           | 724218.697     | 728642.740      | 0.850        |
| SW IC 05       | 0.008        | 5.00             | 17.900                | 450              | 450           | 724213.448     | 728646.287      | 0.950        |
| SW IC 06       | 0.005        | 5.00             | 18.000                | 450              | 450           | 724204.193     | 728652.568      | 1.405        |
| SW IC 07       | 0.016        | 5.00             | 18.000                | 450              | 450           | 724203.049     | 728650.883      | 1.420        |
| SW IC 08       | 0.016        | 5.00             | 18.000                | 450              | 450           | 724193.324     | 728636.292      | 1.540        |
| SW IC 09       | 0.016        | 5.00             | 18.000                | 450              | 450           | 724197.707     | 728629.898      | 0.850        |
| SW IC 10       | 0.016        | 5.00             | 18.000                | 450              | 450           | 724191.762     | 728633.950      | 1.560        |
| SW IC 11       | 0.018        | 5.00             | 18.000                | 450              | 450           | 724182.870     | 728639.888      | 0.850        |
| SW IC 12       |              |                  | 18.000                | 450              | 450           | 724188.227     | 728636.311      | 1.590        |
| FD IC 01       | 0.005        | 5.00             | 17.975                | 800              |               | 724193.093     | 728654.633      | 0.850        |
| FD IC 02       | 0.005        | 5.00             | 17.975                | 800              |               | 724200.570     | 728649.554      | 0.910        |
| FD IC 03       | 0.005        | 5.00             | 17.975                | 800              |               | 724191.243     | 728635.811      | 1.025        |
| FD IC 04       | 0.005        | 5.00             | 17.975                | 800              |               | 724178.369     | 728644.415      | 0.950        |
| FD IC 05       | 0.005        | 5.00             | 17.975                | 800              |               | 724187.537     | 728638.336      | 1.025        |
| SW MH 13       | 0.014        | 5.00             | 17.975                | 1450             |               | 724188.949     | 728637.393      | 1.655        |
| SW Inlet       |              |                  | 17.975                |                  |               | 724189.530     | 728638.218      | 2.005        |
| SW Outlet      |              | 5.00             | 17.795                |                  |               | 724197.910     | 728650.600      | 1.845        |
| SW MH 14       |              |                  | 18.000                | 1450             |               | 724200.148     | 728653.895      | 2.075        |
| CS MH 01       |              |                  | 17.650                | 2250             | 2250          | 724226.701     | 728635.830      | 1.870        |
| CS MH 02       |              |                  | 17.630                | 1450             |               | 724228.418     | 728638.328      | 1.865        |
| EX SO 24282527 |              | 5.00             | 18.917                | 1450             |               | 724203.310     | 728593.247      | 2.517        |
| EX SO 24282601 |              | 5.00             | 16.620                | 1450             |               | 724194.748     | 728695.504      | 1.200        |
| EX SO 24283605 |              |                  | 17.567                | 1450             |               | 724235.418     | 728639.982      | 1.907        |
| EX SO 24283601 |              |                  | 17.528                | 1450             |               | 724248.789     | 728657.308      | 2.818        |
| EX SO 24284503 |              |                  | 16.770                | 1450             |               | 724325.581     | 728601.630      | 2.890        |

