MHL & ASSOCIATES LTD.

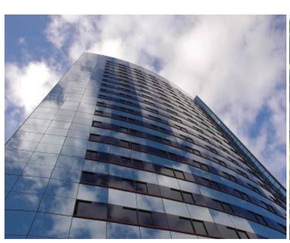
For: **Ballinacurra Project Limited Partnership**

Ballinacurra Mill LRD, Midleton, Cork.

Drainage Impact Assessment
SUDS Statement

November 2025

MHL & Associates Ltd.
Consulting Engineers

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1 INTRODUCTION

This Drainage Impact Assessment ("DIA") has been carried out by MHL & Associates Ltd. on behalf of Ballinacurra Project Limited Partnership for a proposed Large Scale Residential Development (LRD) for zoned lands in Ballinacurra, Midleton, Cork.

This DIA has been prepared in compliance with the most recent Cork County Development Plan which states that efforts should be made to limit the extent of hard surfacing at new developments.

1.1 Site Location

The applicant is seeking planning for the lands located to the south of Midleton town in the village of Ballinacurra. The lands are bounded to the east by the R629 Road, to the north by Rose Lane & Upper Road and to the west and south by existing housing estates Rose Hill & Old Dairy.
Figure 1.1 below shows the site location in relation to Midleton, Ballinacurra and the wider regional road network. The site is about 1.5 km south of Midleton town centre.

Figure 1.1: Site Location indicated with red x

The proposed site layout has been developed by Fourem Architects. Please refer to the design team drawing pack submitted for further details.

Figure 1.2: Site Location

1.2 Development Description

The development is proposed on the brownfield site of Rose Hill/Ballinacurra Mill. The proposed development will consist of the demolition of a number of structures associated with the former Mill complex and the construction of 103 dwelling houses and 25 apartments (total of 128 residential units) as follows: 92 no. new dwelling houses ranging from 2 to 3 storeys in height (comprising of 39 no. 2 bedroom houses, 36 no. 3 bedroom houses and 17 no. 4 bedroom houses), 11 no. dwelling houses in existing structures (including 1 no. 4 bedroom dwelling in Rosehill House, 1 no. 3 bedroom dwelling in Rosehill outbuildings, 1 no. 2 bedroom dwelling and 1 no. 3 bedroom dwelling in Eastville House, and 3 no. 2 bedroom dwellings and 4 no. 3 bedroom dwellings in the Mill Buildings), 25 no. apartments in existing structures (comprising of 1 no. ground floor Studio and 10 no. 1 bedroom apartments and 14 no. 2 bedroom apartments in existing Mill buildings from first to third floor), 1 no. single storey creche, 1 no. single storey café, 2 no. ground floor retail units, 1 no. ground floor commercial office unit, 1 no. ground floor medical centre unit, 1 no. ESB substation.

Ancillary works including provision of roads, footpaths, public open space, communal open space, private open spaces, 214 car park spaces, 114 cycle spaces, EV charging spaces, drainage infrastructure, 2 no. access points (one off Rose Lane and one off Cloyne Road, R629) and all associated site works including landscaping and boundary treatments. It is also proposed to carry out new car parking arrangements along part of Rose Lane to the north of the site measuring 0.057 hectares (bringing gross site area to 3.687 ha).

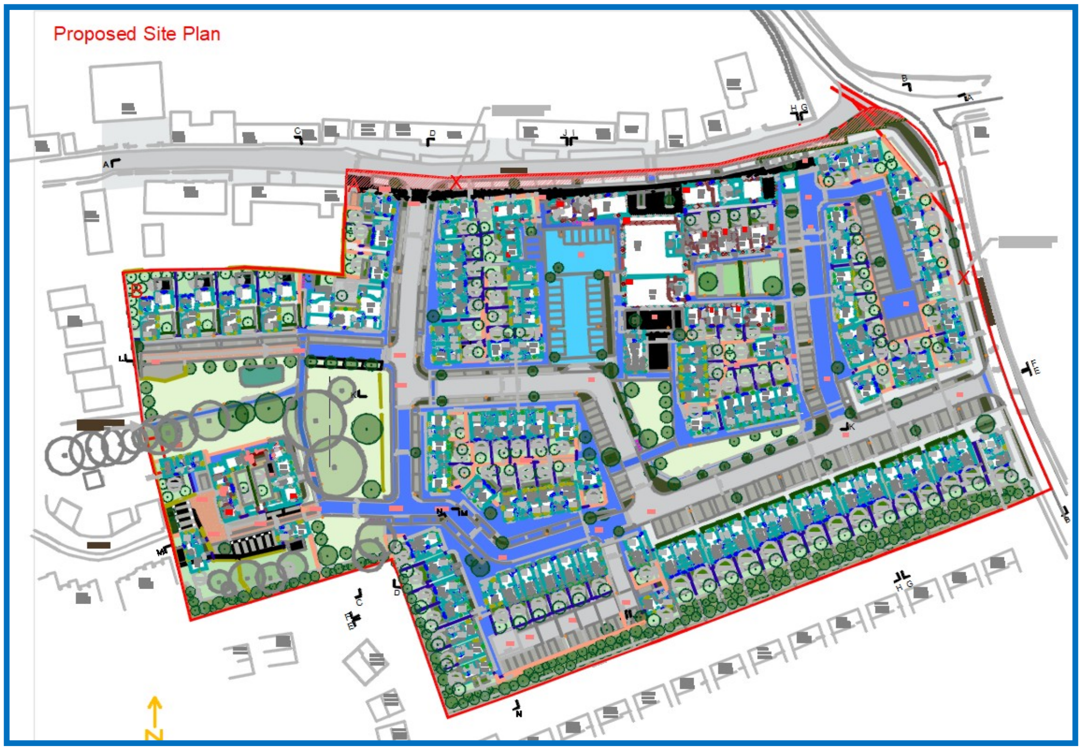


Figure 1.3: Development Site Layout (c: Fourem Architecture)

1.3 Existing Site Hydrology

Local hydrology is intrinsically connected to the hydrogeological setting within the greater development area. According to the EPA (2021) on-line mapping, the proposed development site lies within the KNOCKNAMADDEREE_010 River Basin which has an area of 22.8km^2. The sub catchment for the site is the Farrannamanagh_SC_010_19_12 sub catchment and can be seen in red in Figure 1.4 below.

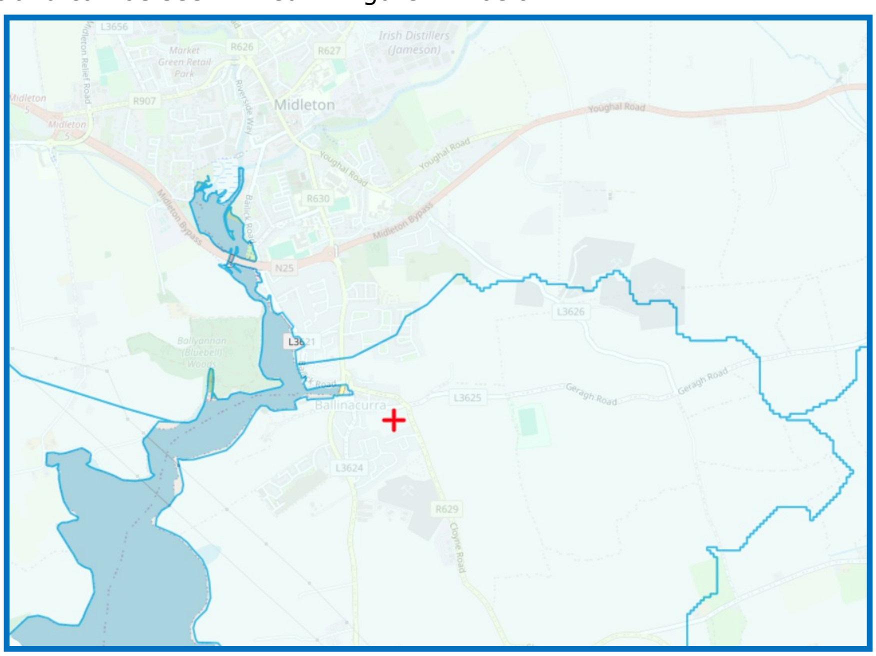


Figure 1.4: Sub Catchment Areas (c: EPA Water Map)

The closest waterbody is the West Ballynacora Stream located to the north of the site. This stream flows into an estuary of Cork harbour to the immediate west. Figure 1.5 1.6 below shows the site in relation to the stream. Figure 1.6 is a photo of the stream looking eastward.

Figure 1.5: Location and direction of watercourses in relation to site (c: EPA Water Map)

Figure 1.6: West Ballynacora Stream (c: Google Maps)

2 PROPOSED DEVELOPMENT SURFACE WATER MANAGEMENT SYSTEM

The proposed surface water management system is designed, as much as is feasible, in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of a greenfield site. The criteria provide a consistent approach to addressing both rate and volume of runoff as well as ensuring the environment is protected from pollution that is washed off roads and buildings.

These drainage design criteria are as follows:
- Criterion 1 - River Water Quality Protection
- Criterion 2 - River Regime Protection
- Criterion 3 - Flood Risk Assessment
- Criterion 4 - River Flood Protection

2.1 Principle Design Considerations

During the design of the storm water drainage for the proposed site, including Suds, the following key documents / standards were taken into consideration.
- Cork County Development Plan 2022-2028
- Greater Dublin Strategic Drainage Study (GDSDS)
- CIRIA report C753 The Suds Manual-v6
- Greater Dublin Regional Code of Practice for Drainage (GDRCoP)

2.2 Storm Water Drainage System Overview

2.2.1 Predevelopment Conditions

For this development, the permissible outflow is calculated using the estimation method contained in the Institute of Hydrology Report No.124: Flood estimation for small catchments:

$$QBAR = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$$

- QBAR is the Mean Annual Peak Flow (Permissible outflow in m3/sec)
- AREA is the Catchment site area in km2.
- SAAR is the Standard Annual Average Rainfall
- SOIL is the soil index.

Given that the development is smaller than 50 hectares, the analysis for determining the permissible outflow employs 50 hectares in the formula. It then linearly interpolates the flow rate values based on the ratio of the development size to 50 hectares. Design summary sheets for the QBAR value can be found in the appendix of this report, outlining the Mean Annual Flow (permissible outflow) specifically calculated for the designated development areas. The allowable runoff estimates method utilizes IH124 and the Soil Index value taken from UKSUDS as 0.3.

2.3 Greenfield Runoff

The area of the greenfield site is approximately 3.63 hectares. The estimated greenfield runoff rate (Qbar) calculated for the development is 15.53 litres per second as per **Figure 2.1** (equivalent to 4.28 l/sec/ha). This was checked for this planning application using the HR Wallingford Greenfield runoff estimation online tool. Details of this calculation are attached in **Appendix B** of this report. A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is also shown in **Figure 2.2**.

GREENFIELD RUNOFF		
	Area (ha)	Qbar (l/s)
SITE	3.63	15.53
Per hectare	1	4.28

Figure 2.1: Greenfield Runoff for Site

Soil Type	3
SPR	0.37
SAAR	1080
Hydrological Region	13
M5-60	17.1
Ratio R	0.21
QBar (l/s)	15.53

Figure 2.2: Summary of design values for Greenfield Runoff Estimation

The M5-60 is the rainfall depth (specified in mm) for a 60 minute storm with a 5 year return period. The rainfall depth for this site was obtained from Met Eireann. **Figure 2.2** below shows the M5-60 value of 17.1mm from the Rainfall Return Period Table obtained from Met Eireann. In the FSR (Flood Studies Report) rainfall method, Ratio R is the dimensionless ratio of a 5-year return period, 60-minute storm rainfall depth (M5-60) to a 5-year return period, 2-day storm rainfall depth (M5-2day), expressed as R= M5-60 / M5-2day. It helps determine the shape of the rainfall profile and is used in calculating rainfall depths for different storm durations and return periods. The Rainfall Return Period Table can also be found in **Appendix C** of this report.

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 160259, Northing: 69374,

	Interval		Years										
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	120,
5 mins	3.3,	4.1,	4.5,	5.1,	5.5,	5.7,	6.6,	7.5,	8.1,	8.9,	9.5,	10.0,	10.3,
10 mins	4.6,	5.7,	6.3,	7.1,	7.6,	8.0,	9.2,	10.5,	11.3,	12.3,	13.2,	13.9,	14.4,
15 mins	5.4,	6.7,	7.4,	8.3,	9.0,	9.4,	10.8,	12.3,	13.3,	14.5,	15.6,	16.4,	16.9,
30 mins	7.3,	9.1,	10.0,	11.2,	12.1,	12.7,	14.6,	16.6,	17.9,	19.5,	21.0,	22.1,	22.8,
1 hours	9.8,	12.2,	13.4,	15.2,	16.3,	17.1,	19.7,	22.4,	24.1,	26.3,	28.3,	29.7,	30.7,
2 hours	13.2,	16.5,	18.1,	20.4,	21.9,	23.0,	26.5,	30.1,	32.4,	35.5,	38.1,	40.1,	41.4,
3 hours	15.7,	19.6,	21.6,	24.3,	26.1,	27.4,	31.5,	35.9,	38.6,	42.2,	45.4,	47.7,	49.2,
4 hours	17.8,	22.2,	24.4,	27.5,	29.5,	31.0,	35.7,	40.6,	43.7,	47.8,	51.3,	54.0,	55.7,
6 hours	21.2,	26.4,	29.1,	32.7,	35.1,	36.9,	42.5,	48.3,	52.0,	56.9,	61.1,	64.3,	66.3,
9 hours	25.2,	31.5,	34.6,	39.0,	41.8,	43.9,	50.6,	57.5,	61.9,	67.7,	72.7,	76.5,	79.0,
12 hours	28.5,	35.6,	39.1,	44.1,	47.3,	49.7,	57.2,	65.1,	70.0,	76.7,	82.3,	86.6,	89.4,
18 hours	33.9,	42.4,	46.6,	52.5,	56.3,	59.2,	68.1,	77.5,	83.4,	91.3,	98.0,	103.1,	106.4,
24 hours	38.4,	48.0,	52.7,	59.4,	63.8,	67.0,	77.1,	87.7,	94.3,	103.3,	110.9,	116.6,	120.4,
2 days	49.4,	60.5,	65.9,	73.4,	78.3,	81.9,	93.0,	104.5,	111.7,	121.2,	129.3,	135.4,	139.3,
3 days	58.8,	71.1,	77.0,	85.3,	90.6,	94.5,	106.5,	118.9,	126.5,	136.7,	145.3,	151.6,	155.8,
4 days	67.3,	80.7,	87.1,	96.0,	101.7,	105.9,	118.7,	131.8,	139.9,	150.6,	159.6,	166.3,	170.6,
6 days	82.8,	98.0,	105.3,	115.3,	121.6,	126.3,	140.5,	155.0,	163.9,	175.6,	185.3,	192.5,	197.3,
8 days	97.0,	113.9,	121.9,	132.9,	139.8,	144.9,	160.3,	176.0,	185.5,	198.0,	208.5,	216.2,	221.2,
10 days	110.4,	128.8,	137.5,	149.4,	156.8,	162.3,	178.8,	195.5,	205.6,	218.9,	230.0,	238.1,	243.4,
12 days	123.3,	143.1,	152.4,	165.0,	172.9,	178.8,	196.3,	213.9,	224.6,	238.6,	250.3,	258.8,	264.3,
16 days	148.0,	170.2,	180.6,	194.7,	203.5,	209.9,	229.3,	248.7,	260.4,	275.6,	288.3,	297.5,	303.5,
20 days	171.6,	196.1,	207.4,	222.9,	232.4,	239.4,	260.4,	281.3,	293.9,	310.3,	323.8,	333.7,	340.2,
25 days	200.1,	227.2,	239.7,	256.6,	267.0,	274.7,	297.5,	320.2,	333.7,	351.4,	365.9,	376.6,	383.4,

NOTES:
These values are derived from a Depth Duration Frequency (DDF) Model update 2023
For details refer to:
'Mateus C., and Coonan, B. 2023. Estimation of point rainfall frequencies in Ireland. Technical Note No. 68. Met Eireann',
Available for download at:
http://hdl.handle.net/2262/102417

Figure 2.3: Rainfall Return Period Table

2.3.1 Post Development Conditions

The stormwater management plan for this particular development incorporates a range of measures, including both soft and hard solutions. The use of Sustainable Drainage Systems (SUDS) and tank systems has been proposed where applicable.

The traditional method of disposing of surface water runoff from impermeable surfaces such as roofs, roads and carparks is collection and redirection to drainage systems. This can result in localised flooding, higher waste treatment costs and the transfer of contaminants (such as oil from carparks) directly to water courses, resulting in pollution and affecting a river's ability to recharge naturally. Sustainable Urban Drainage Systems (SuDS) offer a more integrated approach to rainwater management. It involves a method of replicating the natural characteristics of rainfall runoff from any site, ensuring water is infiltrated or conveyed more slowly to the drainage system and ultimately to water courses via permeable paving, swales, green roofs, rain water harvesting, detention basins, ponds, wetlands and attenuation tanks. SuDS comprise a series of water management measures designed to reduce and manage surface water in an environmentally sustainable way. When implemented correctly, SuDS not only help reduce the risk of localised flooding but also help to alleviate downstream flood risk. There are multiple SuDS measures that can be utilised depending on site-specific circumstances however, SuDS strategies will not be uniform and will differ from site to site owing to site characteristics, location and existing constraints.

The proposed development will include a number of SuDS measures where possible, including water butts/rainwater harvesting, permeable paving in the form of grasscrete, tree-pits and attenuation tanks. Together, these elements provide conveyance, interception storage, and attenuation storage for rainwater runoff.

Collection

Rain water will be collected from the building roofs and discharge via down pipes into the developments stormwater network.

Surface water runoff from paved surfaces will be collected separately by drainage channels, road gullies and underground pipes.

A number of attenuation tanks will be utilised to facilitate storage of stormwater in order to achieve an acceptable discharge rate from the site. The attenuation tanks are specifically designed to cater for all storm events up to and including a 100-year storm event with a 20% climate change factor.

The surface water drainage system for the proposed development will be separate to the foul water system.

Treatment

Treatment is provided in the form of grasscrete for parking areas. Grasscrete allows rainwater to infiltrate into the ground, reducing surface runoff, preventing flooding, and helping to recharge groundwater. Further treatment is provided by the inclusion of tree pits where feasible across the development. These engineered, soil-filled tree boxes with drainage pipes beneath offer interception storage.

