Fassaroe Phase 1 Planning Application

Stormwater Impact Assessment Report

Cosgrave Property Group

April 2022

Notice

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Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
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1. Introduction

The purpose of this Stormwater Impact Assessment report is to provide details of the Storm Water elements associated with the proposed Phase 1 of the Fassaroe Development and allowance for future phases. The proposed storm drainage network has been sized to allow for the future phases of the Fassaroe masterplan area within the control of Cosgrave Property Group.

The proposed Phase 1 planning application comprises of the construction of 650 no. residential units comprising a mix of apartments and houses along with a neighbourhood centre, a crèche, a district park, local parks, the diversion and rerouting of ESB electricity lines, a distributor road connecting to Ballyman Road, a new pedestrian / cycle route across the N11 connecting to Dargle Road, historic landfill remediation works, landscaping works, parking facilities, ancillary services and facilities and associated site development works.

The various elements of the application then include:

- Road link (2.4km) connecting N11 to Ballyman Road (with westerly connection to Ballyman Road already in place).
- Pedestrian / cycle route including bridge across the N11 to Dargle Road Upper.
- 15.3ha of District Park / Active Open Space.
- 650 no. residential units comprising 241 no. houses and 409 no. apartments.
- 3 No. pocket park areas comprising a total of 0.43ha.
- 733sq.m approx. crèche with capacity for approx. 138 no. childcare spaces
- Retail unit / kiosk (108sq.m.) in district park.
- Neighbourhood Centre Phase 1 comprising:
    - 1,035sq.m. retail
    - 360sq.m. café,
    - 480sq.m community concierge (serving entire Fassaroe community)
    - 414sq.m. residential ancillary uses for residents of the neighbourhood centre apartments (residents lounge 256sq.m., residents gym 90sq.m., and residents concierge 68sq.m.)
- Demolition of an existing dwelling at Berryfield Lane.
- Rerouting and undergrounding of overhead ESB lines (110kV and 38kV lines) across site and into existing ESB Substation.
- Site development / ground works on future development areas to ensure sustainable cut and fill balances across the lands
- Water supply, foul and surface water drainage proposals.
- Provisions for public bus services in line with demand towards Bray (DART and Bray bus interchange) and towards the Luas at Cherrywood / Brides Glen.
- Remediation of 5 no. historic landfill sites in line with Certificates of Authorisation issued to Wicklow County Council by the EPA in 2019.

A detailed description of the development is included in Chapter 2 of the Environmental Impact Assessment Report (EIAR) included with this planning application.

This report deals with the following aspects associated with this development:

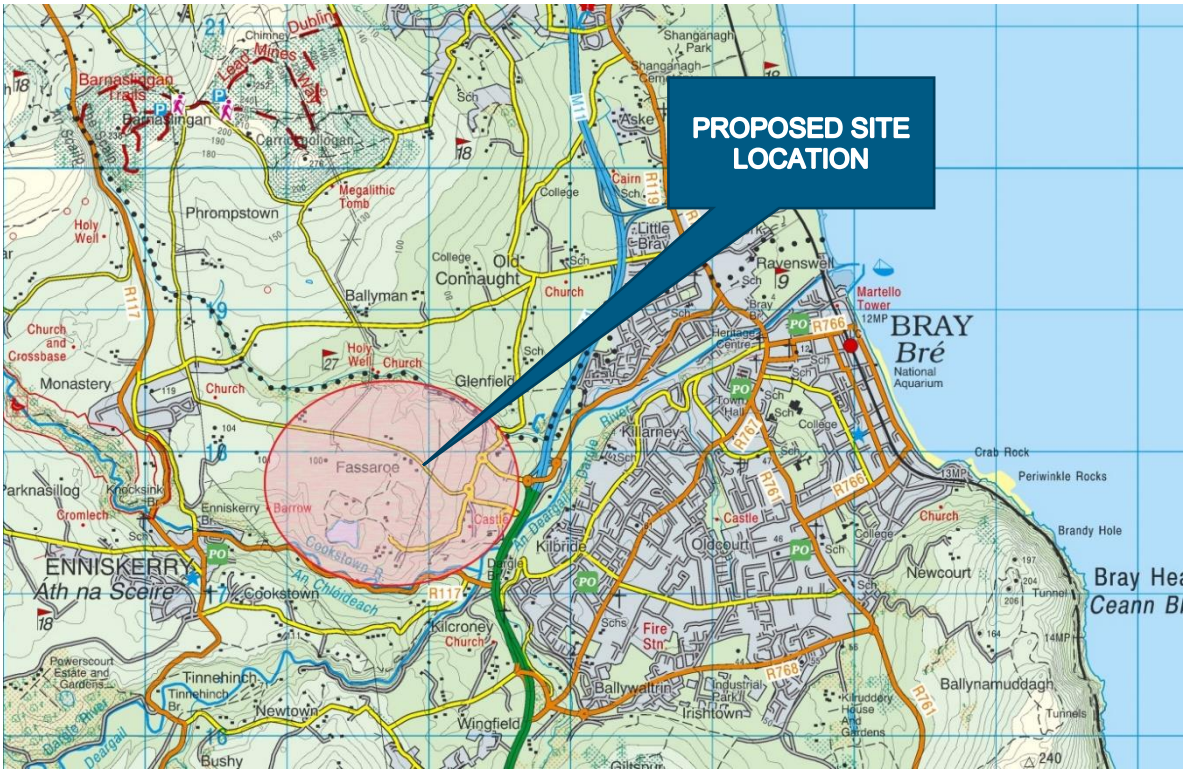
- Existing Site
- Site Infiltration Testing
- Soil Type Classification
- Storm Water Drainage Design
- Sustainable Urban Drainage Systems (SuDS)
- Flood Risk Assessment
- SuDS Maintenance