Links

| Name  | US 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 | EX SO 24282527 | 56.702     | 0.600       | 16.400    | 15.660    | 0.740    | 76.6        | 300      | 5.53          | 45.1         |
| 2.000 | SW Outlet      | 3.983      | 0.600       | 15.950    | 15.925    | 0.025    | 159.3       | 225      | 5.06          | 46.6         |
| 2.001 | SW MH 14       | 32.116     | 0.600       | 15.925    | 15.780    | 0.145    | 221.5       | 225      | 5.68          | 44.7         |
| 2.002 | CS MH 01       | 3.031      | 0.600       | 15.780    | 15.765    | 0.015    | 202.1       | 225      | 5.73          | 44.5         |
| 2.003 | CS MH 02       | 7.193      | 0.600       | 15.765    | 15.735    | 0.030    | 239.8       | 225      | 5.87          | 44.1         |
| 1.001 | EX SO 24283605 | 21.885     | 0.600       | 15.660    | 14.710    | 0.950    | 23.0        | 300      | 5.99          | 43.9         |
| 3.000 | EX SO 24282601 | 66.177     | 0.600       | 15.420    | 14.710    | 0.710    | 93.2        | 300      | 5.68          | 44.7         |
| 1.002 | EX SO 24283601 | 94.853     | 0.600       | 14.710    | 13.880    | 0.830    | 114.3       | 300      | 7.06          | 41.0         |
| 4.000 | SW IC 04       | 6.335      | 0.600       | 17.000    | 16.950    | 0.050    | 126.7       | 150      | 5.12          | 46.4         |
| 4.001 | SW IC 05       | 11.185     | 0.600       | 16.950    | 16.875    | 0.075    | 149.1       | 150      | 5.35          | 45.7         |
| 5.000 | SW IC 01       | 4.725      | 0.600       | 16.700    | 16.665    | 0.035    | 135.0       | 150      | 5.09          | 46.5         |
| 5.001 | SW IC 02       | 4.728      | 0.600       | 16.665    | 16.630    | 0.035    | 135.1       | 150      | 5.18          | 46.2         |
| 5.002 | SW IC 03       | 4.722      | 0.600       | 16.630    | 16.595    | 0.035    | 134.9       | 150      | 5.27          | 45.9         |
| 4.002 | SW IC 06       | 2.037      | 0.600       | 16.595    | 16.580    | 0.015    | 135.8       | 150      | 5.39          | 45.6         |
| 4.003 | SW IC 07       | 17.535     | 0.600       | 16.580    | 16.460    | 0.120    | 146.1       | 150      | 5.74          | 44.5         |
| 4.004 | SW IC 08       | 2.815      | 0.600       | 16.460    | 16.440    | 0.020    | 140.8       | 150      | 5.79          | 44.3         |
| 6.000 | SW IC 09       | 7.195      | 0.600       | 17.150    | 17.100    | 0.050    | 143.9       | 150      | 5.14          | 46.4         |
| 4.005 | SW IC 10       | 4.251      | 0.600       | 16.440    | 16.410    | 0.030    | 141.7       | 150      | 5.88          | 44.1         |
| 7.000 | SW IC 11       | 6.441      | 0.600       | 17.150    | 17.100    | 0.050    | 128.8       | 150      | 5.12          | 46.4         |
| 4.006 | SW IC 12       | 1.301      | 0.600       | 16.410    | 16.395    | 0.015    | 86.7        | 150      | 5.90          | 44.0         |
| 8.000 | FD IC 01       | 9.039      | 0.600       | 17.125    | 17.065    | 0.060    | 150.6       | 150      | 5.18          | 46.2         |
| 8.001 | FD IC 02       | 16.609     | 0.600       | 17.065    | 16.950    | 0.115    | 144.4       | 150      | 5.52          | 45.2         |
| 8.002 | FD IC 03       | 2.787      | 0.600       | 16.950    | 16.900    | 0.050    | 55.7        | 150      | 5.55          | 45.0         |
| 9.000 | FD IC 04       | 11.000     | 0.600       | 17.025    | 16.950    | 0.075    | 146.7       | 150      | 5.22          | 46.1         |

| 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 | 1.798     | 127.1     | 0.0        | 2.217        | 1.607        | 0.000       | 0.0                | 0              | 0.000              |
| 2.000 | 1.033     | 41.1      | 0.0        | 1.620        | 1.850        | 0.000       | 0.0                | 0              | 0.000              |
| 2.001 | 0.874     | 34.8      | 0.0        | 1.850        | 1.645        | 0.000       | 0.0                | 0              | 0.000              |
| 2.002 | 0.916     | 36.4      | 0.0        | 1.645        | 1.640        | 0.000       | 0.0                | 0              | 0.000              |
| 2.003 | 0.840     | 33.4      | 0.0        | 1.640        | 1.607        | 0.000       | 0.0                | 0              | 0.000              |
| 1.001 | 3.289     | 232.5     | 0.0        | 1.607        | 2.518        | 0.000       | 0.0                | 0              | 0.000              |
| 3.000 | 1.629     | 115.1     | 0.0        | 0.900        | 2.518        | 0.000       | 0.0                | 0              | 0.000              |
| 1.002 | 1.470     | 103.9     | 0.0        | 2.518        | 2.590        | 0.000       | 0.0                | 0              | 0.000              |
| 4.000 | 0.891     | 15.7      | 1.0        | 0.700        | 0.800        | 0.008       | 0.0                | 25             | 0.496              |
| 4.001 | 0.820     | 14.5      | 2.0        | 0.800        | 0.975        | 0.016       | 0.0                | 37             | 0.573              |
| 5.000 | 0.863     | 15.2      | 0.6        | 1.150        | 1.185        | 0.005       | 0.0                | 21             | 0.422              |
| 5.001 | 0.863     | 15.2      | 1.3        | 1.185        | 1.220        | 0.010       | 0.0                | 29             | 0.520              |
| 5.002 | 0.863     | 15.3      | 1.9        | 1.220        | 1.255        | 0.015       | 0.0                | 35             | 0.586              |
| 4.002 | 0.860     | 15.2      | 4.4        | 1.255        | 1.270        | 0.036       | 0.0                | 55             | 0.747              |
| 4.003 | 0.829     | 14.6      | 6.3        | 1.270        | 1.390        | 0.052       | 0.0                | 68             | 0.796              |
| 4.004 | 0.845     | 14.9      | 8.2        | 1.390        | 1.410        | 0.068       | 0.0                | 79             | 0.865              |
| 6.000 | 0.835     | 14.8      | 2.0        | 0.700        | 0.750        | 0.016       | 0.0                | 37             | 0.584              |
| 4.005 | 0.842     | 14.9      | 11.9       | 1.410        | 1.440        | 0.100       | 0.0                | 102            | 0.934              |
| 7.000 | 0.884     | 15.6      | 2.3        | 0.700        | 0.750        | 0.018       | 0.0                | 38             | 0.629              |
| 4.006 | 1.080     | 19.1      | 14.1       | 1.440        | 1.430        | 0.118       | 0.0                | 96             | 1.179              |
| 8.000 | 0.816     | 14.4      | 0.6        | 0.700        | 0.760        | 0.005       | 0.0                | 21             | 0.406              |
| 8.001 | 0.834     | 14.7      | 1.2        | 0.760        | 0.875        | 0.010       | 0.0                | 29             | 0.502              |
| 8.002 | 1.350     | 23.9      | 1.8        | 0.875        | 0.925        | 0.015       | 0.0                | 28             | 0.796              |
| 9.000 | 0.827     | 14.6      | 0.6        | 0.800        | 0.875        | 0.005       | 0.0                | 21             | 0.412              |