All stormwater collected within the development networks will pass through a petrol interceptor located within the site prior to discharging to the public stormwater network.

Discharge

It is proposed to discharge the attenuated surface water flow to the existing public stormwater network located along Rose Lane. The maximum discharge rate from the development has been restricted to considerably less than the calculated permissible runoff (QBAR) for the site. The total discharge from the site is 9.64 l/sec which is 62% of the allowable QBar discharge rate for the site of 15.53 l/sec.

Pipe Design
Pipes carrying surface water within the site are suitably sized to cater for a rainfall intensity of 50mm per hour applied to all external impermeable areas and roofs. Surface water runoff from impermeable areas is calculated using the Modified Rational Method.

Design Details
It is proposed to attenuate to 6no. tanks, providing sufficient capacity (m3) which is greater than the storage requirement for the 100-year return period including a climate change factor of 20%. Regarding limiting outflow from the storm network, hydro-brakes (or similar approved) flow control devices are to be fitted at their outlets.

The design of the drainage network was assessed using events with a range of different durations to determine the critical event for each period analysed as follows:

- 1 in 2-year return period events were used to ensure that the system did not surcharge.
- 1 in 30-year return period events were used to ensure that flooding did not occur.
- 1 in 100-year return period events including a climate change factor of 20% were used to ensure that flooding did not occur.

It should be noted that climate change has been accounted in the design. The GDSDS recommend a factor of 20% which has been incorporated into the design.

The layout of the proposed storm water network is shown in the Stormwater Layout drawings.

As per section 16 of the GDRCoP and in particular the criteria as set out in section 16.3, compliance with all 4 Criteria is summarised as follows:

Criterion 1 (River Water Quality Protection):

Interception provided by way of:

- Permeable paving in the form of grasscrete for parking areas.
- Tree pits which will have partial infiltration as well as attenuation.
- Surface water runoff to attenuation tanks. These will be equipped with silt chambers and hydrocarbon interceptors.

Criterion 2 (Stream Regime Protection):

Discharge rate restricted to 62% of QBAR for all storm events up to and including the 1 in 100-year storm event including a climate change factor of 20%.

Criterion 3 (Level of service (flooding) for the site) :

A review of the Office of Public Works (OPW) Flood Hazard Mapping website indicates that there are no records of flooding incidents at the site of the proposed development.

- No Site Flooding.
- No internal property flooding.
- All FFLs are a minimum of 500mm above adjacent on-site attenuation/infiltration tanks.

- Run-off from green areas during high intensity storm events can be catered for in on-site attenuation tanks.

A Flood Risk Assessment has been prepared for this submission and is included in the Engineering Design Report.

Criterion 4 (River Flood Protection):

Discharge rate restricted to 62% of QBAR for all storm events up to and including the 1 in 100-year storm event including a climate change factor of 20%. No reduction in terms of run-off has been allowed for in the sizing of attenuation tanks because of proposed Suds measures such as permeable paving or tree pits.

For the operational phase of the scheme the provision of Suds interception measures will aim to ensure that the first 5mm of rainfall is prevented from discharging from the site. It is often the case that the initial run-off from roads and hard pavement areas has a concentration of pollutants. This first-flush is being addressed on site thus ensuring the quality of the receiving waters is not impacted.

The storm water management proposals for the site have been informed by the relevant standards and comply with best practice in terms of Suds (Sustainable Urban Drainage Design). By providing the measures as outlined, the impact of the proposed development on the Hydrological area has been minimised and results in a reduction in the existing greenfield runoff rate for the site.

3 LAYOUT OF STORM NETWORK

The proposed surface water network has been split into 3no. sub catchment areas. Please refer to Figure 3.2. There are 6no. attenuation tanks in total across the entire site with some catchments being designated multiple tanks which act in a daisy chain scenario. There are 2no. outfalls directly into the public stormwater network along Rose Lane.

The proposed surface water networks will include a storm drainage pipe network and SuDS features, including nature-based features, which will aid the reduction of runoff volumes by slowing surface water flows, both providing the opportunity for evapotranspiration and rainwater storage. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met through the provision of these features.
An assessment of the potential SuDS measures that could be incorporated within the site was conducted using the SuDS Manual, CIRIA 753 as guidance.

The proposed surface water discharge rate from the development has been restricted to 62% of the allowable Qbar discharge rate, as specified. Each catchment will have a hydrobrake flow-control device installed downstream to limit discharge.

To facilitate the removal of grit from runoff before it enters the SuDS systems, grit-sump manholes will be positioned upstream of the attenuation tanks areas. Manholes will also be constructed at various points along pipe runs, including changes in sewer direction, changes in gradients, significant sewer connections, and at intervals not exceeding 90m along straight sections of pipework.

The SuDS strategy for the development involves a combination of measures such as water butts, permeable paving, tree-pits and attenuation tanks. Together, these elements provide conveyance, interception storage, and attenuation storage for rainwater runoff.

All surface water generated on the site will be routed through a new site storm network as shown in Figure 3.1. Design calculations for the developments storm water network can be found in **Appendix D** of this report.

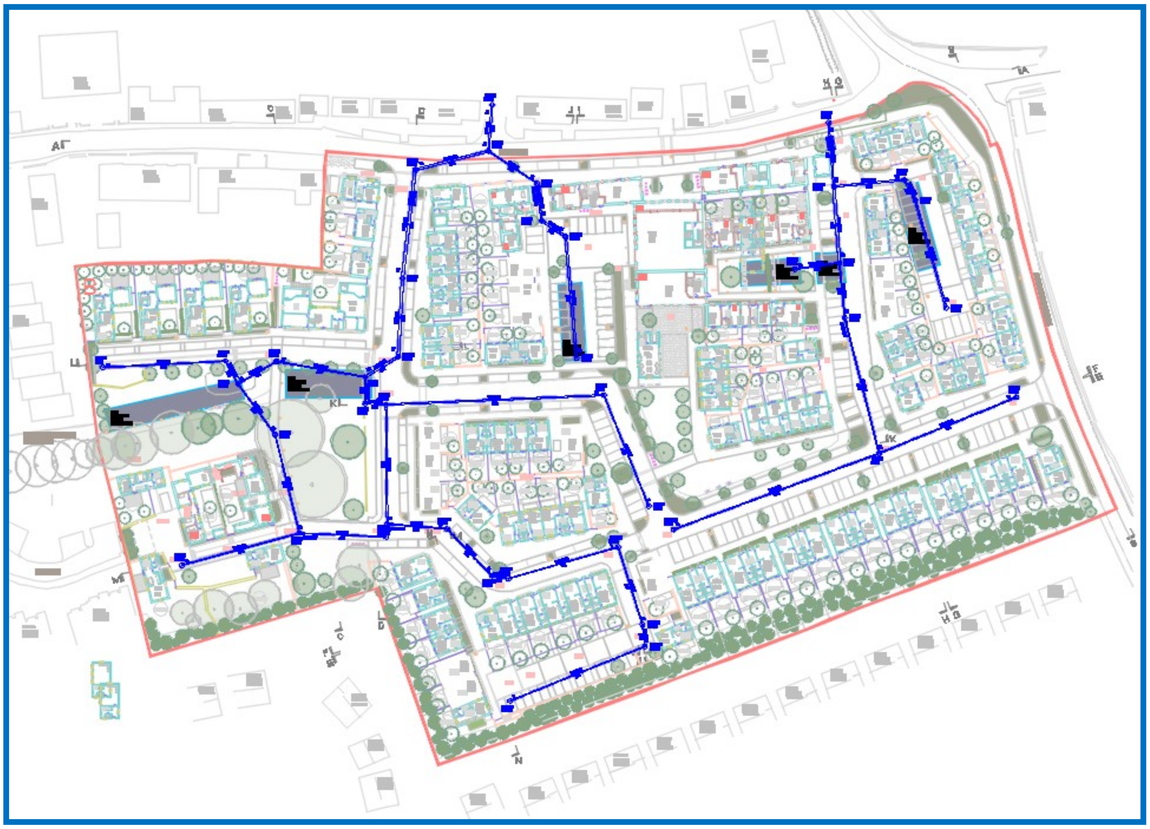


Figure 3.1: Proposed Surface Water Drainage Network

- The proposed storm network has been designed for a 1in30year storm event, the attenuation tanks are designed for a 1in100year storm event, with a rainfall intensity of 50mm/hr.

Please refer to the Surface Water Drainage layout drawings accompanying this application. As part of the design process the "Interim Code of Practice for Sustainable Drainage System" published in July 2004 by the National SUDS Working Group was consulted. The construction of the storm sewer pipe network shall be in accordance with Section 3 of the Department of Environment and Local Government publication "Recommendations for Site Development Works for Housing Areas".

The storm system proposed will incorporate:

- Bypass Hydrocarbon Inceptors: Conder Bypass Separators or similar approved
- Hydro-brake flow control to be installed to control outflow rate l/s or similar approved.
- Attenuation tanks / Concrete tanks
- Sustainable urban drainage systems as described in greater detail in Section 4 of this report.

3.1.1 Catchment Plan

The development has been split into 3No. sub catchment areas, as shown in

Figure 3.2 below.

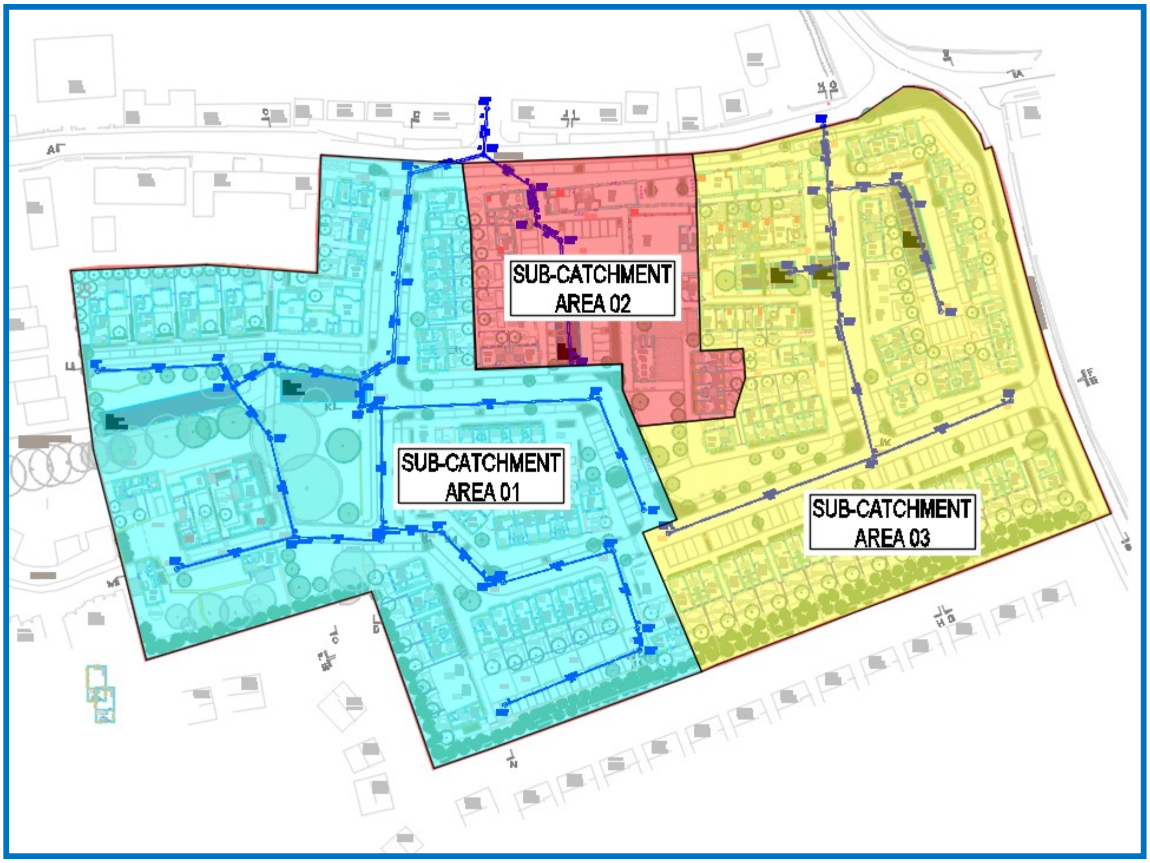


Figure 3.2: Contributing Catchment Areas

Using the permitted greenfield runoff rate (Qbar) as previously discussed in Section 2.3, discharge rates to each of the 2no. outfalls were calculated. These can be seen below in Figure 3.3. The final total outfall discharge rate from the site is 62% of the permissible Qbar discharge rate. Please refer to the Stormwater Layout drawings for location of outfalls.

OUTFALL	Peak Discharge (l/s)
Outfall 01	6.99
Outfall 02	2.65
TOTAL=	9.64

Figure 3.3: Discharge rate (l/s) per Outfall

3.2 Sub Catchment Area 01

Sub Catchment Area (SCA) 01 comprises 1.84 hectares and is located in the western half of the site. The catchments drainage proposals are to include water butts, permeable paving in the form of grasscrete, tree pits and attenuation tanks.

There are 2no. attenuation tanks within this SCA, Storm Tanks 01 & 05. The attenuation tanks have been sized to accommodate a 1in100year storm event with no flooding occurring. This storm event includes a 20% climate change factor.

A hydrocarbon interceptor will be fitted in advance of the final outfall from this SCA. The final discharge from Sub Catchment Area 01 into Outfall 01 is limited at 5.0 l/s at the final manhole which contains a hydrobrake.

3.3 Sub Catchment Area 02

Sub Catchment Area (SCA) 02 comprises 0.44 hectares and is located to the north of the site. The catchments drainage proposals are to include water butts, permeable paving in the form of grasscrete, tree pits and attenuation tanks.

There is 1no. attenuation tank within this SCA, Storm Tank 02. The attenuation tank has been sized to accommodate a 1in100year storm event with no flooding occurring. This storm event includes a 20% climate change factor.

A hydrocarbon interceptor will be fitted in advance of the final outfall from this SCA. The final discharge from Sub Catchment Area 02 into Outfall 01 is limited at 2.0 l/s at the final manhole which contains a hydrobrake.

3.4 Sub Catchment Area 03

Sub Catchment Area (SCA) 03 comprises 1.40 hectares and is located in the western half of the site. The catchments drainage proposals are to include water butts, permeable paving in the form of grasscrete, tree pits and attenuation tanks.

There are 3no. attenuation tanks within this SCA, Storm Tank 03, 04 & 06. The attenuation tanks have been sized to accommodate a 1in100year storm event with no flooding occurring. This storm event includes a 20% climate change factor.

A hydrocarbon interceptor will be fitted in advance of the final outfall from this SCA. The final discharge from Sub Catchment Area 03 into Outfall 02 is limited at 3.0 l/s at the final manhole which contains a hydrobrake.

3.5 Attenuation Tank

3.5.1 Volume of Attenuation

The proposed rate of surface water discharge from the development will be limited to 62% of the permissible Qbar discharge rate, as described. Attenuation storage will be provided in the concrete attenuation tanks which will cater for the 1 in 100-year storm event with a 20% climate change allowance added. The proposed surface water network has been populated with various nature-based SuDS components being proposed as part of the development, which will provide some attenuation, reduce flow rates, and will disperse surface water runoff via evapotranspiration and infiltration. Details of the proposed attenuation tank can be seen in the submitted planning pack. The capacity is summarized as follows:

Attenuation tank ID	Catchment (m^2)	Storage volume required (m^3)
AT-1	4,600	392
AT-2	2,100	179
AT-3	970	104
AT-4	2,400	207
AT-5	2,950	497
AT-6	2,200	187

Figure 3.4: Attenuation Tank Capacities

Each storm run will pass through a hydrocarbon bypass interceptor, an attenuation tank, and flow control manhole before discharging to their respective outfalls. The figures below are typical attenuation tank details provided courtesy of Carlow Tanks.

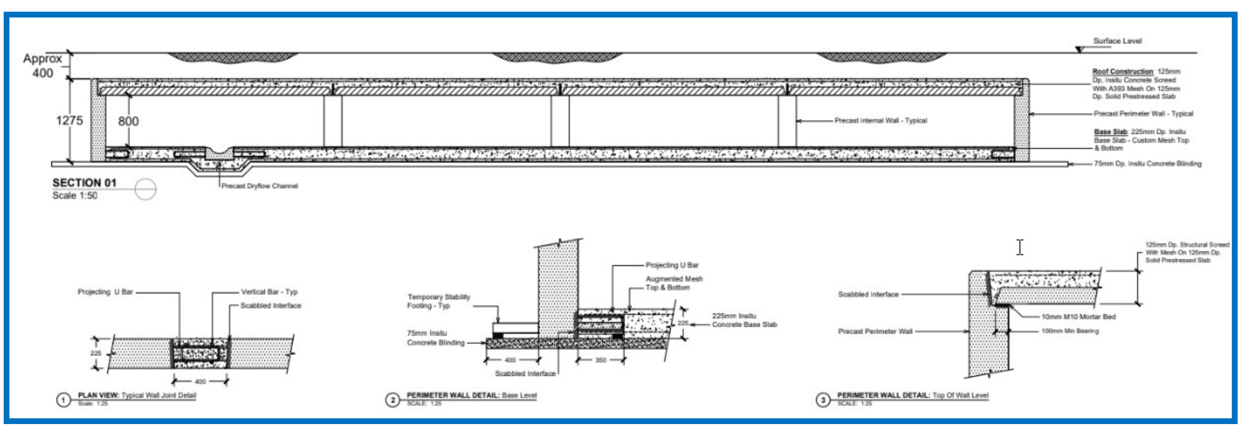


Figure 3.5: Attenuation RC tanks -typical installation & cross section (Carlow tanks)

3.5.2 Hydrocarbon Treatment

In construction, a petrol interceptor serves as a crucial trap designed to filter out hydrocarbon pollutants from rainwater runoff, preventing fuel contamination of streams that carry away the runoff.

The functioning principle of petrol interceptors relies on the fact that certain hydrocarbons, such as petroleum and diesel, tend to float on water. When rainwater runoff, potentially carrying contaminants, flows off roads or hardstanding areas, it enters the interceptor, typically deposited into the first tank.

The initial tank accumulates a layer of hydrocarbons and other scum. Typically, petrol interceptors consist of three separate tanks, each interconnected with a dip pipe. As more liquid enters the interceptor, water moves into the second tank, leaving the majority of hydrocarbons behind because they cannot enter the dip pipe. The dip pipe's opening into the second tank is positioned below the surface.