### Links

| Name  | US 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) |
|-------|----------|------------|-------------|-----------|-----------|----------|-------------|----------|---------------|--------------|
| 9.001 | FD IC 05 | 1.698      | 0.600       | 16.950    | 16.900    | 0.050    | 34.0        | 150      | 5.24          | 46.0         |
| 4.007 | SW MH 13 | 1.009      | 0.600       | 16.320    | 16.315    | 0.005    | 201.8       | 225      | 5.92          | 43.9         |

| 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) |
|-------|-----------|-----------|------------|--------------|--------------|-------------|--------------------|----------------|--------------------|
| 9.001 | 1.733     | 30.6      | 1.2        | 0.875        | 0.925        | 0.010       | 0.0                | 21             | 0.854              |
| 4.007 | 0.916     | 36.4      | 18.7       | 1.430        | 1.435        | 0.157       | 0.0                | 115            | 0.924              |

### Simulation Settings

|                      |                      |                            |        |
|----------------------|----------------------|----------------------------|--------|
| Rainfall Methodology | FSR                  | Analysis Speed             | Normal |
| Rainfall Events      | Singular             | Skip Steady State          | x      |
| FSR Region           | Scotland and Ireland | Drain Down Time (mins)     | 1200   |
| M5-60 (mm)           | 15.700               | Additional Storage (m³/ha) | 20.0   |
| Ratio-R              | 0.271                | Starting Level (m)         |        |
| Summer CV            | 0.750                | Check Discharge Rate(s)    | x      |
| Winter CV            | 0.840                | Check Discharge Volume     | x      |

### Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 2                     | 0                     | 0                     | 0                     |
| 30                    | 20                    | 0                     | 0                     |
| 100                   | 20                    | 0                     | 0                     |

### Node SW MH 14 Online Hydro-Brake® Control

|                          |        |                         |                                |
|--------------------------|--------|-------------------------|--------------------------------|
| Flap Valve               | ✓      | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | x      | Sump Available          | ✓                              |
| Invert Level (m)         | 15.925 | Product Number          | CTL-SHE-0050-1200-1100-1200    |
| Design Depth (m)         | 1.100  | Min Outlet Diameter (m) | 0.075                          |
| Design Flow (l/s)        | 1.2    | Min Node Diameter (mm)  | 1200                           |

### Node SW Outlet Flow through Pond Storage Structure

|                             |         |                           |        |                          |        |
|-----------------------------|---------|---------------------------|--------|--------------------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Porosity                  | 0.67   | Main Channel Length (m)  | 20.000 |
| Side Inf Coefficient (m/hr) | 0.00000 | Invert Level (m)          | 15.950 | Main Channel Slope (1:X) | 1000.0 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 624    | Main Channel n           | 0.030  |