While some contaminants may inadvertently enter the second tank, it does not accumulate as much hydrocarbon on its surface. Similarly, as water continues to enter the second tank, it is then pushed into the third tank.

The third tank is designed to be clear of any floating hydrocarbons on its surface. As an additional precaution, the outlet pipe also functions as a dip pipe. When water exits the third tank through the outlet pipe, it should be free of contaminants.

There are 3no. different sub catchment areas that eventually discharge to 2no. outfalls along Rose Lane. Each local network will have a petrol interceptor incorporated into the system to reduce the risk of pollutants.

3.5.3 Silt Control

The proposed bypass interceptors can also include a silt storage capacity in addition to the oil storage capacity that allow silt to be collected in the interceptor prior to discharge to the proposed attenuation tanks. This silt build up can then be removed from the tanks.

3.5.4 Flow Control

Flow controls will be provided for each of the 6no. stormwater attenuation tanks. It is proposed to use Hydrobrake vortex control to manage the discharge rates which are shown in Figure 3.3 in Section 3.1.1.

4 SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)

The proposed surface water drainage network is to be designed in accordance with Sustainable Urban Drainage Systems (SUDS) principles. Surface water is a valuable resource, and it is intended to incorporate various nature-based SUDS systems in the scheme, particularly within the various amenity areas. Appropriate nature-based SUDS tools will be employed to enhance biodiversity, beauty, tranquillity and the natural aesthetic of buildings, places and landscapes and it can help make them more resilient to the changing climate.

This SUDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing, conveying, and treating runoff on site and, where possible, on the surface rather than underground.

By adopting this approach, it is intended to deliver and enhance the green space within the development and link to wider green networks, supporting the provision of habitats and places for wildlife to live and flourish, aligning with the wider design ambitions.

Further enhancing the site's sustainable urban drainage system (SUDS), the proposal includes permeable paving in the form of grasscrete for parking areas. This choice promotes increased water infiltration, reducing surface runoff and aiding in groundwater recharge. Additionally, the incorporation of rain harvesting systems, including rain butts, underscores a commitment to water conservation. These systems capture and store rainwater for later use, contributing to both sustainable water management and the overall eco-friendly design of the site. By seamlessly integrating permeable paving and rain harvesting solutions, the project not only addresses stormwater concerns but also aligns with environmentally responsible practices, fostering a more resilient and resource-conscious urban environment.

The surface water strategy will employ a series of nature based Sustainable Urban Drainage tools ensuring that the development will:

- Manage and control runoff volumes and flow rates from impermeable surfaces, reducing the impact of urbanisation on flooding.
- Provide opportunities for harvesting rainwater runoff.
- Promote groundwater and aquifer body recharge.
- Protect natural flow regimes in watercourses.
- Encourage evapotranspiration from planted and other storage area.

The SuDS strategy for the development involves a combination of measures such as water butts, permeable paving in the form of grasscrete, tree-pits and attenuation tanks. Together, these elements provide conveyance, interception storage, and attenuation storage for rainwater runoff.

4.1 SUDs Objectives

4.1.1 Quantity Control Processes – Outline

Several techniques can be employed to regulate the quantity of runoff from a development, each offering distinct advantages in stormwater control, flood risk management, water conservation, and groundwater recharge. Various techniques can be applied to manage runoff from a development, each offering specific benefits in stormwater control, flood risk management, water conservation, and groundwater recharge.

a) Infiltration:
Involves soaking water into the ground, considered the most favourable method for restoring the natural hydrologic process, impacted by subsoil characteristics.
b) Detention / Attenuation:
Slows down surface water flows using storage volumes and constrained outlets, ideally above ground, reducing peak flow rates while maintaining overall runoff volume.
c) Conveyance:
Transfers runoff through channels, trenches, and pipes, crucial for linking Sustainable Drainage System (SuDS) components; uncontrolled conveyance to the environment is not sustainable.
d) Water Harvesting:
Captures and uses runoff on-site for domestic or irrigation purposes, contributing to Flood Risk Management by efficiently managing and utilizing runoff.

4.1.2 Quality Control Processes

A number of natural water quality treatment processes can be exploited within SuDS design. Different processes will predominate for each SuDS technique and will be present at different stages in the treatment train.

a)	Sedimentation – reducing flow velocities to a level at which the sediment particles fall out of suspension;
b)	Filtration & Biofiltration – trapping pollutants within the soil or aggregate matrix, on plants or on geotextile layers;
c)	Adsorption – pollutants attach or bind to the surface of soil or aggregate particles;
d)	Biodegradation – Microbial communities in the ground degrade organic pollutants such as oils and grease;
e)	Volatilisation – transfer of a compound from solution in water to the soil atmosphere and then to the general atmosphere;
f)	Precipitation – transform dissolved constituents to form a suspension of particles of insoluble precipitates;
g)	Plant Uptake – removal of nutrients from water by plants in ponds and wetland;
h)	Nitrification – Ammonia and ammonium ions can be oxidised by bacteria in the ground to form nitrate which readily used as a nutrient by plants;
i)	Photolysis – The breakdown of organic pollutants by exposure to ultraviolet light.

4.2 SUDs Techniques

Apart from the previously mentioned goals, the replication of a natural drainage system requires the implementation of a 'Management Train.' This hierarchy of Sustainable Drainage System (SuDS) techniques follows a sequence:

- Prevention: Aims to prevent both runoff and pollution.
- Source Control: Focuses on controlling runoff at or close to its source.
- Site Control: Involves managing surface water within the site or local area.
- Regional Control: Encompasses the collective management of surface water from multiple sites.

Different SuDS components align with these objectives and are better suited for specific stages of the Management Train. The fundamental principle is to locally manage surface water in smaller sub-catchments, reducing the reliance on conveyance to larger systems downstream.

Source Control	Site Control	Regional Control
Rainwater Harvesting	Permeable Paving	Detention Ponds/Basins
Green Roofs	Bioretention Strips	Retention Ponds/Basins
Permeable Paving	Infiltration Trenches	Wetlands
Bioretention Strips	Filter Drains	Infiltration Basins
Filter Drains	Filter Strips	Detention Basins
Infiltration Trenches	Swales	Petrol Interceptors
Filter Strips	Sand Filters	
Soakaways	Infiltration Basins	
Swales	Detention Basins	
	Petrol Interceptors*	

Figure 4.1: SuDS Techniques for Source, Site & Regional Control

As noted above, source control, site control and regional control that are used on site have been highlighted. Please refer to the appendix of this report which provides further details on the SUDs elements proposed to be used on site as part of the stormwater management train system.

The new drainage system provided for the proposed development will be entirely separated from the wastewater sewer network. Noting this methodology, the site is to be split into separate sub catchment zones for attenuation purposes.

The site's impervious areas are proposed to be attenuated by SUDs methods coupled with tanking solutions. The SUDs design philosophy will incorporate multiple controls to ensure the water management train is developed throughout the site. Figure 4.2 overleaf shows the desirable management train where source infiltration of roofs and hardstanding area are to be captured by permeable paving and soakaways before the public hard standing areas are collected by further application of basins.

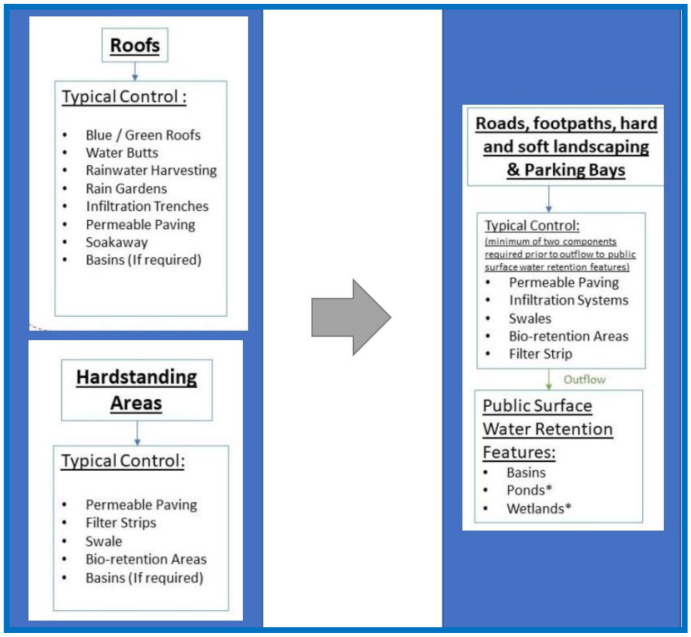


Figure 4.2: SUDS Stormwater Management (Preferred Management Train)

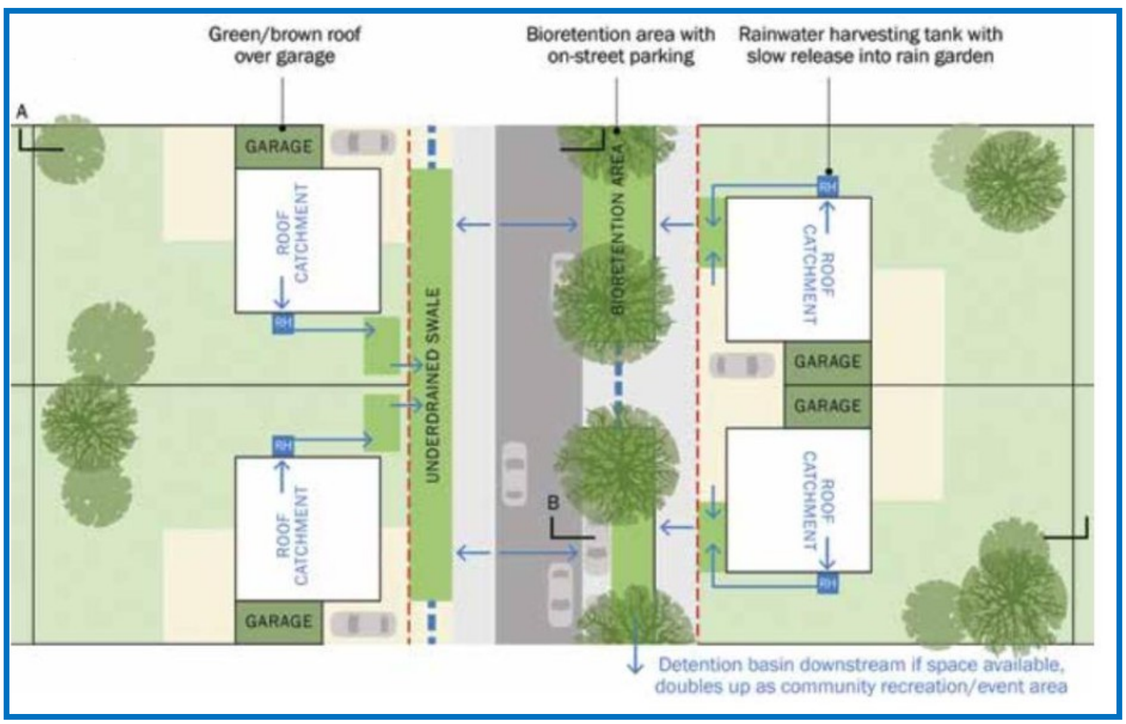


Figure 4.3 Typical Swale and Bioretention site layout incorporation.

This proposed storm system will alleviate any untoward effects of the development on downstream receiving environment, habitats/water quality and represent a sustainable design solution.

Figure 4.4: Typical grasscrete parking area

The following SuDS features have been identified as applicable and will be provided within the proposed scheme:

- Water Butts: These are compact, independent storage devices crafted to gather runoff from roofs. They serve as the prevalent method for harvesting rainwater in gardens, typically offering a capacity of less than 0.5m3. Two-stage devices can offer additional storage volume for attenuation through a controlled overflow, though it's important to note that inadequate maintenance can result in blockages. This solution is deemed suitable for all types of developments.
- Permeable Paving: Permeable paving is designed to allow rainwater to infiltrate through the surface, either into underlying layers or underground storage and released at a controlled rate to surface water sewers. Permeable paving can provide attenuation of rainfall, and potentially can also store runoff from surrounding areas, if designed and sized appropriately. It is proposed that all parking areas will be provided with permeable paving in the form of grasscrete. The passage of surface water into ground and then its re-charge into the water table is an entirely natural process. Grass paving introduces another benefit not found in other permeable paving systems, that of carbon sequestration. Within an urban environment a massive imbalance is created by human exhalation, vehicle emissions and mechanical sources such as air conditioning systems. The introduction of urban greenspace with CO2 digesting vegetation is therefore a means of partially redressing the natural balance, particularly in a ground level scenario, close to vehicle exhaust emissions
- Tree Pits: Tree pits will be used where feasible across the development to provide interception storage and will contain engineered soil-filled tree boxes with drainage pipes beneath.
- Concrete Attenuation Tanks: will be required to manage the volume of runoff expected as previously noted.

5 OPERATION AND MAINTENANCE

To uphold the intended performance standards, it's essential to conduct regular inspections and maintenance of all proposed Sustainable Drainage Systems (SuDS) areas. Following the guidelines outlined in CIRIA C753, a "passive maintenance" strategy will be adopted, integrating many SuDS maintenance tasks into typical site management practices. This approach encompasses a range of routine, periodic, and corrective maintenance measures to ensure the effective functioning of the SuDS system.

The site management plan must incorporate regular removal of litter from all applicable Sustainable Drainage Systems (SuDS) features, including permeable paving and tree pits. Grass maintenance is also crucial for all SuDS components. Proper management of SuDS vegetation green waste should be integrated into regular site green waste protocols.

Regular inspections of the inlets and outlets of SuDS features are necessary to identify and remove any silt or debris buildup. These inspections should occur periodically. Additionally, to ensure accessibility for maintenance purposes, inlets and outlets should be strimmed approximately 1.0m all around. Control chambers should undergo annual inspections, and any accumulated silt should be removed as necessary during these inspections. Silt removed from the site can undergo dewatering and then be applied to land outside the SuDS component profile. This ensures the continued effectiveness and functionality of the SuDS features while managing silt in an environmentally responsible manner.

As 50% of the **Grasscrete** structure is essentially of a natural landscape form, then the reality is that some basic maintenance will be required. A planned process will ensure that the system remains in perfect working order and that usage interruption is minimised. In a regular use scenario the passage of wheels along the Grasscrete surface will tend to trim the grass to the extent that cutting is rarely required. This can lead to some variable growth with areas not subjected to traffic featuring the prostrate growth of creeping grasses, whereas the growth in trafficked areas is likely to be predominantly of hardy perennial species able to quickly recover under use. Accessibility for grass cutting equipment will be geared to the presence or otherwise of road kerbs. Should kerbs not be required we recommend that the adjacent landscape areas, if grassed, be finished with a slight fall down onto the Grasscrete. This will enable mowers to traverse to and fro without the need to raise the mower blades. Where kerbs are installed this will generally call for the perimeter grass within the Grasscrete area to be cut by strimmer.

Petrol Interceptors requires periodic inspection and removal of the separated oils and petrol residues to ensure it continues to operate effectively. Safe access must be provided for the provision of maintenance to the petrol interceptor.

The proposed Sustainable Drainage Systems (SuDS) system is designed to require low maintenance, as many of the listed actions are part of standard site upkeep and are necessary regardless. Regular inspections should be conducted to detect any damage or operational issues with the SuDS system. In case of the need for cleaning or other interventions, appropriate all-terrain machinery can be utilized in these areas to access outfalls effectively. This approach ensures that maintenance can be carried out efficiently while minimizing disruption to the surrounding environment.

6 AMENITY AND BIODIVERSITY

Achieving amenity and biodiversity standards is all about creating attractive, pleasant, and liveable urban areas for both people and nature.

The proposed Sustainable Drainage Systems (SuDS) features in this development are carefully designed to offer a range of benefits. They will not only enhance the visual appeal but also create habitats for wildlife while managing rainfall effectively. The areas of grasscrete, for instance, can be planted with any number of species of grass including native meadow grasses to boost biodiversity within the landscape.

These basins serve multiple purposes, functioning as public spaces when not holding runoff. They could be used for sports or social activities, providing both recreation and ecological benefits. Situating them within the housing development ensures easy access for residents and encourages the use of open spaces during dry periods.

Vegetation selection for, tree pits should be planned to maximize both ecological value and aesthetic appeal, enhancing the overall amenity value of the area.

The construction details of these features will be finalized through collaboration with landscape design and ecological experts, ensuring that they are effective and environmentally friendly. The attached drawings provide initial guidelines, which will be further refined before construction begins on-site.

6.1 Summary of Ecological Importance

A comprehensive ecological impact assessment has been carried out and the proposed site is considered to be of Local Importance (Higher Value) from an ecological perspective due to the presence of locally significant populations of Bee Orchid, bird species such as Kestrel, and roosting bats. Disturbance impacts will occur during the construction phase which cannot be avoided or fully mitigated, and these would have a slight negative impact on the relevant receptors at a local level on a temporary basis at least.

With the implementation of the avoidance and mitigation measures outlined herein the overall ecological effect of the proposed project (relative to the 'do-nothing' scenario) is considered to be slight negative effect at a local level during construction. Following completion of construction, a neutral effect overall is expected, and following establishment of landscaping measures in the operational phase the predicted ecological effect of the proposed development is considered to be a slight, positive effect at a local level (following EPA, 2022). Following CIEEM (2024) the ecological effect of the proposed development is considered to be 'not significant'.

6.2 Sensitive Receptors

Potential receptors are as noted in the figure below.

Sensitive Receptor	Location/ Potential Impact
Watercourses	Onsite works will also involve ground clearance, re-profiling, groundworks, and construction, with potential for runoff, dust, light, and noise impacts.
Residents	As seen in the proposed site development layout is proximal to a large number of existing houses that would be sensitive to noise, dust and lighting impacts. Mitigation measures should be put in place to avoid impacting the residents proximal to the proposed development during the

	site clearance and construction phase of the project
Terrestrial Fauna and Flora	On-site Fauna and flora of conservation importance to be reviewed by Ecologist.
Birds	Subsequent planting should be supplemented with bird boxes.
Bats	Mitigation measures may include a pre-construction bat survey and measures to protect bats during site clearance if individuals are found on site.

Figure 6.1: Sensitive Receptors/ Potential Impact

7 SITE INVESTIGATION

As part of the design for the proposed development, comprehensive site investigations were carried out by PGL PRIORITY on the proposed site in September 2023. In total, site investigation consisted of 4 No. trial pits to measure the depth of soil and rock, and 2 No. infiltration pits to measure the on-site infiltration rate. The investigation also included laboratory testing on samples taken from trial pits. The results of investigation indicate a shallow water table at the south of the site. No bedrock was encountered during the course of the study.