### Inlets

SW Inlet

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|-----------|-----------|---------------|-----------|-----------|---------------|-----------|-----------|---------------|
| 0.000     | 170.0     | 170.0         | 0.706     | 170.0     | 202.6         | 0.707     | 0.0       | 202.6         |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event        | US Node        | Depth (m) | Flood (m <sup>3</sup> ) | Status |
|-------------------|----------------|-----------|-------------------------|--------|
| 15 minute winter  | SW IC 01       | 0.021     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 02       | 0.031     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 03       | 0.038     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 04       | 0.026     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 05       | 0.039     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 06       | 0.070     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 07       | 0.070     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 08       | 0.124     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 09       | 0.040     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 10       | 0.132     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 11       | 0.041     | 0.0000                  | OK     |
| 15 minute winter  | SW IC 12       | 0.122     | 0.0000                  | OK     |
| 15 minute winter  | FD IC 01       | 0.022     | 0.0000                  | OK     |
| 15 minute winter  | FD IC 02       | 0.030     | 0.0000                  | OK     |
| 15 minute winter  | FD IC 03       | 0.031     | 0.0000                  | OK     |
| 15 minute winter  | FD IC 04       | 0.022     | 0.0000                  | OK     |
| 15 minute winter  | FD IC 05       | 0.023     | 0.0000                  | OK     |
| 15 minute winter  | SW MH 13       | 0.127     | 0.0000                  | OK     |
| 480 minute winter | SW Inlet       | 0.167     | 0.0000                  | OK     |
| 480 minute winter | SW Outlet      | 0.187     | 0.0000                  | OK     |
| 480 minute winter | SW MH 14       | 0.212     | 0.0000                  | OK     |
| 480 minute winter | CS MH 01       | 0.027     | 0.0000                  | OK     |
| 480 minute winter | CS MH 02       | 0.027     | 0.0000                  | OK     |
| 15 minute summer  | EX SO 24282527 | 0.000     | 0.0000                  | OK     |
| 15 minute summer  | EX SO 24282601 | 0.000     | 0.0000                  | OK     |

| Link Event (Upstream Depth) | US Node        | Link              | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m <sup>3</sup> ) | Discharge Vol (m <sup>3</sup> ) |
|-----------------------------|----------------|-------------------|---------------|----------------|----------|----------------------------|---------------------------------|
| 15 minute winter            | SW IC 01       | 5.000             | 0.7           | 0.324          | 0.044    | 0.0099                     |                                 |
| 15 minute winter            | SW IC 02       | 5.001             | 1.3           | 0.436          | 0.088    | 0.0145                     |                                 |
| 15 minute winter            | SW IC 03       | 5.002             | 2.0           | 0.343          | 0.128    | 0.0272                     |                                 |
| 15 minute winter            | SW IC 04       | 4.000             | 1.0           | 0.365          | 0.064    | 0.0177                     |                                 |
| 15 minute winter            | SW IC 05       | 4.001             | 2.0           | 0.569          | 0.138    | 0.0393                     |                                 |
| 15 minute winter            | SW IC 06       | 4.002             | 4.6           | 0.567          | 0.301    | 0.0165                     |                                 |
| 15 minute winter            | SW IC 07       | 4.003             | 6.6           | 0.561          | 0.453    | 0.2077                     |                                 |
| 15 minute winter            | SW IC 08       | 4.004             | 8.7           | 0.546          | 0.583    | 0.0450                     |                                 |
| 15 minute winter            | SW IC 09       | 6.000             | 2.1           | 0.576          | 0.140    | 0.0259                     |                                 |
| 15 minute winter            | SW IC 10       | 4.005             | 12.8          | 0.803          | 0.857    | 0.0675                     |                                 |
| 15 minute winter            | SW IC 11       | 7.000             | 2.3           | 0.614          | 0.146    | 0.0239                     |                                 |
| 15 minute winter            | SW IC 12       | 4.006             | 15.0          | 1.073          | 0.786    | 0.0181                     |                                 |
| 15 minute winter            | FD IC 01       | 8.000             | 0.7           | 0.326          | 0.046    | 0.0187                     |                                 |
| 15 minute winter            | FD IC 02       | 8.001             | 1.3           | 0.499          | 0.088    | 0.0431                     |                                 |
| 15 minute winter            | FD IC 03       | 8.002             | 1.9           | 0.772          | 0.082    | 0.0070                     |                                 |
| 15 minute winter            | FD IC 04       | 9.000             | 0.7           | 0.398          | 0.046    | 0.0184                     |                                 |
| 15 minute winter            | FD IC 05       | 9.001             | 1.3           | 0.809          | 0.043    | 0.0028                     |                                 |
| 15 minute winter            | SW MH 13       | 4.007             | 20.0          | 0.908          | 0.548    | 0.0222                     |                                 |
| 480 minute winter           | SW Inlet       | Flow through Pond | 2.5           | 0.022          | 0.001    | 20.1424                    |                                 |
| 480 minute winter           | SW Outlet      | 2.000             | 1.8           | 0.234          | 0.044    | 0.1474                     |                                 |
| 480 minute winter           | SW MH 14       | 2.001             | 1.0           | 0.377          | 0.028    | 0.0832                     |                                 |
| 480 minute winter           | CS MH 01       | 2.002             | 1.0           | 0.363          | 0.027    | 0.0081                     |                                 |
| 480 minute winter           | CS MH 02       | 2.003             | 1.0           | 0.388          | 0.029    | 0.0181                     |                                 |
| 15 minute summer            | EX SO 24282527 | 1.000             | 0.0           | 0.000          | 0.000    | 0.0297                     |                                 |
| 15 minute summer            | EX SO 24282601 | 3.000             | 0.0           | 0.000          | 0.000    | 0.0607                     |                                 |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event        | US Node        | Depth (m) | Flood (m <sup>3</sup> ) | Status |
|-------------------|----------------|-----------|-------------------------|--------|
| 480 minute winter | EX SO 24283605 | 0.014     | 0.0000                  | OK     |
| 480 minute winter | EX SO 24283601 | 0.021     | 0.0000                  | OK     |
| 480 minute winter | EX SO 24284503 | 0.021     | 0.0000                  | OK     |

| Link Event (Upstream Depth) | US Node        | Link  | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m <sup>3</sup> ) | Discharge Vol (m <sup>3</sup> ) |
|-----------------------------|----------------|-------|---------------|----------------|----------|----------------------------|---------------------------------|
| 480 minute winter           | EX SO 24283605 | 1.001 | 1.0           | 0.599          | 0.004    | 0.0359                     |                                 |
| 480 minute winter           | EX SO 24283601 | 1.002 | 1.0           | 0.468          | 0.009    | 0.1980                     | 35.9                            |

**Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event        | US Node        | Depth (m) | Flood (m <sup>3</sup> ) | Status     |
|-------------------|----------------|-----------|-------------------------|------------|
| 15 minute winter  | SW IC 01       | 0.205     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 02       | 0.240     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 03       | 0.274     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 04       | 0.039     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 05       | 0.060     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 06       | 0.306     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 07       | 0.311     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 08       | 0.338     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 09       | 0.061     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 10       | 0.317     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 11       | 0.064     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 12       | 0.228     | 0.0000                  | SURCHARGED |
| 15 minute winter  | FD IC 01       | 0.031     | 0.0000                  | OK         |
| 15 minute summer  | FD IC 02       | 0.044     | 0.0000                  | OK         |
| 15 minute winter  | FD IC 03       | 0.047     | 0.0000                  | OK         |
| 15 minute summer  | FD IC 04       | 0.032     | 0.0000                  | OK         |
| 15 minute summer  | FD IC 05       | 0.035     | 0.0000                  | OK         |
| 15 minute winter  | SW MH 13       | 0.183     | 0.0000                  | OK         |
| 600 minute winter | SW Inlet       | 0.452     | 0.0000                  | OK         |
| 600 minute winter | SW Outlet      | 0.472     | 0.0000                  | SURCHARGED |
| 600 minute winter | SW MH 14       | 0.497     | 0.0000                  | SURCHARGED |
| 30 minute winter  | CS MH 01       | 0.027     | 0.0000                  | OK         |
| 30 minute summer  | CS MH 02       | 0.027     | 0.0000                  | OK         |
| 15 minute summer  | EX SO 24282527 | 0.000     | 0.0000                  | OK         |
| 15 minute summer  | EX SO 24282601 | 0.000     | 0.0000                  | OK         |