Figure 4.1 below highlights the test locations of the site investigation.

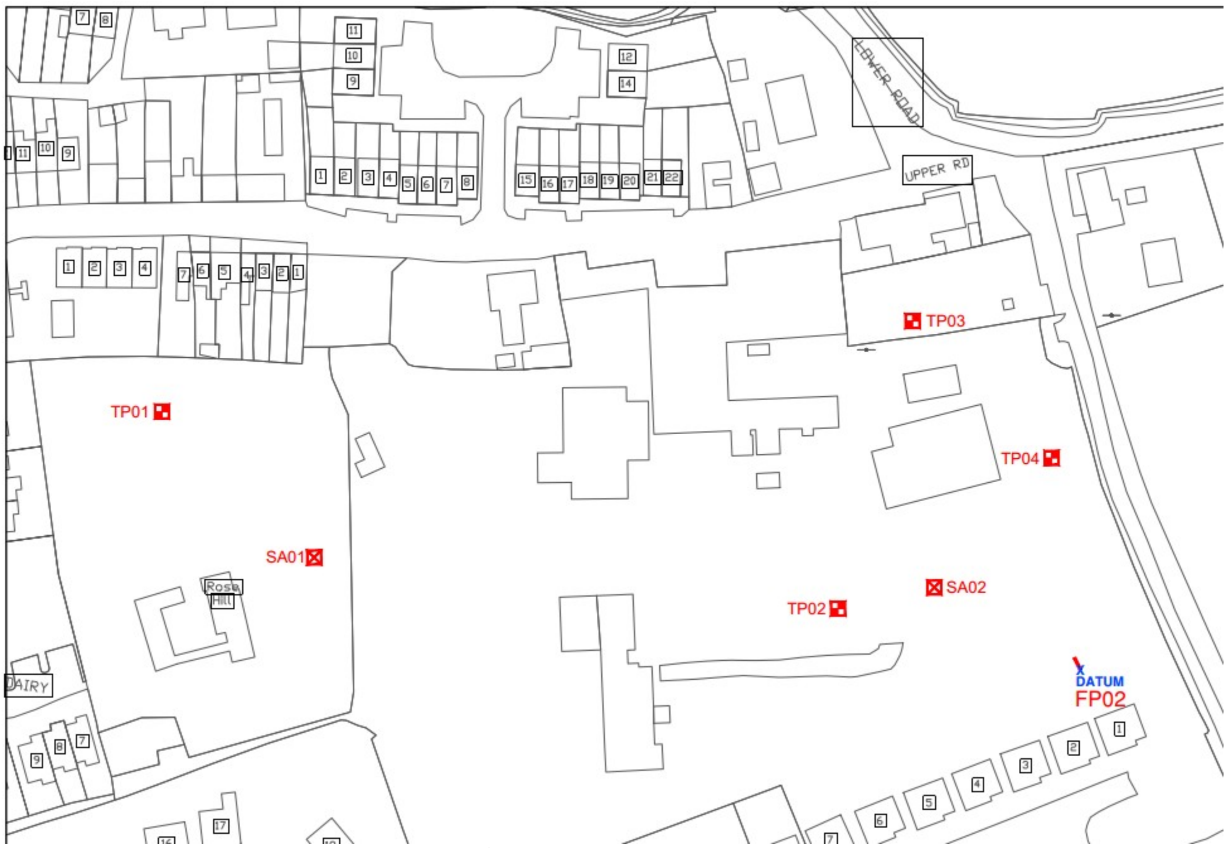


Figure 4.1: Site investigation locations

The complete results and logs of the site investigations are included in appendices of the Engineering Design Report. A full Site Investigation Factual and Interpretative Report will be included as part of the planning application.

Site Investigation - Storm design

With regards to the design of the storm water network, it was found that the chances of onsite infiltration are low. This result, in combination with a known history of localised flooding, informed the design team that soak pits should not be utilised as a method of catering for surface water within the site. Rather, the decision was made to utilise several attenuation tanks in combination with more appropriate SUDs measures as outlined in Section 3. See extract from infiltration test results in **Figure 4.2** and **4.3** below. The infiltration tests were carried out in accordance with BRE Digest 365.

BRE 36

P23154 **Old Mill Ballinacurra**

Test 1 **SA01** E588728.859 N571675.861 8

l, m	**2.200**	b, m	**1.300**	d, m	**2.000**
l_base, m	**2.200**			d_eff, m	**0.790**
l_eff, m	**2.200**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m
Start: 12:00:00	0	1.210	0	0.79	0.00
	30	1.350	1800	0.65	0.14
	227	1.520	13620	0.48	0.31
End: 17:20:00	320	1.720	19200	0.28	0.51

Area	2.860 m^2	$V_{p75\text{-}25\ theory}$	volume	1.1297 r
50% Area_eff, a_{p50}	5.625 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.7293 r
50% Area_act, a_{p50}	4.645 m^2	$t_{p\ 75\text{-}\ 25\ actual}$	time	9600 s

Infiltration Coefficient f 1.64E-05 r

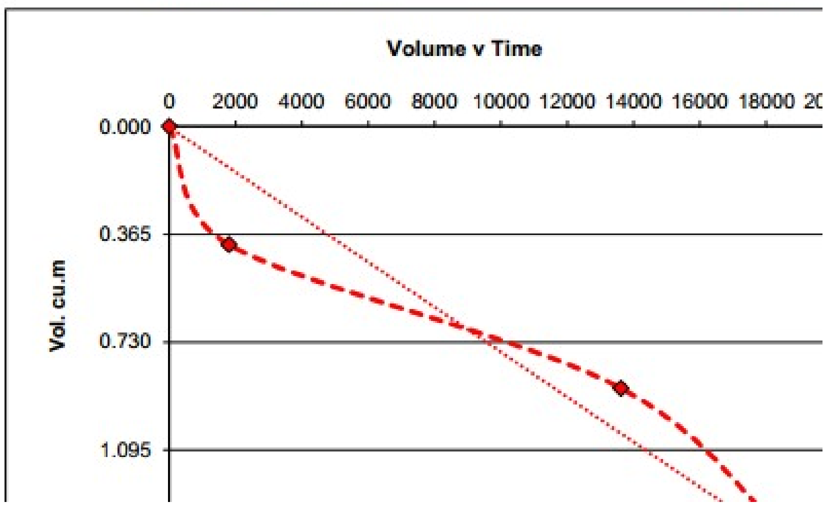


Figure 4.2: Infiltration test results – P23154

E

P23154 **Old Mill Ballinacurra**

Test 1 **SA02** E588888.642 N57166

l, m	**2.200**	b, m	**1.300**	d, m	**2.0**
l_base, m	**2.200**			d_eff, m	**0.3**
l_eff, m	**2.200**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall,
Start: 11:15:00	0	1.650	0	0.35	0.0
End: 11:45:00	30	2.000	1800	0.00	0.3

Area	2.860 m^2	$V_{p75-25\ theory}$	volume	0
50% Area_eff, a_{p50}	4.085 m^2	$V_{p\ 75-25\ actual}$	volume	0
50% Area_act, a_{p50}	4.085 m^2	$t_{p\ 75-25\ actual}$	time	

Infiltration Coefficient *f* 1.3

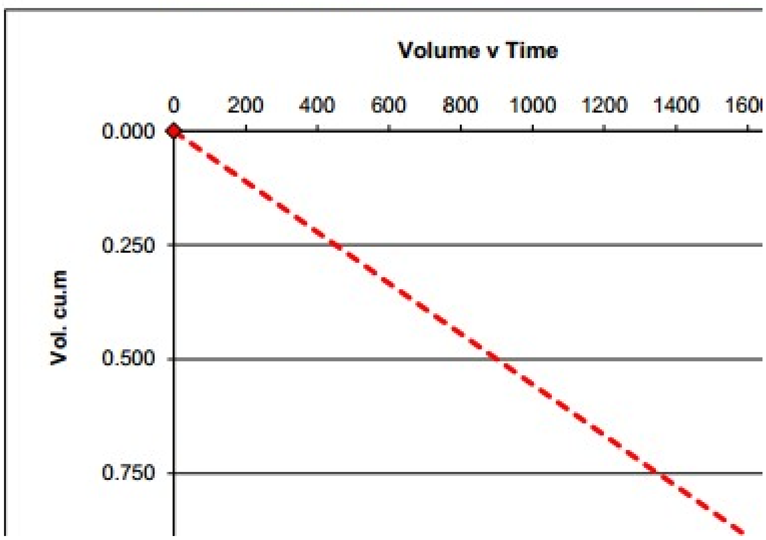


Figure 4.3: Infiltration test results – P23154

8 SUDS STATEMENT

SUDS SELECTION HIERARCHY SHEET			
Suds Measures		**Measures to be used on site**	**Rational for selecting / not selecting measure including discharge rate applied with supporting calculations**
Water butt – 150L capacity or more (based water use demand) with means of overflow		YES	Suitable for development type.
Permeable paving – consider for all hard paved areas without heavy traffic.		YES	Suitable for development type.
Tree pits – disconnect downpipe connection into drains and allow roof runoff into planter with means of overflow		YES	Suitable for development type.
Green Roof – requires a minimum substrate depth (growth medium) of at least 80 mm excluding the vegetative map		NO	Not suitable for development type.
Rain garden - disconnect downpipe/RWP into the planted flower bed		NO	Not suitable for development type.
Other		Attenuation Tanks	Suitable for development type.

SUDSSELECTIONHIERARCHYSHEETFORLARGE-SCALE DEVELOPMENT AND AGRICULTURAL DEVELOPMENT				
Suds Measures	**Measures to be used on site**	**Rational for selecting / not selecting measure**	**Area of feature (m^2)**	**Attenuation volume of feature (m^3) (see No. 8)**
Source Control Providing storage at source				
Swales	NO	Site geometry/ SI findings		
Integrated constructed tree pits	YES	Site geometry/ SI findings	As per submitted layouts	As per submitted layout proposals
Rainwater Butts	YES	Site geometry/ SI findings	As per submitted layouts	As per submitted layout proposals
Soak ways	NO	Site geometry/ SI findings		
Infiltration trenches	NO	Site geometry/ SI findings		
Permeable pavement (Grass Crete, Block Paving, Porous Asphalt etc.)	YES	Site geometry/ SI findings	As per submitted layouts	As per submitted layout proposals
Green Roofs	NO	Site geometry/ SI findings		
Green wall	NO	Site geometry/ SI findings		
Filter strips	NO	Site geometry/ SI findings		
Bio-retention systems/Raingardens	NO	Site geometry/ SI findings		
Filter Drain	NO	Site geometry/ SI findings		
Site Control				
Detention Basins	NO	Site geometry/ SI findings		
Retention basins	NO	Site geometry/ SI findings		
Regional Control				
Ponds	NO	Site geometry/ SI findings		
Wetlands	NO	Site geometry/ SI findings		
Other				
Petrol/Oil interceptor/Grit Trap	YES	Site geometry/ SI findings	As per submitted layouts	As per submitted layout proposals
Attenuation tank –	YES	Site geometry/ SI findings	As per submitted layouts	As per submitted layout proposals
Oversized pipes– only as a last resort where other measures are not feasible	NO	Site geometry/ SI findings		
Other	NO	Site geometry/ SI findings		

9 APPENDICES

10 APPENDIX A: SUDS DETAILS- TYPICAL

10.1 Water Butts

Water Butts are compact, independent storage devices crafted to gather runoff from roofs. They serve as the prevalent method for harvesting rainwater in gardens, typically offering a capacity of less than 0.5m3. Two-stage devices can offer additional storage volume for attenuation through a controlled overflow, though it's important to note that inadequate maintenance can result in blockages. This solution is deemed suitable for all types of developments.

Figure 10.1: Domestic Water Butt (Susdrain.org)

10.2 Rainwater Harvesting

Rainwater harvesting entails gathering rainwater from roofs and hard surfaces, akin to the concept of Water Butts but on a larger scale. The collected water is commonly utilized for non-potable purposes such as irrigation, toilet flushing, and operating washing machines. The size of the harvesting tank is determined by factors such as catchment area, seasonal rainfall patterns, demand fluctuations, and the desired retention time. Additionally, the tank can serve as a means of stormwater attenuation by providing extra storage capacity.

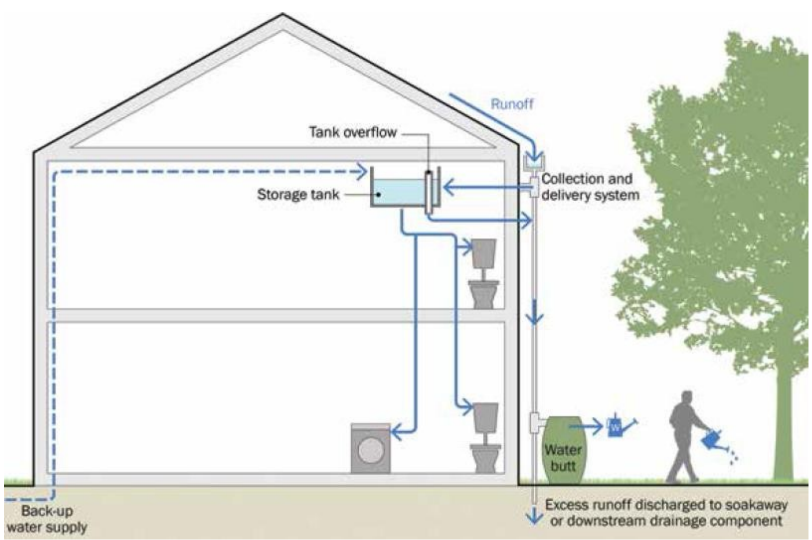


Figure 10.2: Rainwater Harvesting Schematic (CIRIA 753)

Rainwater Harvesting is recommended for use in commercial, industrial, and educational buildings, in this case at the proposed creche site.

10.3 Permeable Paving

Permeable pavements offer surfaces suitable for both pedestrian and vehicular traffic, enabling rainwater to permeate through the pavement and reach the underlying layers. From there, the water either infiltrates into the ground or is collected and directed to the drainage network. This type of pavement is best suited for areas with light traffic loads and volume. Typically designed to handle rainwater directly falling on its surface, permeable pavements can also accommodate runoff from other impermeable areas, including Water Butts, Modified Planters, or directly from rainwater goods and paved surfaces.

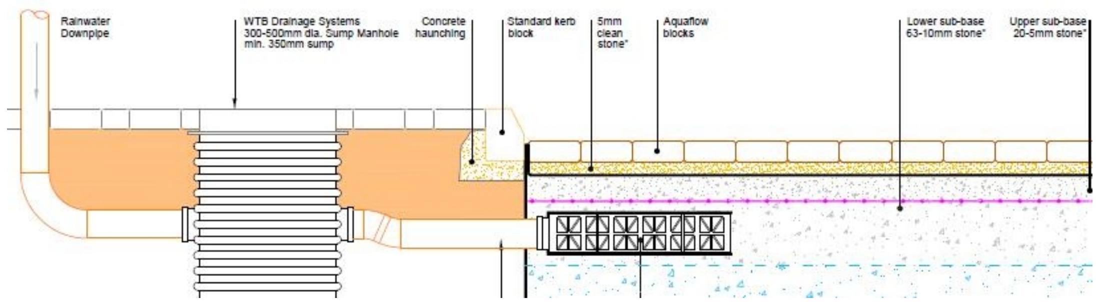


Figure 10.3: Typical Permeable Paving Detail (c: Roadstone)

Permeable paving is endorsed for both residential and commercial parking spaces. Additionally, lightly trafficked roads could benefit from the implementation of permeable block paving. However, a comprehensive site investigation is essential to assess whether total, partial, or no infiltration to groundwater is feasible. This detailed examination helps determine the most suitable approach for implementing permeable paving based on site-specific conditions.

10.4 Tree Pits

Tree pits areas function as stormwater controls, collecting and treating runoff through the use of soils and vegetation in shallow landscaped basins to remove pollutants. The treated runoff can then be collected and conveyed downstream, and/or allowed to infiltrate into the subsoil. Additionally, a portion of the runoff volume is naturally reduced through processes like evaporation and plant transpiration.