| Link Event (Upstream Depth) | US Node        | Link              | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m <sup>3</sup> ) | Discharge Vol (m <sup>3</sup> ) |
|-----------------------------|----------------|-------------------|---------------|----------------|----------|----------------------------|---------------------------------|
| 15 minute winter            | SW IC 01       | 5.000             | 1.7           | 0.371          | 0.112    | 0.0832                     |                                 |
| 15 minute winter            | SW IC 02       | 5.001             | 3.4           | 0.444          | 0.223    | 0.0832                     |                                 |
| 15 minute winter            | SW IC 03       | 5.002             | 5.2           | 0.391          | 0.341    | 0.0831                     |                                 |
| 15 minute winter            | SW IC 04       | 4.000             | 2.3           | 0.454          | 0.145    | 0.0322                     |                                 |
| 15 minute winter            | SW IC 05       | 4.001             | 4.5           | 0.709          | 0.312    | 0.0714                     |                                 |
| 15 minute winter            | SW IC 06       | 4.002             | 9.0           | 0.570          | 0.592    | 0.0359                     |                                 |
| 15 minute winter            | SW IC 07       | 4.003             | 12.2          | 0.691          | 0.831    | 0.3087                     |                                 |
| 15 minute winter            | SW IC 08       | 4.004             | 15.5          | 0.881          | 1.039    | 0.0496                     |                                 |
| 15 minute winter            | SW IC 09       | 6.000             | 4.5           | 0.710          | 0.307    | 0.0460                     |                                 |
| 15 minute winter            | SW IC 10       | 4.005             | 23.0          | 1.308          | 1.547    | 0.0748                     |                                 |
| 15 minute winter            | SW IC 11       | 7.000             | 5.1           | 0.760          | 0.329    | 0.0436                     |                                 |
| 15 minute winter            | SW IC 12       | 4.006             | 27.7          | 1.574          | 1.452    | 0.0227                     |                                 |
| 15 minute winter            | FD IC 01       | 8.000             | 1.4           | 0.396          | 0.095    | 0.0316                     |                                 |
| 15 minute summer            | FD IC 02       | 8.001             | 2.7           | 0.599          | 0.184    | 0.0751                     |                                 |
| 15 minute winter            | FD IC 03       | 8.002             | 4.0           | 0.932          | 0.169    | 0.0121                     |                                 |
| 15 minute summer            | FD IC 04       | 9.000             | 1.4           | 0.477          | 0.094    | 0.0317                     |                                 |
| 15 minute summer            | FD IC 05       | 9.001             | 2.7           | 0.975          | 0.089    | 0.0048                     |                                 |
| 15 minute winter            | SW MH 13       | 4.007             | 38.2          | 1.161          | 1.048    | 0.0331                     |                                 |
| 600 minute winter           | SW Inlet       | Flow through Pond | 3.5           | 0.019          | 0.002    | 52.5733                    |                                 |
| 600 minute winter           | SW Outlet      | 2.000             | 2.0           | 0.212          | 0.049    | 0.1584                     |                                 |
| 600 minute winter           | SW MH 14       | 2.001             | 1.0           | 0.378          | 0.028    | 0.0835                     |                                 |
| 30 minute winter            | CS MH 01       | 2.002             | 1.0           | 0.396          | 0.027    | 0.0082                     |                                 |
| 30 minute summer            | CS MH 02       | 2.003             | 1.0           | 0.389          | 0.029    | 0.0182                     |                                 |
| 15 minute summer            | EX SO 24282527 | 1.000             | 0.0           | 0.000          | 0.000    | 0.0335                     |                                 |
| 15 minute summer            | EX SO 24282601 | 3.000             | 0.0           | 0.000          | 0.000    | 0.0685                     |                                 |

**Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event       | US Node        | Depth (m) | Flood (m <sup>3</sup> ) | Status |
|------------------|----------------|-----------|-------------------------|--------|
| 30 minute summer | EX SO 24283605 | 0.014     | 0.0000                  | OK     |
| 30 minute winter | EX SO 24283601 | 0.021     | 0.0000                  | OK     |
| 30 minute winter | EX SO 24284503 | 0.021     | 0.0000                  | OK     |

| Link Event (Upstream Depth) | US Node        | Link  | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m <sup>3</sup> ) | Discharge Vol (m <sup>3</sup> ) |
|-----------------------------|----------------|-------|---------------|----------------|----------|----------------------------|---------------------------------|
| 30 minute summer            | EX SO 24283605 | 1.001 | 1.0           | 0.857          | 0.004    | 0.0360                     |                                 |
| 30 minute winter            | EX SO 24283601 | 1.002 | 1.0           | 0.468          | 0.009    | 0.1986                     | 28.5                            |

**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.88%**

| Node Event        | US Node        | Depth (m) | Flood (m <sup>3</sup> ) | Status     |
|-------------------|----------------|-----------|-------------------------|------------|
| 15 minute winter  | SW IC 01       | 0.367     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 02       | 0.402     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 03       | 0.435     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 04       | 0.067     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 05       | 0.123     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 06       | 0.467     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 07       | 0.468     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 08       | 0.465     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 09       | 0.070     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 10       | 0.430     | 0.0000                  | SURCHARGED |
| 15 minute winter  | SW IC 11       | 0.074     | 0.0000                  | OK         |
| 15 minute winter  | SW IC 12       | 0.281     | 0.0000                  | SURCHARGED |
| 15 minute winter  | FD IC 01       | 0.036     | 0.0000                  | OK         |
| 15 minute winter  | FD IC 02       | 0.052     | 0.0000                  | OK         |
| 15 minute winter  | FD IC 03       | 0.055     | 0.0000                  | OK         |
| 15 minute winter  | FD IC 04       | 0.037     | 0.0000                  | OK         |
| 15 minute winter  | FD IC 05       | 0.041     | 0.0000                  | OK         |
| 360 minute winter | SW MH 13       | 0.267     | 0.0000                  | SURCHARGED |
| 360 minute winter | SW Inlet       | 0.617     | 0.0000                  | OK         |
| 360 minute winter | SW Outlet      | 0.637     | 0.0000                  | SURCHARGED |
| 360 minute winter | SW MH 14       | 0.662     | 0.0000                  | SURCHARGED |
| 15 minute winter  | CS MH 01       | 0.027     | 0.0000                  | OK         |
| 15 minute winter  | CS MH 02       | 0.027     | 0.0000                  | OK         |
| 15 minute summer  | EX SO 24282527 | 0.000     | 0.0000                  | OK         |
| 15 minute summer  | EX SO 24282601 | 0.000     | 0.0000                  | OK         |

| Link Event (Upstream Depth) | US Node        | Link              | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m <sup>3</sup> ) | Discharge Vol (m <sup>3</sup> ) |
|-----------------------------|----------------|-------------------|---------------|----------------|----------|----------------------------|---------------------------------|
| 15 minute winter            | SW IC 01       | 5.000             | 2.2           | 0.365          | 0.144    | 0.0832                     |                                 |
| 15 minute winter            | SW IC 02       | 5.001             | 4.4           | 0.438          | 0.289    | 0.0832                     |                                 |
| 15 minute winter            | SW IC 03       | 5.002             | 6.6           | 0.424          | 0.435    | 0.0831                     |                                 |
| 15 minute winter            | SW IC 04       | 4.000             | 3.0           | 0.483          | 0.189    | 0.0727                     |                                 |
| 15 minute winter            | SW IC 05       | 4.001             | 5.9           | 0.731          | 0.404    | 0.1847                     |                                 |
| 15 minute winter            | SW IC 06       | 4.002             | 11.5          | 0.653          | 0.756    | 0.0359                     |                                 |
| 15 minute winter            | SW IC 07       | 4.003             | 15.0          | 0.854          | 1.027    | 0.3087                     |                                 |
| 15 minute winter            | SW IC 08       | 4.004             | 18.8          | 1.070          | 1.261    | 0.0496                     |                                 |
| 15 minute winter            | SW IC 09       | 6.000             | 5.8           | 0.757          | 0.395    | 0.0555                     |                                 |
| 15 minute winter            | SW IC 10       | 4.005             | 28.1          | 1.597          | 1.890    | 0.0748                     |                                 |
| 15 minute winter            | SW IC 11       | 7.000             | 6.6           | 0.809          | 0.424    | 0.0527                     |                                 |
| 15 minute winter            | SW IC 12       | 4.006             | 34.2          | 1.943          | 1.793    | 0.0227                     |                                 |
| 15 minute winter            | FD IC 01       | 8.000             | 1.9           | 0.430          | 0.129    | 0.0393                     |                                 |
| 15 minute winter            | FD IC 02       | 8.001             | 3.6           | 0.641          | 0.246    | 0.0940                     |                                 |
| 15 minute winter            | FD IC 03       | 8.002             | 5.4           | 1.000          | 0.226    | 0.0151                     |                                 |
| 15 minute winter            | FD IC 04       | 9.000             | 1.9           | 0.511          | 0.127    | 0.0399                     |                                 |
| 15 minute winter            | FD IC 05       | 9.001             | 3.7           | 1.048          | 0.120    | 0.0060                     |                                 |
| 360 minute winter           | SW MH 13       | 4.007             | 9.8           | 0.751          | 0.269    | 0.0401                     |                                 |
| 360 minute winter           | SW Inlet       | Flow through Pond | 5.4           | 0.030          | 0.003    | 71.4144                    |                                 |
| 360 minute winter           | SW Outlet      | 2.000             | 1.7           | 0.230          | 0.042    | 0.1584                     |                                 |
| 360 minute winter           | SW MH 14       | 2.001             | 1.0           | 0.378          | 0.028    | 0.0835                     |                                 |
| 15 minute winter            | CS MH 01       | 2.002             | 1.0           | 0.426          | 0.027    | 0.0082                     |                                 |
| 15 minute winter            | CS MH 02       | 2.003             | 1.0           | 0.389          | 0.029    | 0.0182                     |                                 |
| 15 minute summer            | EX SO 24282527 | 1.000             | 0.0           | 0.000          | 0.000    | 0.0339                     |                                 |
| 15 minute summer            | EX SO 24282601 | 3.000             | 0.0           | 0.000          | 0.000    | 0.0694                     |                                 |