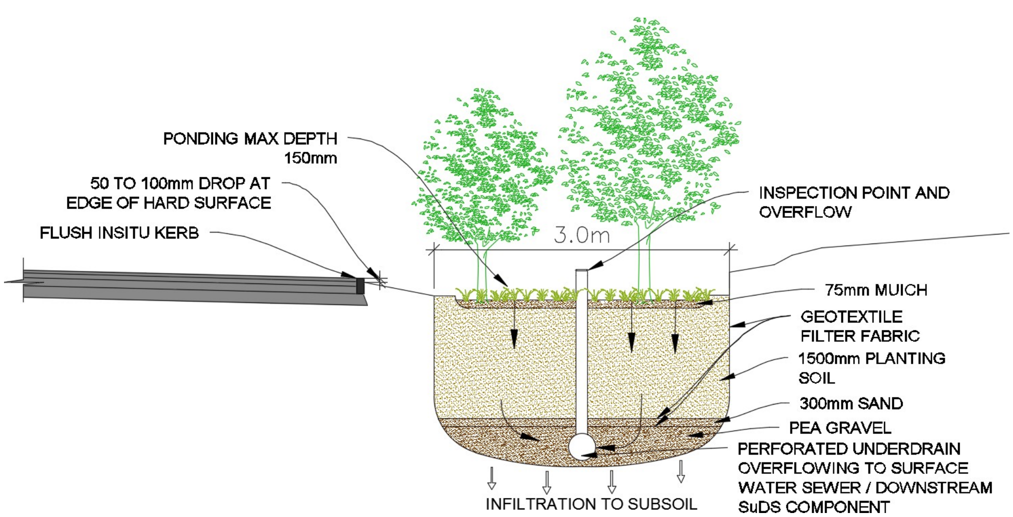


Figure 10.4: Tree pit schematic

11 APPENDIX B: HR WALLINGFORD GREENFIELD RUNOFF ESTIMATION

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Desmond Archer
Site name:	Ballinacurra Mill
Site location:	Ballinacurra

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.89729° N
Longitude:	8.16228° W
Reference:	1833915130
Date:	Apr 23 2024 16:18

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 3.5

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	1015	1015
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	9.85	15.53
1 in 1 year (l/s):	8.37	13.2
1 in 30 years (l/s):	16.26	25.62
1 in 100 year (l/s):	19.21	30.28
1 in 200 years (l/s):	21.18	33.39

12 APPENDIX C: RAINFALL RETURN PERIOD TABLE

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 160259, Northing: 69374,

	Interval		Years										
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	120,
5 mins	3.3,	4.1,	4.5,	5.1,	5.5,	5.7,	6.6,	7.5,	8.1,	8.9,	9.5,	10.0,	10.3,
10 mins	4.6,	5.7,	6.3,	7.1,	7.6,	8.0,	9.2,	10.5,	11.3,	12.3,	13.2,	13.9,	14.4,
15 mins	5.4,	6.7,	7.4,	8.3,	9.0,	9.4,	10.8,	12.3,	13.3,	14.5,	15.6,	16.4,	16.9,
30 mins	7.3,	9.1,	10.0,	11.2,	12.1,	12.7,	14.6,	16.6,	17.9,	19.5,	21.0,	22.1,	22.8,
1 hours	9.8,	12.2,	13.4,	15.2,	16.3,	17.1,	19.7,	22.4,	24.1,	26.3,	28.3,	29.7,	30.7,
2 hours	13.2,	16.5,	18.1,	20.4,	21.9,	23.0,	26.5,	30.1,	32.4,	35.5,	38.1,	40.1,	41.4,
3 hours	15.7,	19.6,	21.6,	24.3,	26.1,	27.4,	31.5,	35.9,	38.6,	42.2,	45.4,	47.7,	49.2,
4 hours	17.8,	22.2,	24.4,	27.5,	29.5,	31.0,	35.7,	40.6,	43.7,	47.8,	51.3,	54.0,	55.7,
6 hours	21.2,	26.4,	29.1,	32.7,	35.1,	36.9,	42.5,	48.3,	52.0,	56.9,	61.1,	64.3,	66.3,
9 hours	25.2,	31.5,	34.6,	39.0,	41.8,	43.9,	50.6,	57.5,	61.9,	67.7,	72.7,	76.5,	79.0,
12 hours	28.5,	35.6,	39.1,	44.1,	47.3,	49.7,	57.2,	65.1,	70.0,	76.7,	82.3,	86.6,	89.4,
18 hours	33.9,	42.4,	46.6,	52.5,	56.3,	59.2,	68.1,	77.5,	83.4,	91.3,	98.0,	103.1,	106.4,
24 hours	38.4,	48.0,	52.7,	59.4,	63.8,	67.0,	77.1,	87.7,	94.3,	103.3,	110.9,	116.6,	120.4,
2 days	49.4,	60.5,	65.9,	73.4,	78.3,	81.9,	93.0,	104.5,	111.7,	121.2,	129.3,	135.4,	139.3,
3 days	58.8,	71.1,	77.0,	85.3,	90.6,	94.5,	106.5,	118.9,	126.5,	136.7,	145.3,	151.6,	155.8,
4 days	67.3,	80.7,	87.1,	96.0,	101.7,	105.9,	118.7,	131.8,	139.9,	150.6,	159.6,	166.3,	170.6,
6 days	82.8,	98.0,	105.3,	115.3,	121.6,	126.3,	140.5,	155.0,	163.9,	175.6,	185.3,	192.5,	197.3,
8 days	97.0,	113.9,	121.9,	132.9,	139.8,	144.9,	160.3,	176.0,	185.5,	198.0,	208.5,	216.2,	221.2,
10 days	110.4,	128.8,	137.5,	149.4,	156.8,	162.3,	178.8,	195.5,	205.6,	218.9,	230.0,	238.1,	243.4,
12 days	123.3,	143.1,	152.4,	165.0,	172.9,	178.8,	196.3,	213.9,	224.6,	238.6,	250.3,	258.8,	264.3,
16 days	148.0,	170.2,	180.6,	194.7,	203.5,	209.9,	229.3,	248.7,	260.4,	275.6,	288.3,	297.5,	303.5,
20 days	171.6,	196.1,	207.4,	222.9,	232.4,	239.4,	260.4,	281.3,	293.9,	310.3,	323.8,	333.7,	340.2,
25 days	200.1,	227.2,	239.7,	256.6,	267.0,	274.7,	297.5,	320.2,	333.7,	351.4,	365.9,	376.6,	383.4,

NOTES:
These values are derived from a Depth Duration Frequency (DDF) Model update 2023
For details refer to:
'Mateus C., and Coonan, B. 2023. Estimation of point rainfall frequencies in Ireland. Technical Note No. 68. Met Eireann',
Available for download at:
http://hdl.handle.net/2262/102417

13 APPENDIX D: STORMWATER NETWORK DESIGN CALCULATIONS

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.048	1.350	Type B	12.200	10.463	1.512	588782.559	571601.656
S2	0.012	1.350	Type B	11.599	9.569	1.806	588817.616	571618.848
S3	0.017	1.350	Type B	11.422	9.519	1.677	588817.072	571627.295
S4	0.076	1.350	Type C	10.661	9.036	1.400	588810.661	571646.205
S5	0.047	1.350	Type B	11.223	8.795	2.128	588778.495	571637.997
S6	0.006	1.350	Type B	10.699	8.680	1.719	588760.313	571651.912
S7	0.033	1.350	Type B	10.176	7.348	2.453	588746.805	571652.351
S9	0.059	1.350	Type B	9.853	8.080	1.548	588820.793	571658.926
S10	0.079	1.350	Type C	8.276	6.620	1.281	588807.386	571691.703
S12	0.004	1.350	Type B	7.579	5.570	1.634	588749.838	571690.731
S13	0.061	1.350	Type C	7.235	6.079	0.931	588686.123	571641.036
S14	0.013	1.200	Type B	10.151	7.806	2.120	588744.461	571649.108
S15	0.032	1.200	Type B	8.617	5.896	2.496	588719.625	571650.172
S16	0.000	1.200	Type B	8.435	5.746	2.464	588712.660	571678.382
S17	0.061	1.350	Type C	8.842	7.350	1.267	588663.760	571698.941
S18	0.010	1.200	Type B	8.440	6.005	2.209	588698.501	571699.349
S19	0.000	1.200	Type B	8.669	5.486	2.957	588702.082	571692.790
S20	0.017	1.500	Type B	8.173	5.337	2.536	588713.071	571699.233
S21	0.026	1.200	Type B	7.300	5.182	1.818	588738.430	571694.809
S22	0.031	1.200	Unknown	7.143	4.974	1.419	588747.852	571700.623
S23	0.060	1.200	Unknown	6.232	4.581	0.900	588749.071	571723.015
S24	0.000	1.350	Unknown	5.058	3.557	0.900	588752.679	571754.018
S25	0.116	1.350	Type B	7.923	4.723	2.600	588798.797	571700.199
S26	0.010	1.350	Unknown	6.291	4.491	1.200	588795.637	571734.904
S27	0.034	1.350	Unknown	6.103	4.450	1.203	588788.835	571739.456
S28	0.000	1.350	Type C	5.326	3.911	1.190	588787.389	571750.167
S29	0.000	1.350	Unknown	4.968	3.485	1.050	588773.654	571759.327
S30	0.000	1.350	Type C	4.998	3.315	1.233	588774.659	571772.525

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)
1.000	S1	10.463	S2	9.569	Circ	0.225mØ	39.046	43.7	0.600	1.512
1.001	S2	9.569	S3	9.519	Circ	0.225mØ	8.464	170.8	0.600	1.806
1.002	S3	9.519	S4	9.036	Circ	0.225mØ	19.967	41.3	0.600	1.677
1.003	S4	9.036	S5	8.870	Circ	0.225mØ	33.197	200.0	0.600	1.400
1.004	S5	8.795	S6	8.680	Circ	0.3mØ	22.896	200.0	0.600	2.128
1.005	S6	8.680	S7	8.066	Circ	0.3mØ	13.515	22.0	0.600	1.719
1.006	S7	7.348	S12	5.570	Circ	0.375mØ	38.500	21.7	0.600	2.453
2.000	S9	8.080	S10	6.770	Circ	0.225mØ	35.413	27.0	0.600	1.548
2.001	S10	6.620	S12	5.570	Circ	0.375mØ	57.557	54.8	0.600	1.281
1.007	S12	5.570	S21	5.510	Circ	0.375mØ	12.115	200.0	0.600	1.634
3.000	S13	6.079	S15	5.896	Circ	0.225mØ	34.725	189.9	0.600	0.931
4.000	S14	7.806	S15	5.960	Circ	0.225mØ	24.858	13.5	0.600	2.120
3.001	S15	5.896	S16	5.746	Circ	0.225mØ	29.057	193.5	0.600	2.496
3.002	S16	5.746	S19	5.486	Circ	0.225mØ	17.873	68.8	0.600	2.464
5.000	S17	7.350	S18	6.005	Circ	0.225mØ	34.743	25.8	0.600	1.267
5.001	S18	6.005	S19	5.486	Circ	0.225mØ	7.473	14.4	0.600	2.209
3.003	S19	5.486	S20	5.412	Circ	0.225mØ	12.739	171.3	0.600	2.957
3.004	S20	5.337	S21	5.182	Circ	0.3mØ	25.741	166.1	0.600	2.536
1.008	S21	5.182	S22	5.124	Circ	0.6mØ	11.072	190.9	0.600	1.518
1.009	S22	4.974	S23	4.581	Circ	0.75mØ	22.425	57.1	0.600	1.419
1.010	S23	4.581	S24	3.557	Circ	0.75mØ	31.212	30.5	0.600	0.900
1.011	S24	3.557	S29	3.485	Circ	0.6mØ	21.636	300.0	0.600	0.900
6.000	S25	4.723	S26	4.491	Circ	0.6mØ	34.849	150.0	0.600	2.600
6.001	S26	4.491	S27	4.450	Circ	0.6mØ	8.185	200.0	0.600	1.200
6.002	S27	4.450	S28	3.911	Circ	0.45mØ	10.808	20.0	0.600	1.203
6.003	S28	3.911	S29	3.693	Circ	0.225mØ	16.509	75.7	0.600	1.190
1.012	S29	3.485	S30	3.315	Circ	0.45mØ	13.236	77.7	0.600	1.033

Outfall Details

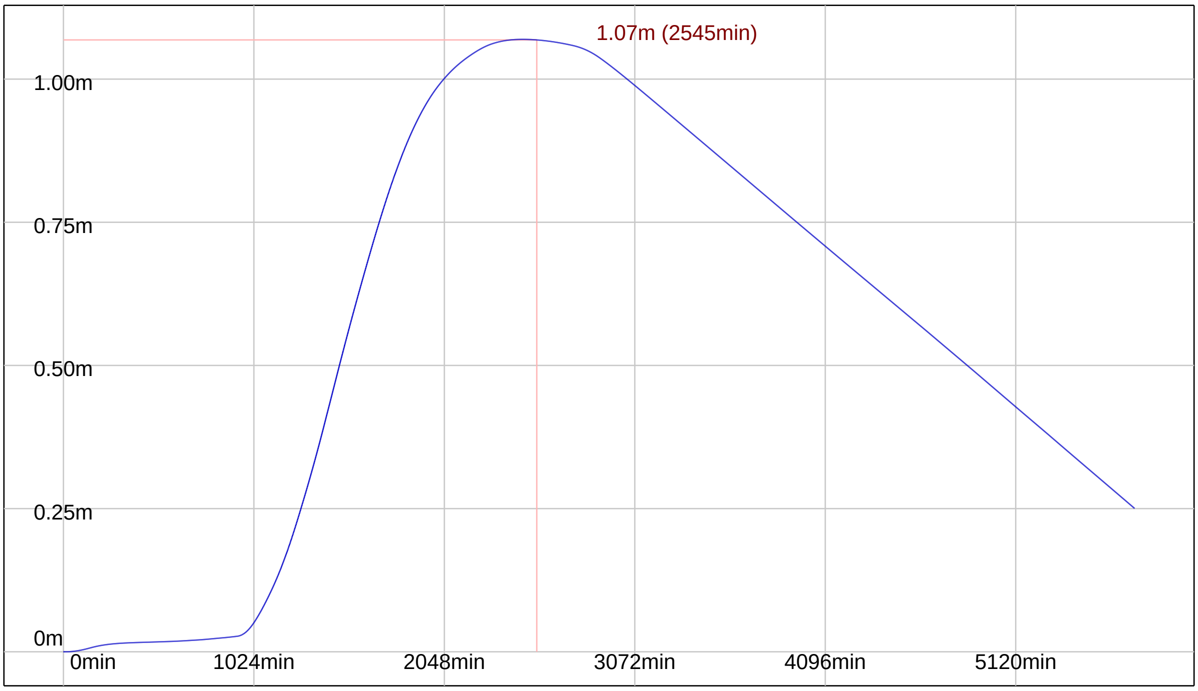
Outfall Manhole S30 : Free Discharge

Flow Control Details

Tank Structure at Manhole S19

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
5.486	2.000	95.00	247.935	235.538	471.077	0.00000000	0.00000000	2.00

Tank at S19 (100Yr+20% 2880Min Winter)

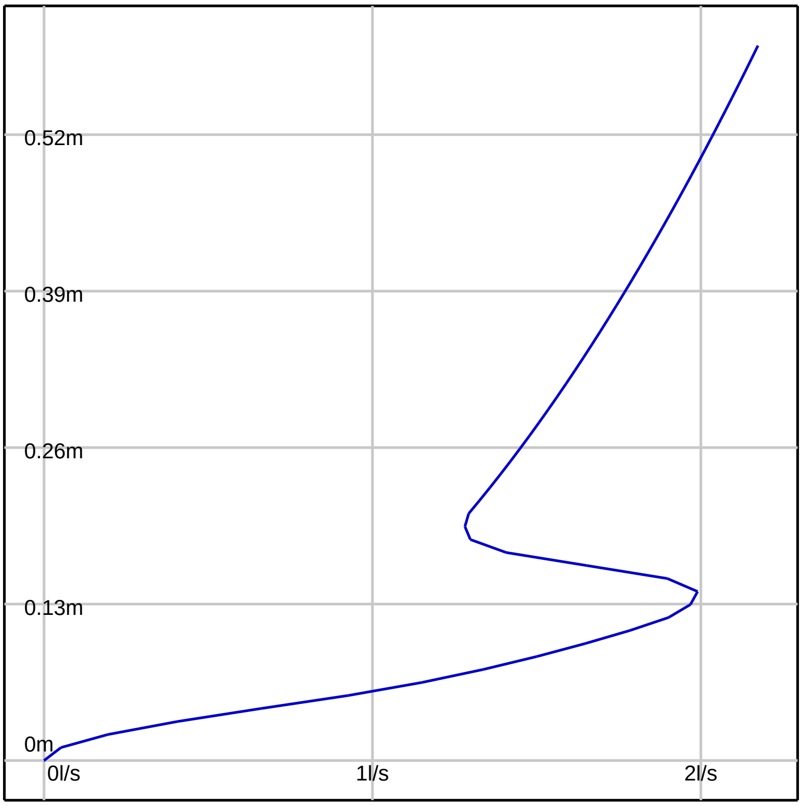


Controls within Manhole S20

Hydro-Brake® Optimum Control at Manhole S20

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CFP-0068-2000-0500-2000 ID:642968	0.500	2.000	0.000	0.139	1.992	0.193	1.281

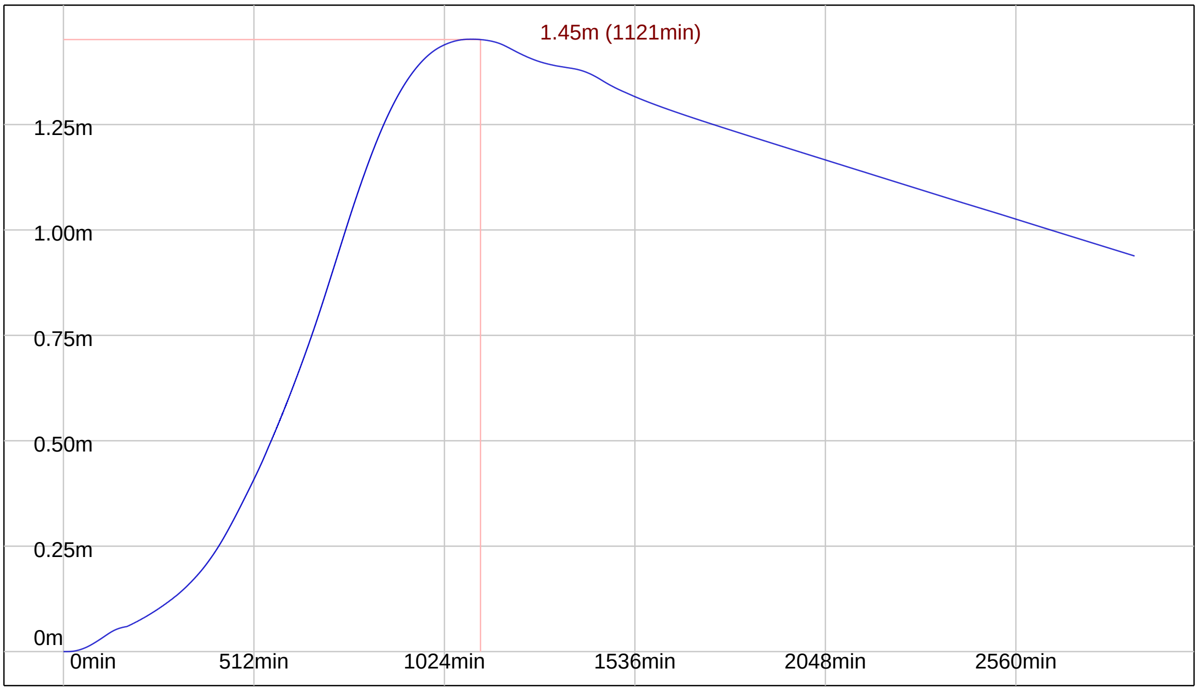
Hydro-Brake® Optimum Control at S20



Tank Structure at Manhole S21

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
5.182	2.000	100.00	195.463	195.463	390.926	0.00000000	0.00000000	2.00

Tank at S21 (100Yr+20% 1440Min Winter)