**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.88%**

| Node Event       | US Node        | Depth (m) | Flood (m <sup>3</sup> ) | Status |
|------------------|----------------|-----------|-------------------------|--------|
| 15 minute winter | EX SO 24283605 | 0.014     | 0.0000                  | OK     |
| 15 minute winter | EX SO 24283601 | 0.021     | 0.0000                  | OK     |
| 15 minute winter | EX SO 24284503 | 0.021     | 0.0000                  | OK     |

| Link Event (Upstream Depth) | US Node        | Link  | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m <sup>3</sup> ) | Discharge Vol (m <sup>3</sup> ) |
|-----------------------------|----------------|-------|---------------|----------------|----------|----------------------------|---------------------------------|
| 15 minute winter            | EX SO 24283605 | 1.001 | 1.0           | 0.904          | 0.004    | 0.0360                     |                                 |
| 15 minute winter            | EX SO 24283601 | 1.002 | 1.0           | 0.468          | 0.009    | 0.1986                     | 26.5                            |

## Appendix F – Water Demand Calculations

# Boylan Centre Development



## Water Demand

Calculations by: **PB**

Checked by: **KF**

Date: 25/10/2025

### Calculation

| Residential Unit Type        | Unit   |
|------------------------------|--------|
| Average Occupancy Per Unit   | 2.70   |
| Number of Units              | 59.00  |
| Average Occupancy (PE)       | 160.00 |
| Average Usage (l/person/day) | 150.00 |

| Hotel Unit Type              | Room   |
|------------------------------|--------|
| Average Occupancy Per Room   | 1.50   |
| Number of Rooms              | 0.00   |
| Average Occupancy (PE)       | 0.00   |
| Average Usage (l/person/day) | 250.00 |

|  |          |
|--|----------|
| Average Residential Daily Demand (l/day)       | 24000.00 |
| Average Residential Daily Demand (l/s)         | 0.28     |
| Average Residential Day/Peak Week Demand (l/s) | 0.35     |
| Peak Hour Residential Demand (l/s)             | 1.74     |

|  |      |
|--|------|
| Average Hotel Daily Demand (l/day)       | 0.00 |
| Average Hotel Daily Demand (l/s)         | 0.00 |
| Average Hotel Day/Peak Week Demand (l/s) | 0.00 |
| Peak Hour Hotel Demand (l/s)             | 0.00 |

| Commercial Unit Type                     |  | Shopping | Commercial | Pub / Restaurant | Gym   | Community | WC    |
|--|--|----------|------------|------------------|-------|-----------|-------|
| Average Occupancy m <sup>2</sup> /Person |  | 18.00    | 25.00      | 5.00             | 5.00  | 5.00      | -     |
| Area / Frequency use m <sup>2</sup>      |  | 0.00     | 0.00       | 0.00             | 0.00  | 150.00    | 0.00  |
| Average Occupancy / No. of WC (PE)       |  | 0.00     | 0.00       | 0.00             | 0.00  | 30.00     | 0.00  |
| Average Usage (l/person/day)             |  | 25.00    | 100.00     | 60.00            | 60.00 | 50.00     | 10.00 |
| Average Daily Demand (l/day)             |  | 0.00     | 0.00       | 0.00             | 0.00  | 1500.00   | 0.00  |

|   |         |
|---|---------|
| Average Commercial Daily Demand (l/day)       | 1500.00 |
| Average Commercial Daily Demand (l/s)         | 0.02    |
| Average Commercial Day/Peak Week Demand (l/s) | 0.02    |
| Peak Hour Commercial Demand (l/s)             | 0.11    |

### Water Demand

|                                    | Residential | Hotel | Commercial | Total |
|------------------------------------|-------------|-------|------------|-------|
| Average Daily Demand (l/s)         | 0.28        | 0.00  | 0.02       | 0.30  |
| Average Day/Peak Week Demand (l/s) | 0.35        | 0.00  | 0.02       | 0.37  |
| Peak Hour Water Demand (l/s)       | 1.74        | 0.00  | 0.11       | 1.84  |

### NOTES:

- Per-Capita Consumption 150 l/person/day as per IW Water Code of Practice (3.7.2 Water Demand Calculations)
- Average Occupancy Ratio of 2.7 persons per dwelling as per IW Water Code of Practice (3.7.2 Water Demand Calculations)
- Flow Rates for Design as per IW Water Code of Practice (Appendix D)
- Average Day/Week Demand Factor is 1.25 as per IW Water Code of Practice (3.7.2 Water Demand Calculations)
- Peak Demand Factor is 5 as per IW Water Code of Practice (3.7.2 Water Demand Calculations)
- Average Occupancy (or PE Population Equivalent) = No of Residential Units x Average Occupancy Ratio
- Average Demand = Average Occupancy x Per Capita Consumption
- Average Day/Peak Week demand = Average Daily Domestic Demand x Average Day/Week Demand Factor
- Peak Hour Water Demand = Average Occupancy x per Capita Consumption x Average Day/Week Demand Factor x Peak Demand Factor