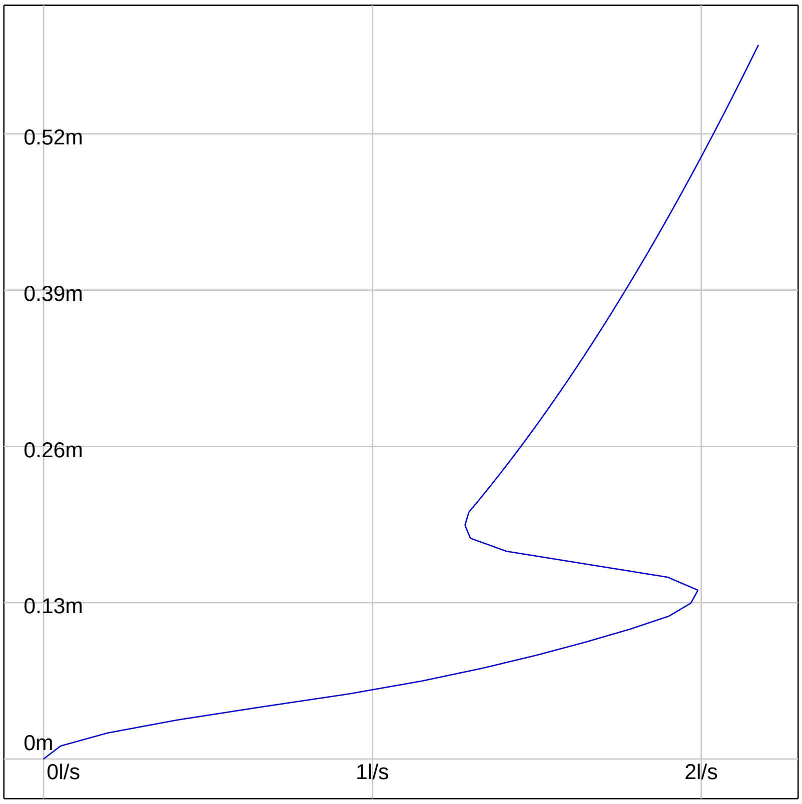


Controls within Manhole S22

Hydro-Brake® Optimum Control at Manhole S22

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CFP-0068-2000-0500-2000	0.500	2.000	0.000	0.139	1.992	0.193	1.281

Hydro-Brake® Optimum Control at S22

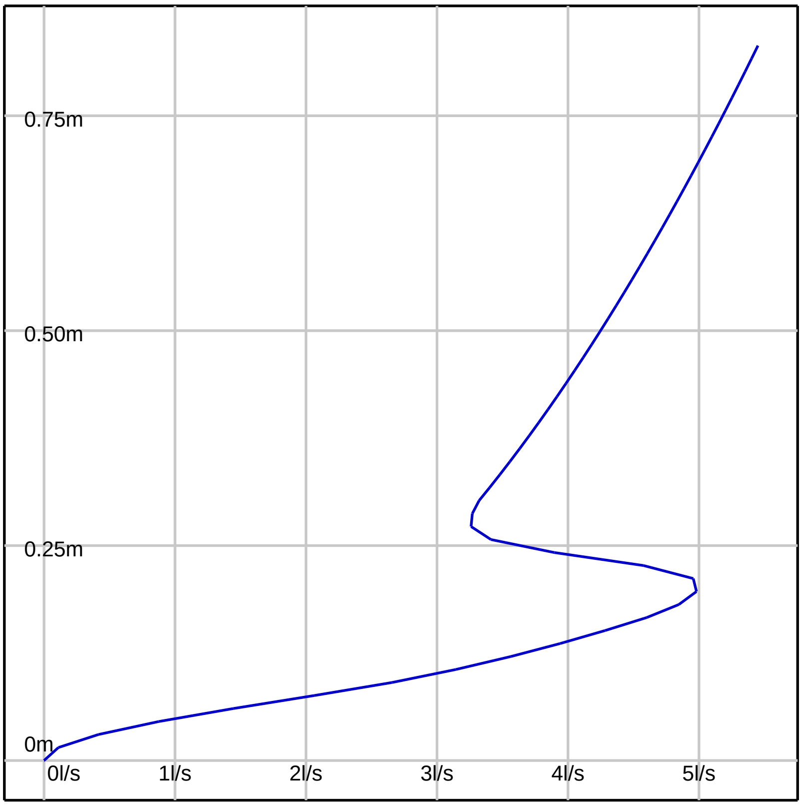


Controls within Manhole S24

Hydro-Brake® Optimum Control at Manhole S24

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CHE-0106-5000-0700-5000	0.700	5.000	0.000	0.203	5.000	0.279	3.253

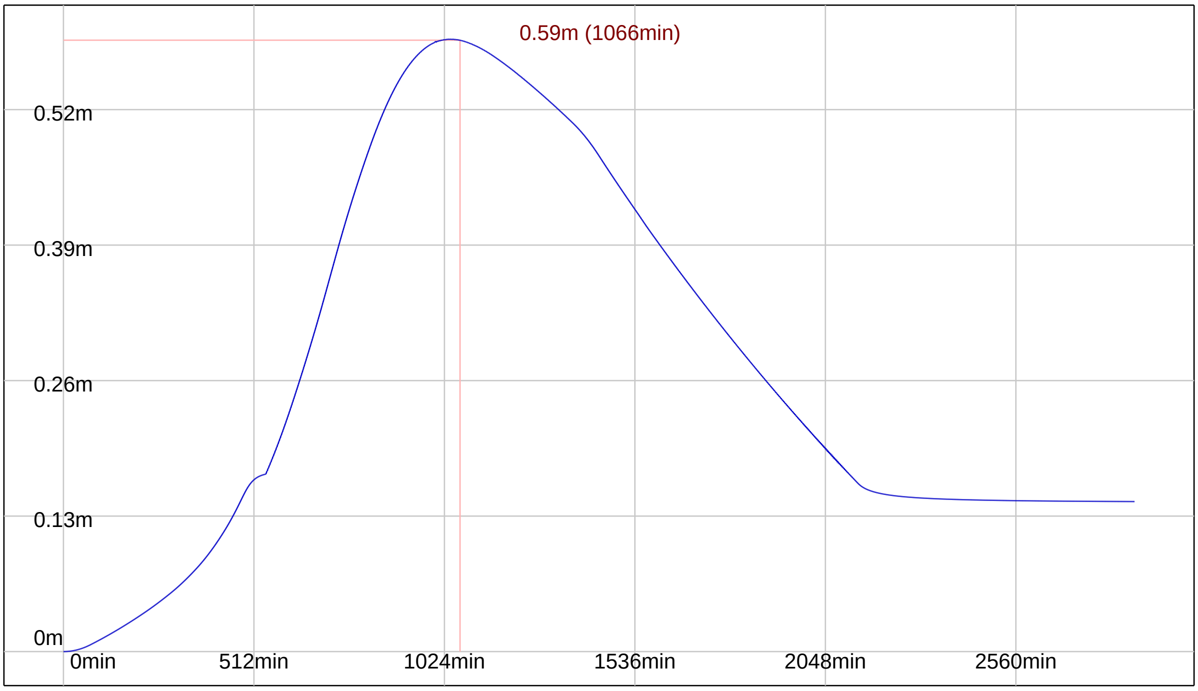
Hydro-Brake® Optimum Control at S24



Tank Structure at Manhole S25

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
4.723	1.200	100.00	148.782	148.782	178.539	0.00000000	0.00000000	2.00

Tank at S25 (100Yr+20% 1440Min Winter)

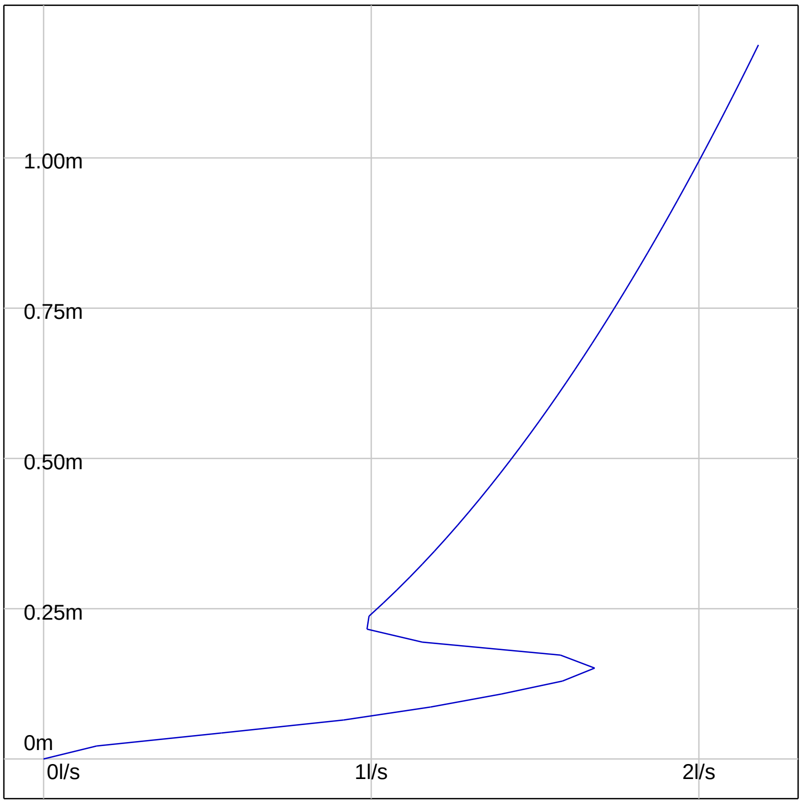


Controls within Manhole S27

Hydro-Brake® Optimum Control at Manhole S27

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CHE-0064-2000-1000-2000	1.000	2.000	0.000	0.156	1.687	0.223	0.983

Hydro-Brake® Optimum Control at S27



Simulation Settings

FSR: M5-60=17.10, R=0.21, Locale=England and Wales
Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +20%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	29.767	0.00	-0.16	30Yr 720Min Winter	5.875	0.00	0.11
2Yr 15Min Summer	29.767	0.00	-0.19	30Yr 960Min Summer	4.885	0.00	0.03
2Yr 30Min Winter	20.880	0.00	-0.18	30Yr 960Min Winter	4.885	0.00	0.07
2Yr 30Min Summer	20.880	0.00	-0.19	30Yr 1440Min Summer	3.757	0.00	-0.02
2Yr 60Min Winter	14.263	0.00	-0.10	30Yr 1440Min Winter	3.757	0.00	-0.03
2Yr 60Min Summer	14.263	0.00	-0.15	30Yr 2160Min Summer	2.883	0.00	-0.03
2Yr 120Min Winter	9.625	0.00	-0.04	30Yr 2160Min Winter	2.883	0.00	-0.06
2Yr 120Min Summer	9.625	0.00	-0.07	30Yr 2880Min Summer	2.391	0.00	-0.03
2Yr 180Min Summer	7.647	0.00	-0.04	30Yr 2880Min Winter	2.391	0.00	-0.06
2Yr 180Min Winter	7.647	0.00	0.00	30Yr 4320Min Summer	1.839	0.00	-0.01
2Yr 240Min Summer	6.503	0.00	-0.04	30Yr 4320Min Winter	1.839	0.00	-0.04
2Yr 240Min Winter	6.503	0.00	0.00	30Yr 5760Min Summer	1.528	0.00	-0.01
2Yr 360Min Summer	5.167	0.00	-0.04	30Yr 5760Min Winter	1.528	0.00	-0.01
2Yr 360Min Winter	5.167	0.00	0.00	30Yr 7200Min Summer	1.327	0.00	0.00
2Yr 480Min Summer	4.388	0.00	-0.04	30Yr 7200Min Winter	1.327	0.00	-0.01
2Yr 480Min Winter	4.388	0.00	0.00	30Yr 8640Min Summer	1.184	0.00	-0.01
2Yr 600Min Summer	3.866	0.00	-0.04	30Yr 8640Min Winter	1.184	0.00	-0.01
2Yr 600Min Winter	3.866	0.00	-0.02	30Yr 10080Min Summer	1.077	0.00	0.01
2Yr 720Min Summer	3.486	0.00	-0.05	30Yr 10080Min Winter	1.077	0.00	-0.02
2Yr 720Min Winter	3.486	0.00	-0.03	100Yr+20% 15Min Summer	79.099	0.00	-0.06
2Yr 960Min Summer	2.962	0.00	-0.03	100Yr+20% 15Min Winter	79.099	0.00	0.00
2Yr 960Min Winter	2.962	0.00	-0.04	100Yr+20% 30Min Summer	58.359	0.00	-0.07
2Yr 1440Min Winter	2.356	0.00	0.02	100Yr+20% 30Min Winter	58.359	0.00	0.00
2Yr 1440Min Summer	2.356	0.00	0.02	100Yr+20% 60Min Summer	41.246	0.00	0.05
2Yr 2160Min Winter	1.875	0.00	0.02	100Yr+20% 60Min Winter	41.246	0.00	0.15
2Yr 2160Min Summer	1.875	0.00	0.01	100Yr+20% 120Min Summer	28.118	0.00	0.30
2Yr 2880Min Summer	1.593	0.00	0.01	100Yr+20% 120Min Winter	28.118	0.00	0.52
2Yr 2880Min Winter	1.593	0.00	0.02	100Yr+20% 180Min Summer	21.977	0.00	0.39
2Yr 4320Min Summer	1.266	0.00	0.01	100Yr+20% 180Min Winter	21.977	0.00	0.81
2Yr 4320Min Winter	1.266	0.00	0.01	100Yr+20% 240Min Summer	18.252	0.00	0.41
2Yr 5760Min Summer	1.075	0.00	0.00	100Yr+20% 240Min Winter	18.252	0.00	0.89
2Yr 5760Min Winter	1.075	0.00	0.00	100Yr+20% 360Min Summer	14.052	0.00	0.53
2Yr 7200Min Summer	0.946	0.00	0.00	100Yr+20% 360Min Winter	14.052	0.00	0.99
2Yr 7200Min Winter	0.946	0.00	-0.01	100Yr+20% 480Min Summer	11.639	0.00	0.57
2Yr 8640Min Summer	0.852	0.00	0.00	100Yr+20% 480Min Winter	11.639	0.00	1.05
2Yr 8640Min Winter	0.852	0.00	-0.01	100Yr+20% 600Min Summer	10.041	0.00	0.55
2Yr 10080Min Winter	0.779	0.00	-0.01	100Yr+20% 600Min Winter	10.041	0.00	1.05
2Yr 10080Min Summer	0.779	0.00	0.00	100Yr+20% 720Min Summer	8.890	0.00	0.54
30Yr 15Min Summer	51.610	0.00	-0.13	100Yr+20% 720Min Winter	8.890	0.00	1.01
30Yr 15Min Winter	51.610	0.00	-0.10	100Yr+20% 960Min Summer	7.323	0.00	0.42
30Yr 30Min Summer	37.490	0.00	-0.10	100Yr+20% 960Min Winter	7.323	0.00	0.92
30Yr 30Min Winter	37.490	0.00	-0.05	100Yr+20% 1440Min Summer	5.548	0.00	0.19
30Yr 60Min Summer	26.221	0.00	0.04	100Yr+20% 1440Min Winter	5.548	0.00	0.57
30Yr 60Min Winter	26.221	0.00	0.00	100Yr+20% 2160Min Summer	4.188	0.00	0.01
30Yr 120Min Summer	17.819	0.00	0.03	100Yr+20% 2160Min Winter	4.188	0.00	0.14
30Yr 120Min Winter	17.819	0.00	0.06	100Yr+20% 2880Min Summer	3.436	0.00	-0.01
30Yr 180Min Summer	13.998	0.00	0.04	100Yr+20% 2880Min Winter	3.436	0.00	0.01
30Yr 180Min Winter	13.998	0.00	0.10	100Yr+20% 4320Min Summer	2.604	0.00	-0.09
30Yr 240Min Summer	11.710	0.00	0.03	100Yr+20% 4320Min Winter	2.604	0.00	-0.05
30Yr 240Min Winter	11.710	0.00	0.08	100Yr+20% 5760Min Summer	2.145	0.00	-0.08
30Yr 360Min Summer	9.103	0.00	0.06	100Yr+20% 5760Min Winter	2.145	0.00	-0.07
30Yr 360Min Winter	9.103	0.00	0.10	100Yr+20% 7200Min Summer	1.850	0.00	-0.07
30Yr 480Min Summer	7.598	0.00	0.06	100Yr+20% 7200Min Winter	1.850	0.00	-0.07
30Yr 480Min Winter	7.598	0.00	0.14	100Yr+20% 8640Min Summer	1.645	0.00	-0.05
30Yr 600Min Summer	6.598	0.00	0.05	100Yr+20% 8640Min Winter	1.645	0.00	-0.06

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 600Min Winter	6.598	0.00	0.13	100Yr+20% 10080Min Winter	1.493	0.00	-0.06
30Yr 720Min Summer	5.875	0.00	0.04	100Yr+20% 10080Min Summer	1.493	0.00	-0.05

Simulation Results

Return Period Yrs: 2.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	10.505	0.043	6.413		OK
S2	15 min Winter	9	9.635	0.066	7.580		OK
S3	15 min Winter	9	9.572	0.053	9.852		OK
S4	15 min Winter	9	9.151	0.116	19.437		OK
S5	15 min Winter	9	8.911	0.116	25.457		OK
S6	15 min Winter	9	8.747	0.067	26.240		OK
S7	15 min Winter	9	7.414	0.066	30.340		OK
S9	15 min Winter	8	8.122	0.042	7.883		OK
S10	15 min Winter	8	6.684	0.064	18.228		OK
S12	1440 min Winter	1013	5.735	0.165	1.990		OK
S13	15 min Winter	8	6.149	0.069	8.142		OK
S14	15 min Winter	8	7.823	0.017	1.775		OK
S15	15 min Winter	9	5.990	0.094	13.462		OK
S16	15 min Winter	9	5.828	0.082	13.732		OK
S17	15 min Winter	8	7.392	0.042	8.112		OK
S18	15 min Winter	8	6.051	0.045	9.309		OK
S19	2160 min Winter	1628	5.761	0.241	0.258		Surcharged
S20	2160 min Winter	1630	5.761	0.424	0.541		Surcharged
S21	2160 min Winter	1488	5.732	0.582	2.446		OK
S22	2160 min Winter	1488	5.732	0.758	2.179		Surcharged
S23	15 min Winter	8	4.615	0.034	9.260		OK
S24	30 min Winter	23	3.840	0.283	3.965		OK
S25	1440 min Winter	948	4.779	0.199	0.996		OK
S26	1440 min Winter	962	4.784	0.293	0.709		OK
S27	1440 min Winter	962	4.784	0.334	1.104		OK
S28	2160 min Winter	1107	3.937	0.026	1.681		OK
S29	30 min Summer	19	3.527	0.041	6.638		OK
S30	30 min Summer	19	3.356	0.041	6.625		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	S1	S2	0.054	0.855	6.295	0.080	OK
1.001	15 min Winter	9	S2	S3	0.060	0.914	7.699	0.194	OK
1.002	15 min Winter	9	S3	S4	0.084	0.731	9.903	0.122	OK
1.003	15 min Winter	9	S4	S5	0.116	0.951	19.561	0.535	OK
1.004	15 min Winter	9	S5	S6	0.116	1.010	25.445	0.325	OK
1.005	15 min Winter	9	S6	S7	0.066	2.247	26.190	0.110	OK
1.006	15 min Winter	9	S7	S12	0.107	1.170	30.245	0.070	OK
2.000	15 min Winter	8	S9	S10	0.042	1.508	7.702	0.077	OK
2.001	15 min Winter	9	S10	S12	0.105	0.791	17.816	0.066	OK
1.007	2160 min Winter	1487	S12	S21	0.193	0.584	11.297	0.080	OK
3.000	15 min Winter	9	S13	S15	0.081	0.616	7.917	0.211	OK
4.000	15 min Winter	9	S14	S15	0.024	1.111	1.750	0.012	OK
3.001	15 min Winter	9	S15	S16	0.088	0.955	13.732	0.369	OK
3.002	2160 min Winter	1611	S16	S19	0.120	0.470	1.164	0.019	OK
5.000	15 min Winter	8	S17	S18	0.044	1.478	8.013	0.078	OK
5.001	2160 min Winter	1471	S18	S19	0.117	0.637	0.776	0.006	OK
3.003	2160 min Winter	1471	S19	S20	0.225	0.514	2.415	0.061	OK
3.004	720 min Winter	441	S20	S21	0.300	0.305	7.578	0.088	Surcharged
1.008	2160 min Winter	1684	S21	S22	0.575	0.440	6.873	0.014	OK
1.009	30 min Summer	14	S22	S23	0.025	0.663	1.933	0.001	OK
1.010	30 min Winter	22	S23	S24	0.153	0.496	8.025	0.004	OK
1.011	30 min Summer	19	S24	S29	0.044	0.539	4.981	0.013	OK
6.000	1440 min Winter	1061	S25	S26	0.174	0.245	4.856	0.009	OK
6.001	1440 min Winter	1090	S26	S27	0.314	0.083	1.869	0.004	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
6.002	2160 min Winter	1106	S27	S28	0.021	0.632	1.682	0.002	OK
6.003	2160 min Winter	1107	S28	S29	0.026	0.668	1.681	0.028	OK
1.012	30 min Summer	19	S29	S30	0.041	0.913	6.625	0.018	OK

Return Period Yrs: 30.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	10.519	0.056	11.121		OK
S2	15 min Winter	9	9.658	0.089	13.112		OK
S3	15 min Winter	9	9.589	0.070	17.077		OK
S4	15 min Winter	9	9.203	0.167	33.713		OK
S5	15 min Winter	9	8.954	0.159	44.301		OK
S6	15 min Winter	9	8.769	0.088	45.792		OK
S7	15 min Winter	9	7.435	0.087	52.966		OK
S9	15 min Winter	8	8.135	0.055	13.671		OK
S10	15 min Winter	8	6.705	0.085	31.671		OK
S12	2160 min Winter	1589	6.078	0.508	1.923		Surcharged
S13	15 min Winter	8	6.173	0.093	14.121		OK
S14	15 min Winter	8	7.829	0.023	3.078		OK
S15	2160 min Winter	1803	6.098	0.201	0.303		OK
S16	2160 min Winter	1805	6.098	0.352	0.304		Surcharged
S17	15 min Winter	8	7.406	0.056	14.068		OK
S18	2160 min Winter	1787	6.098	0.093	0.209		OK
S19	2160 min Winter	1804	6.098	0.578	0.472		Surcharged
S20	2160 min Winter	1804	6.098	0.761	0.557		Surcharged
S21	2160 min Winter	1590	6.078	0.928	2.041		Surcharged
S22	2160 min Winter	1590	6.078	1.104	2.174		Surcharged
S23	15 min Winter	8	4.624	0.042	15.192		OK
S24	120 min Winter	84	4.229	0.672	4.754		Surcharged
S25	1440 min Winter	1005	4.938	0.358	1.096		OK
S26	1440 min Winter	1008	4.941	0.450	1.054		OK
S27	1440 min Winter	1008	4.941	0.491	1.383		Surcharged
S28	2880 min Winter	1217	3.937	0.026	1.679		OK
S29	30 min Summer	59	3.527	0.041	6.615		OK
S30	30 min Summer	59	3.356	0.041	6.637		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S1	S2	0.072	0.994	10.955	0.139	OK
1.001	15 min Winter	9	S2	S3	0.079	1.066	13.345	0.337	OK
1.002	15 min Winter	9	S3	S4	0.119	0.819	17.184	0.212	OK
1.003	15 min Winter	9	S4	S5	0.161	1.120	34.079	0.932	OK
1.004	15 min Winter	9	S5	S6	0.159	1.167	44.414	0.568	OK
1.005	15 min Winter	9	S6	S7	0.088	2.638	45.771	0.192	OK
1.006	720 min Winter	454	S7	S12	0.202	0.794	8.249	0.019	OK
2.000	15 min Winter	8	S9	S10	0.055	1.773	13.417	0.134	OK
2.001	720 min Winter	454	S10	S12	0.201	0.468	4.759	0.018	OK
1.007	720 min Winter	454	S12	S21	0.375	0.791	30.742	0.218	Surcharged
3.000	15 min Winter	9	S13	S15	0.110	0.717	13.804	0.368	OK
4.000	2160 min Winter	1798	S14	S15	0.070	0.661	0.225	0.002	OK
3.001	2160 min Winter	1803	S15	S16	0.213	0.555	1.790	0.048	OK
3.002	2160 min Winter	1350	S16	S19	0.225	0.512	4.026	0.064	OK
5.000	15 min Winter	8	S17	S18	0.057	1.801	13.926	0.136	OK
5.001	2160 min Winter	1787	S18	S19	0.159	0.711	4.406	0.032	OK
3.003	600 min Winter	338	S19	S20	0.225	0.511	7.717	0.195	OK
3.004	720 min Winter	340	S20	S21	0.300	0.325	7.411	0.086	Surcharged
1.008	5760 min Summer	3812	S21	S22	0.600	0.439	7.902	0.016	Surcharged
1.009	15 min Winter	8	S22	S23	0.029	0.681	1.781	0.001	OK
1.010	120 min Winter	84	S23	S24	0.348	0.390	8.060	0.004	OK
1.011	180 min Summer	86	S24	S29	0.044	0.551	4.978	0.013	OK
6.000	1440 min Winter	1590	S25	S26	0.332	0.203	5.085	0.009	OK
6.001	1440 min Winter	1362	S26	S27	0.470	0.083	5.042	0.010	OK
6.002	2880 min Winter	1216	S27	S28	0.021	0.633	1.682	0.002	OK
6.003	2880 min Winter	1217	S28	S29	0.026	0.668	1.681	0.028	OK
1.012	30 min Summer	59	S29	S30	0.041	0.913	6.637	0.018	OK

Return Period Yrs: 100.0

Climate Change %: 20

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	10.533	0.070	17.046		OK
S2	15 min Winter	9	9.682	0.113	20.067		OK
S3	15 min Winter	9	9.607	0.087	26.156		OK
S4	15 min Winter	9	9.349	0.313	51.649		Surcharged
S5	15 min Winter	9	8.999	0.204	65.550		OK
S6	15 min Winter	9	8.788	0.108	67.397		OK
S7	15 min Winter	9	7.454	0.106	78.301		OK
S9	15 min Winter	8	8.149	0.069	20.954		OK
S10	15 min Winter	8	6.725	0.105	48.595		OK
S12	1440 min Winter	1096	6.602	1.032	3.075		Surcharged
S13	2880 min Winter	2467	6.589	0.510	0.194		Surcharged
S14	15 min Winter	8	7.834	0.028	4.717		OK
S15	2880 min Winter	2467	6.589	0.693	0.336		Surcharged
S16	2880 min Winter	2467	6.589	0.843	0.337		Surcharged
S17	15 min Winter	8	7.419	0.069	21.563		OK
S18	2880 min Winter	2469	6.589	0.584	0.224		Surcharged
S19	2880 min Winter	2469	6.589	1.069	0.557		Surcharged
S20	2880 min Winter	2478	6.589	1.252	0.618		Surcharged
S21	1440 min Winter	1095	6.603	1.453	3.309		Surcharged
S22	1440 min Winter	1082	6.602	1.628	0.320		Surcharged
S23	120 min Winter	84	4.725	0.143	6.114		OK
S24	120 min Winter	87	4.730	1.173	6.472		Surcharged
S25	1440 min Winter	1039	5.168	0.588	1.237		OK
S26	1440 min Winter	1001	5.187	0.696	0.133		Surcharged
S27	1440 min Winter	1038	5.177	0.726	2.859		Surcharged
S28	1440 min Winter	1043	3.937	0.026	1.687		OK
S29	360 min Winter	249	3.528	0.042	6.990		OK
S30	360 min Winter	249	3.357	0.042	6.990		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S1	S2	0.091	1.110	16.827	0.213	OK
1.001	15 min Winter	9	S2	S3	0.100	1.194	20.438	0.516	OK
1.002	15 min Winter	9	S3	S4	0.156	0.894	26.318	0.324	OK
1.003	15 min Winter	9	S4	S5	0.205	1.311	49.883	1.365	OK
1.004	15 min Winter	9	S5	S6	0.201	1.295	65.284	0.835	OK
1.005	15 min Winter	9	S6	S7	0.108	2.939	67.275	0.283	OK
1.006	180 min Winter	110	S7	S12	0.216	1.158	30.740	0.071	OK
2.000	15 min Winter	8	S9	S10	0.069	2.003	20.616	0.205	OK
2.001	180 min Winter	110	S10	S12	0.215	0.685	17.761	0.066	OK
1.007	180 min Summer	124	S12	S21	0.375	1.281	64.215	0.456	Surcharged
3.000	1440 min Summer	1275	S13	S15	0.225	0.453	2.760	0.074	OK
4.000	1440 min Winter	894	S14	S15	0.116	0.809	0.433	0.003	OK
3.001	600 min Summer	596	S15	S16	0.225	0.887	8.556	0.230	OK
3.002	240 min Summer	275	S16	S19	0.225	1.141	15.086	0.240	OK
5.000	2160 min Winter	1276	S17	S18	0.121	0.967	1.495	0.015	OK
5.001	960 min Winter	706	S18	S19	0.225	1.051	13.503	0.098	OK
3.003	600 min Winter	283	S19	S20	0.225	0.510	7.563	0.191	OK
3.004	720 min Winter	290	S20	S21	0.300	0.345	7.205	0.084	Surcharged
1.008	4320 min Winter	4011	S21	S22	0.600	0.438	7.531	0.015	Surcharged
1.009	120 min Winter	84	S22	S23	0.082	0.728	2.174	0.001	OK
1.010	120 min Winter	112	S23	S24	0.447	0.416	12.376	0.006	OK
1.011	360 min Winter	249	S24	S29	0.045	0.564	5.451	0.014	OK
6.000	1440 min Winter	1039	S25	S26	0.522	0.203	5.927	0.011	OK
6.001	1440 min Winter	1558	S26	S27	0.600	0.087	22.816	0.047	Surcharged
6.002	1440 min Winter	1002	S27	S28	0.021	0.636	1.699	0.002	OK
6.003	1440 min Winter	1043	S28	S29	0.026	0.668	1.687	0.028	OK
1.012	360 min Winter	249	S29	S30	0.042	0.928	6.990	0.019	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S31	0.121	1.350	Type C	10.149	8.630	1.219	588826.444	571651.194
S32	0.105	1.350	Type C	9.472	8.267	0.905	588924.414	571688.988
S33	0.029	1.200	Unknown	9.446	7.900	1.246	588885.189	571672.972
S34	0.043	1.200	Type A	7.458	3.678	3.480	588875.376	571711.672
S40	0.000	1.350	Type B	6.868	3.671	2.447	588859.151	571726.032
S35	0.072	1.200	Type B	6.642	3.599	2.744	588873.538	571727.106
S36	0.046	1.350	Type A	7.827	3.770	3.607	588905.878	571716.187
S37	0.005	1.350	Type B	6.364	3.616	2.299	588895.500	571745.256
S41	0.000	1.350	Type B	5.962	3.583	1.930	588892.488	571751.133
S38	0.019	1.350	Unknown	5.514	3.481	1.658	588872.253	571749.214
S39	0.000	1.350	Type C	4.672	3.398	0.899	588870.750	571767.494

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)
1.000	S31	8.630	S33	7.900	Circ	0.3mØ	62.652	85.8	0.600	1.219
2.000	S32	8.267	S33	7.900	Circ	0.3mØ	42.369	115.4	0.600	0.905
1.001	S33	7.900	S34	6.241	Circ	0.3mØ	39.925	24.1	0.600	1.246
1.002	S34	3.678	S35	3.599	Circ	0.3mØ	15.543	196.4	0.600	3.480
3.000	S40	3.671	S35	3.599	Circ	0.75mØ	14.427	200.0	0.600	2.447
1.003	S35	3.599	S38	3.481	Circ	0.75mØ	22.145	188.1	0.600	2.294
4.000	S36	3.770	S37	3.616	Circ	0.45mØ	30.866	200.0	0.600	3.607
4.001	S37	3.616	S41	3.583	Circ	0.45mØ	6.604	200.0	0.600	2.299
4.002	S41	3.583	S38	3.481	Circ	0.45mØ	20.325	200.0	0.600	1.930
1.004	S38	3.481	S39	3.398	Circ	0.375mØ	18.342	220.6	0.600	1.658

Outfall Details

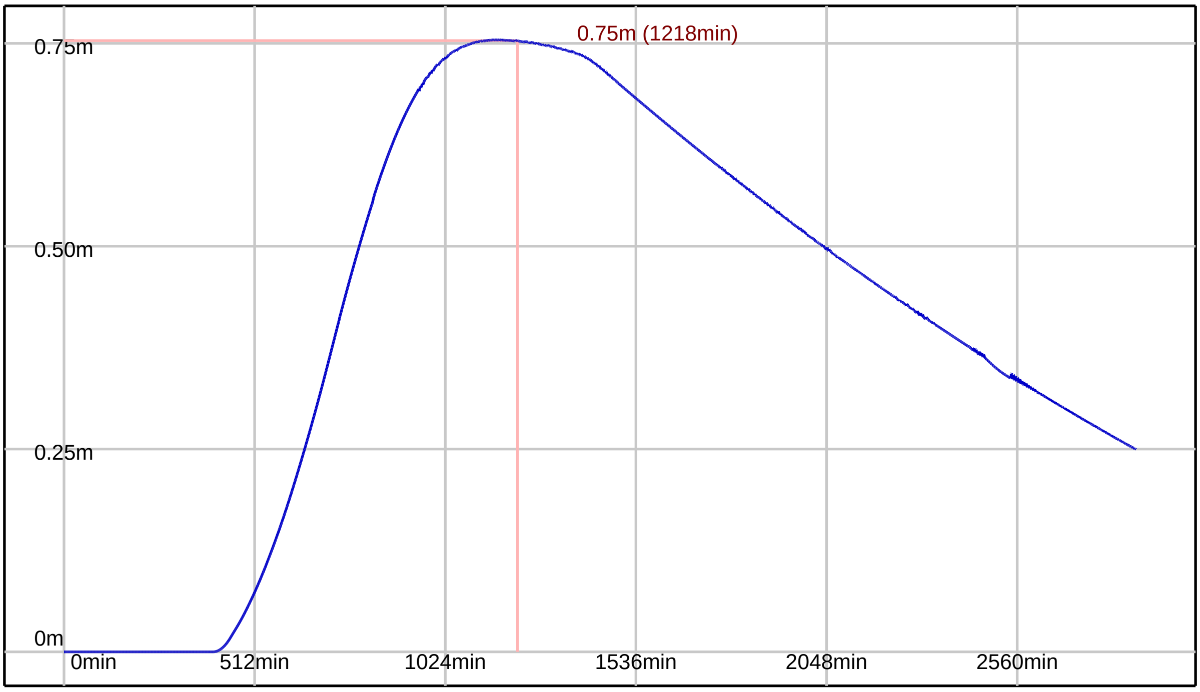
Outfall Manhole S39 : Free Discharge

Flow Control Details

Tank Structure at Manhole S40

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
3.671	1.500	95.00	124.017	117.816	176.724	0.00000000	0.00000000	2.00

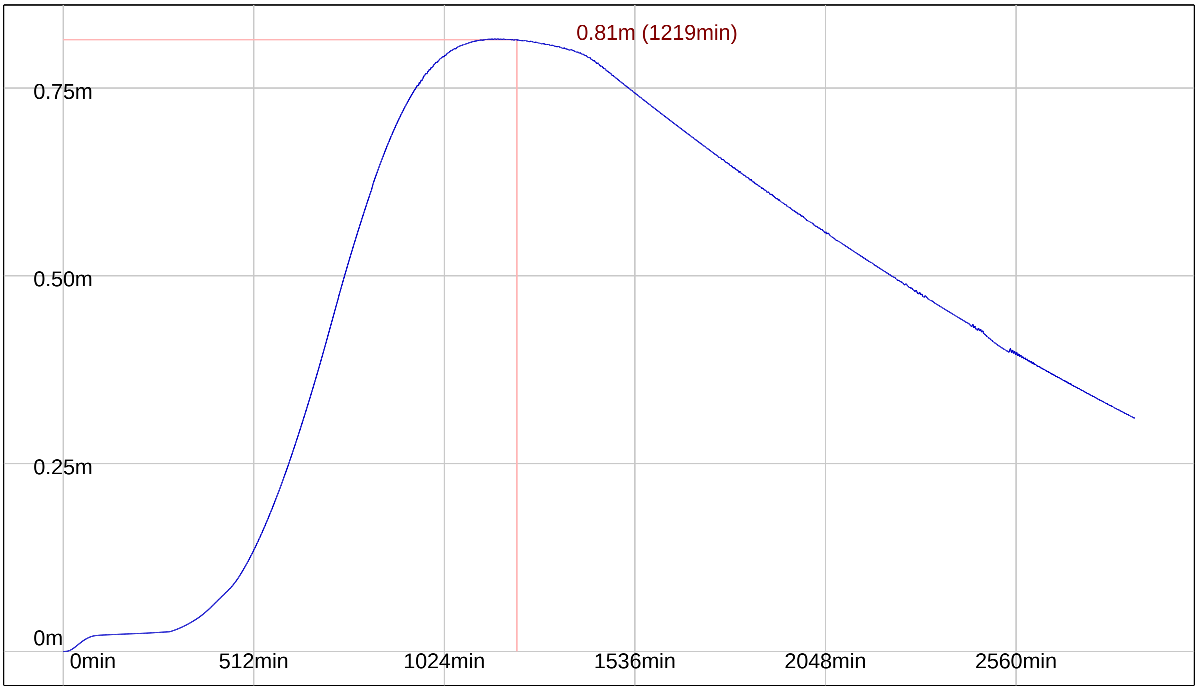
Tank at S40 (100Yr+20% 1440Min Winter)



Tank Structure at Manhole S35

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
3.599	1.500	100.00	68.523	68.523	102.785	0.00000000	0.00000000	2.00

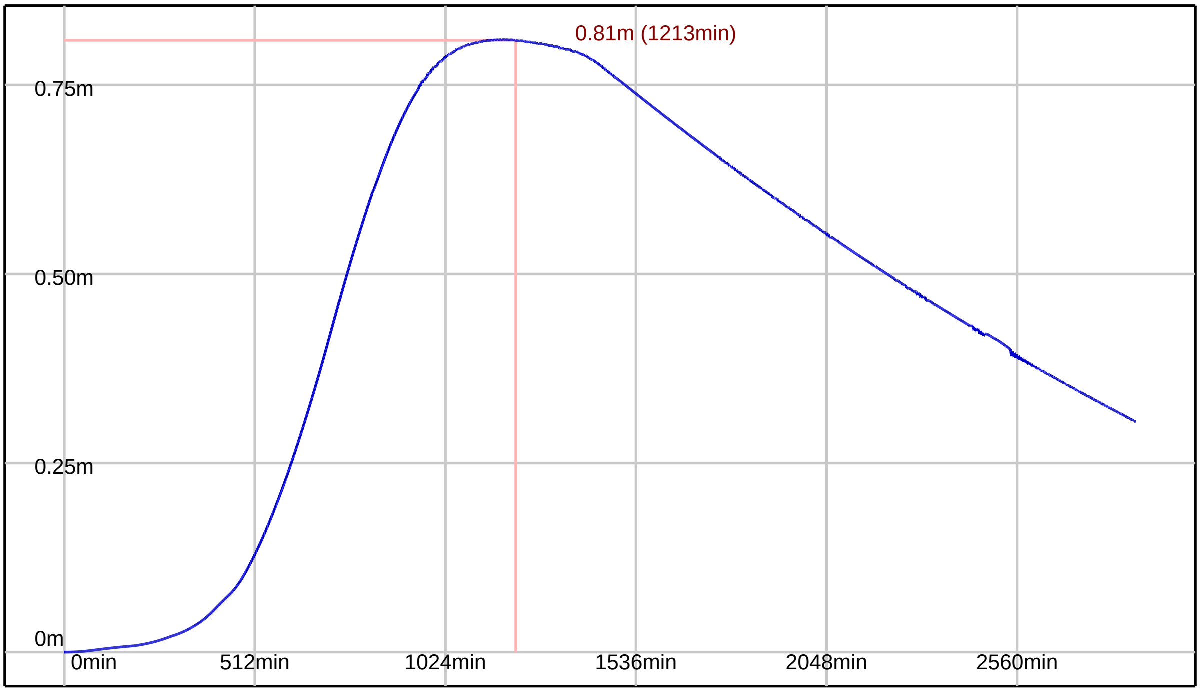
Tank at S35 (100Yr+20% 1440Min Winter)



Tank Structure at Manhole S37

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
3.616	1.200	100.00	172.154	172.154	206.585	0.00000000	0.00000000	2.00

Tank at S37 (100Yr+20% 1440Min Winter)

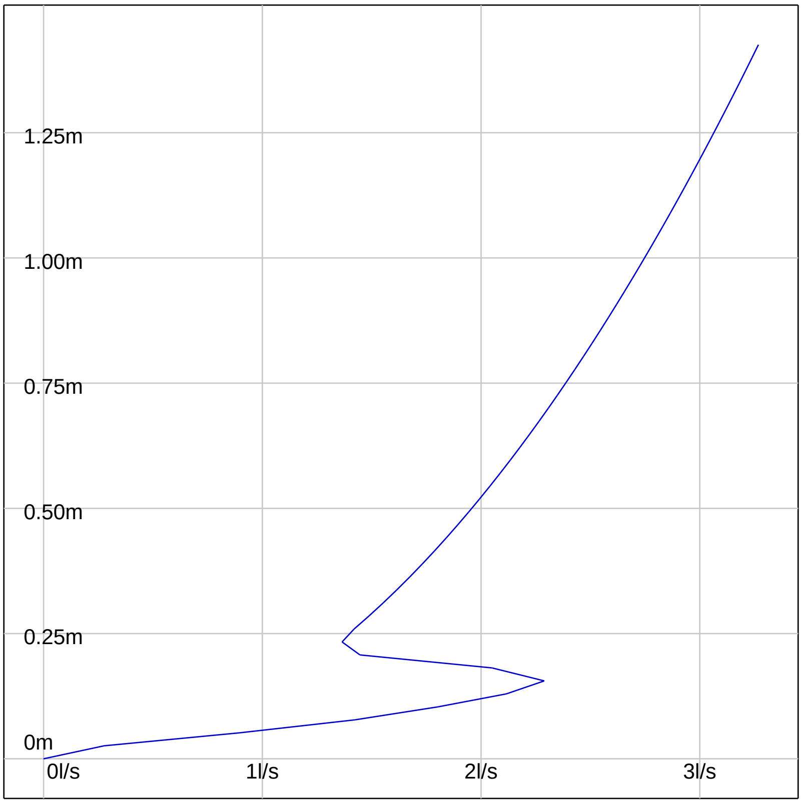


Controls within Manhole S38

Hydro-Brake® Optimum Control at Manhole S38

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CFP-0070-3000-1200-3000	1.200	3.000	0.000	0.160	2.295	0.228	1.360

Hydro-Brake® Optimum Control at S38



Simulation Settings

FSR: M5-60=17.10, R=0.21, Locale=England and Wales

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +20%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	29.767	0.00	0.28	30Yr 720Min Winter	5.875	0.00	0.00
2Yr 15Min Summer	29.767	0.00	0.00	30Yr 960Min Summer	4.885	0.00	-0.04
2Yr 30Min Winter	20.880	0.00	0.25	30Yr 960Min Winter	4.885	0.00	-0.02
2Yr 30Min Summer	20.880	0.00	0.16	30Yr 1440Min Summer	3.757	0.00	0.03
2Yr 60Min Winter	14.263	0.00	0.08	30Yr 1440Min Winter	3.757	0.00	8.55
2Yr 60Min Summer	14.263	0.00	0.16	30Yr 2160Min Summer	2.883	0.00	0.03
2Yr 120Min Winter	9.625	0.00	0.00	30Yr 2160Min Winter	2.883	0.00	1.10
2Yr 120Min Summer	9.625	0.00	0.00	30Yr 2880Min Summer	2.391	0.00	2.07
2Yr 180Min Summer	7.647	0.00	0.00	30Yr 2880Min Winter	2.391	0.00	7.07
2Yr 180Min Winter	7.647	0.00	0.00	30Yr 4320Min Summer	1.839	0.00	0.24
2Yr 240Min Summer	6.503	0.00	0.00	30Yr 4320Min Winter	1.839	0.00	5.96
2Yr 240Min Winter	6.503	0.00	-0.05	30Yr 5760Min Summer	1.528	0.00	0.12
2Yr 360Min Summer	5.167	0.00	-0.05	30Yr 5760Min Winter	1.528	0.00	1.83
2Yr 360Min Winter	5.167	0.00	-0.07	30Yr 7200Min Summer	1.327	0.00	0.08
2Yr 480Min Summer	4.388	0.00	-0.07	30Yr 7200Min Winter	1.327	0.00	0.09
2Yr 480Min Winter	4.388	0.00	-0.08	30Yr 8640Min Summer	1.184	0.00	0.05
2Yr 600Min Summer	3.866	0.00	-0.06	30Yr 8640Min Winter	1.184	0.00	0.05
2Yr 600Min Winter	3.866	0.00	-0.08	30Yr 10080Min Summer	1.077	0.00	0.00
2Yr 720Min Summer	3.486	0.00	0.00	30Yr 10080Min Winter	1.077	0.00	-0.01
2Yr 720Min Winter	3.486	0.00	-0.08	100Yr+20% 15Min Summer	79.099	0.00	0.48
2Yr 960Min Summer	2.962	0.00	0.02	100Yr+20% 15Min Winter	79.099	0.00	0.59
2Yr 960Min Winter	2.962	0.00	0.00	100Yr+20% 30Min Summer	58.359	0.00	0.55
2Yr 1440Min Winter	2.356	0.00	0.00	100Yr+20% 30Min Winter	58.359	0.00	0.48
2Yr 1440Min Summer	2.356	0.00	0.00	100Yr+20% 60Min Summer	41.246	0.00	0.38
2Yr 2160Min Winter	1.875	0.00	0.00	100Yr+20% 60Min Winter	41.246	0.00	0.36
2Yr 2160Min Summer	1.875	0.00	0.00	100Yr+20% 120Min Summer	28.118	0.00	0.33
2Yr 2880Min Summer	1.593	0.00	0.00	100Yr+20% 120Min Winter	28.118	0.00	0.46
2Yr 2880Min Winter	1.593	0.00	0.00	100Yr+20% 180Min Summer	21.977	0.00	0.32
2Yr 4320Min Summer	1.266	0.00	0.00	100Yr+20% 180Min Winter	21.977	0.00	0.56
2Yr 4320Min Winter	1.266	0.00	0.00	100Yr+20% 240Min Summer	18.252	0.00	0.32
2Yr 5760Min Summer	1.075	0.00	0.00	100Yr+20% 240Min Winter	18.252	0.00	0.57
2Yr 5760Min Winter	1.075	0.00	-0.01	100Yr+20% 360Min Summer	14.052	0.00	0.29
2Yr 7200Min Summer	0.946	0.00	0.00	100Yr+20% 360Min Winter	14.052	0.00	0.55
2Yr 7200Min Winter	0.946	0.00	0.00	100Yr+20% 480Min Summer	11.639	0.00	0.23
2Yr 8640Min Summer	0.852	0.00	0.00	100Yr+20% 480Min Winter	11.639	0.00	0.49
2Yr 8640Min Winter	0.852	0.00	-0.01	100Yr+20% 600Min Summer	10.041	0.00	0.16
2Yr 10080Min Winter	0.779	0.00	-0.01	100Yr+20% 600Min Winter	10.041	0.00	0.41
2Yr 10080Min Summer	0.779	0.00	0.00	100Yr+20% 720Min Summer	8.890	0.00	0.11
30Yr 15Min Summer	51.610	0.00	0.35	100Yr+20% 720Min Winter	8.890	0.00	0.32
30Yr 15Min Winter	51.610	0.00	0.50	100Yr+20% 960Min Summer	7.323	0.00	0.04
30Yr 30Min Summer	37.490	0.00	0.41	100Yr+20% 960Min Winter	7.323	0.00	0.15
30Yr 30Min Winter	37.490	0.00	0.41	100Yr+20% 1440Min Summer	5.548	0.00	0.09
30Yr 60Min Summer	26.221	0.00	0.31	100Yr+20% 1440Min Winter	5.548	0.00	0.29
30Yr 60Min Winter	26.221	0.00	0.25	100Yr+20% 2160Min Summer	4.188	0.00	0.20
30Yr 120Min Summer	17.819	0.00	0.18	100Yr+20% 2160Min Winter	4.188	0.00	0.21
30Yr 120Min Winter	17.819	0.00	0.14	100Yr+20% 2880Min Summer	3.436	0.00	6.83
30Yr 180Min Summer	13.998	0.00	0.12	100Yr+20% 2880Min Winter	3.436	0.00	0.14
30Yr 180Min Winter	13.998	0.00	0.11	100Yr+20% 4320Min Summer	2.604	0.00	7.53
30Yr 240Min Summer	11.710	0.00	0.08	100Yr+20% 4320Min Winter	2.604	0.00	5.22
30Yr 240Min Winter	11.710	0.00	0.10	100Yr+20% 5760Min Summer	2.145	0.00	7.35
30Yr 360Min Summer	9.103	0.00	0.03	100Yr+20% 5760Min Winter	2.145	0.00	8.13
30Yr 360Min Winter	9.103	0.00	0.06	100Yr+20% 7200Min Summer	1.850	0.00	5.54
30Yr 480Min Summer	7.598	0.00	0.00	100Yr+20% 7200Min Winter	1.850	0.00	10.07
30Yr 480Min Winter	7.598	0.00	0.04	100Yr+20% 8640Min Summer	1.645	0.00	6.86
30Yr 600Min Summer	6.598	0.00	0.00	100Yr+20% 8640Min Winter	1.645	0.00	8.17

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 600Min Winter	6.598	0.00	0.00	100Yr+20% 10080Min Winter	1.493	0.00	10.08
30Yr 720Min Summer	5.875	0.00	-0.02	100Yr+20% 10080Min Summer	1.493	0.00	5.93

Simulation Results

Return Period Yrs: 2.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S31	15 min Winter	8	8.702	0.072	16.051		OK
S32	15 min Winter	8	8.340	0.073	13.818		OK
S33	15 min Winter	9	7.976	0.076	32.390		OK
S34	1440 min Winter	1072	3.869	0.191	1.131		OK
S40	1440 min Winter	1073	3.869	0.198	0.000		OK
S35	1440 min Winter	1072	3.869	0.259	1.404		OK
S36	1440 min Winter	1076	3.869	0.099	0.167		OK
S37	1440 min Winter	1073	3.869	0.253	0.170		OK
S41	1440 min Winter	1073	3.869	0.286	0.195		OK
S38	1440 min Winter	1072	3.869	0.388	1.664		Surcharged
S39	8640 min Summer	4919	3.431	0.033	2.289		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	S31	S33	0.074	1.163	15.678	0.131	OK
2.000	15 min Winter	9	S32	S33	0.074	1.006	13.575	0.131	OK
1.001	15 min Winter	9	S33	S34	0.076	2.327	32.897	0.145	OK
1.002	1440 min Winter	1072	S34	S35	0.225	0.536	4.049	0.051	OK
3.000	1440 min Winter	2029	S40	S35	0.228	0.092	1.527	0.002	OK
1.003	1440 min Winter	2061	S35	S38	0.323	0.114	6.822	0.008	OK
4.000	1440 min Winter	1074	S36	S37	0.176	0.259	0.626	0.003	OK
4.001	1440 min Winter	2063	S37	S41	0.269	0.313	5.198	0.023	OK
4.002	1440 min Winter	2076	S41	S38	0.337	0.068	2.858	0.013	OK
1.004	4320 min Winter	2046	S38	S39	0.033	0.475	2.288	0.017	OK

Return Period Yrs: 30.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S31	15 min Winter	8	8.726	0.096	27.881		OK
S32	15 min Winter	8	8.363	0.096	24.004		OK
S33	15 min Winter	9	8.001	0.101	56.010		OK
S34	2160 min Winter	1614	4.091	0.413	1.347		Surcharged
S40	2160 min Winter	1628	4.091	0.420	0.000		OK
S35	2160 min Winter	1614	4.091	0.481	2.922		OK
S36	2160 min Winter	1608	4.092	0.322	0.210		OK
S37	2160 min Winter	1603	4.092	0.476	0.237		Surcharged
S41	2880 min Winter	1893	4.236	0.653	27.818		Surcharged
S38	2160 min Winter	1618	4.093	0.612	1.632		Surcharged
S39	10080 min Winter	8341	3.431	0.033	2.289		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S31	S33	0.098	1.357	27.334	0.228	OK
2.000	15 min Winter	8	S32	S33	0.098	1.172	23.637	0.229	OK
1.001	15 min Winter	9	S33	S34	0.101	2.722	57.033	0.251	OK
1.002	360 min Winter	243	S34	S35	0.300	0.693	15.611	0.198	Surcharged
3.000	2160 min Winter	2199	S40	S35	0.451	0.131	15.181	0.017	OK
1.003	2160 min Winter	1616	S35	S38	0.546	0.117	20.299	0.023	OK
4.000	2160 min Winter	1608	S36	S37	0.386	0.268	1.486	0.007	OK
4.001	2160 min Winter	2196	S37	S41	0.450	0.321	19.217	0.084	OK
4.002	2880 min Winter	2169	S41	S38	0.450	0.316	46.463	0.204	OK
1.004	7200 min Winter	3155	S38	S39	0.033	0.475	2.288	0.017	OK

Return Period Yrs: 100.0

Climate Change %: 20

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S31	15 min Winter	8	8.751	0.121	42.747		OK
S32	15 min Winter	8	8.388	0.121	36.803		OK
S33	15 min Winter	9	8.027	0.127	85.642		OK
S34	1440 min Winter	1141	4.425	0.747	1.966		Surcharged
S40	1440 min Winter	1170	4.425	0.754	0.204		Surcharged
S35	1440 min Winter	1160	4.425	0.815	2.185		Surcharged
S36	1440 min Winter	1178	4.426	0.656	0.266		Surcharged
S37	1440 min Winter	1185	4.426	0.810	0.477		Surcharged
S41	2880 min Winter	2164	4.749	1.167	110.297		Surcharged
S38	2880 min Winter	1980	4.559	1.078	88.137		Surcharged
S39	2880 min Winter	2111	3.433	0.035	2.651		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S31	S33	0.124	1.524	42.008	0.350	OK
2.000	15 min Winter	8	S32	S33	0.124	1.315	36.287	0.351	OK
1.001	15 min Winter	9	S33	S34	0.127	3.058	87.267	0.384	OK
1.002	120 min Summer	82	S34	S35	0.300	1.129	61.749	0.782	Surcharged
3.000	2160 min Winter	3173	S40	S35	0.750	0.071	14.827	0.017	Surcharged
1.003	2880 min Winter	2023	S35	S38	0.750	0.418	184.539	0.205	Surcharged
4.000	2880 min Winter	2581	S36	S37	0.450	0.276	4.318	0.019	OK
4.001	4320 min Summer	3047	S37	S41	0.450	2.372	377.254	1.656	OK
4.002	2880 min Winter	2086	S41	S38	0.450	1.305	203.106	0.892	OK
1.004	2880 min Winter	2111	S38	S39	0.036	0.498	2.651	0.020	OK

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