1.1. Site Location

The proposed application site forms part of a larger designated new development area under the Bray Municipal District Local Area Plan 2018 -2024 (LAP). These wider development lands are identified as an 'Action Area' in the LAP. The lands lie on the western side of Bray. The location of the site is shown below on **Figure 1-1 – Site Location.**

The site location is indicated on Atkins drawing 5186693_HTR_01_DR_0001.

Figure 1-1 – Site Location



1.2. Existing Site Description

The existing site is predominantly existing green field land with a number of private single dwellings. A large recycling centre is located to the East of the proposed site

The majority of the proposed phase 1 development is predominantly a steep sloping site, the highest point located to the west of the site area of circa 103mOD and falling to the East / North East direction to a lowest level of circa 23mOD adjacent to the existing bridge at the N11.

The majority of the site discharges into the County Brook (EPA code 10C02) to the north. An existing public storm drain is located to the East at the lower end of the site. The existing storm drainage network travels under the M11 prior to discharge into the Dargle River.

1.3. 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;

- Bray Municipal District Local Area Plan 2018 - 2024
- CIRIA report C753 The SuDS Manual-v6
- Greater Dublin Strategic Drainage Study (GDSDS)
- Wicklow County Development Plan, 2016 – 2022

The proposed stormwater drainage has been developed in consultation with the relevant authorities including the Bray District Engineer and Wicklow County Council (WCC) at preplanning stages.

2. Surface Water Design

The storm drainage system has been designed for the proposed phase 1 Development and including allowance made for future phases in accordance with the key documents and standards listed in Section 1.3 above.

Surface water generated from the proposed residential development area will be conveyed through a proposed surface water network including SuDS and attenuated / managed within areas of the site prior to final discharge at agreed Qbar greenfield run-off rates.

The proposed phase 1 development overall site area will have 4No. stormwater discharge locations;

1. County Brook (EPA code 10C06) located to the North of the site.
2. Existing 750mm dia Storm Water Network located to the East of the site.
3. Existing 300mm dia Storm Water Network located to the West of the site granted under WCC planning Ref; 1715
4. Proposed Soakaway located to the west of the central area of the site.

The proposed storm drainage network for the development is as indicated on the planning drawings 5186693_HTR_01_DR_0501-0515.

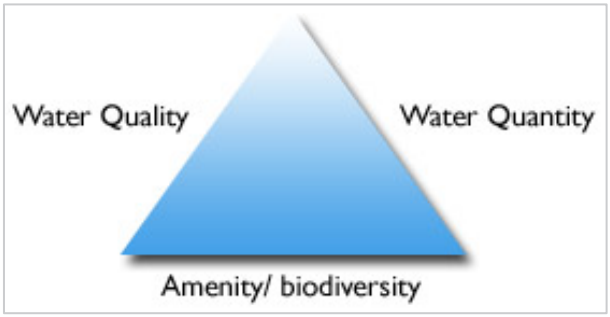
The proposed measures included within the design are as follows:

- Swales within Open Space / Park areas adjacent to roads / car parks
- Permeable paving in light traffic areas (parking bays)
- Extensive Green roofs (sedum) to suitable apartment blocks / Commercial - Retail Buildings
- Intensive Green courtyards to suitable apartment blocks
- Underground modular system within green corridors / park areas
- Forebays prior to Attenuation ponds
- Storm Water Attenuation ponds in coordination with the landscape design
- Soakaway
- Filter drains in rear gardens
- Tree pits
- Vortex flow control devices

2.1. Proposed Sustainable Urban Drainage (SuDS) Strategy

For the proposed development a “SuDS triangle” was utilised to ensure all three functions are provided for within the SuDS strategy.

Figure 2-1 - SuDS Triangle

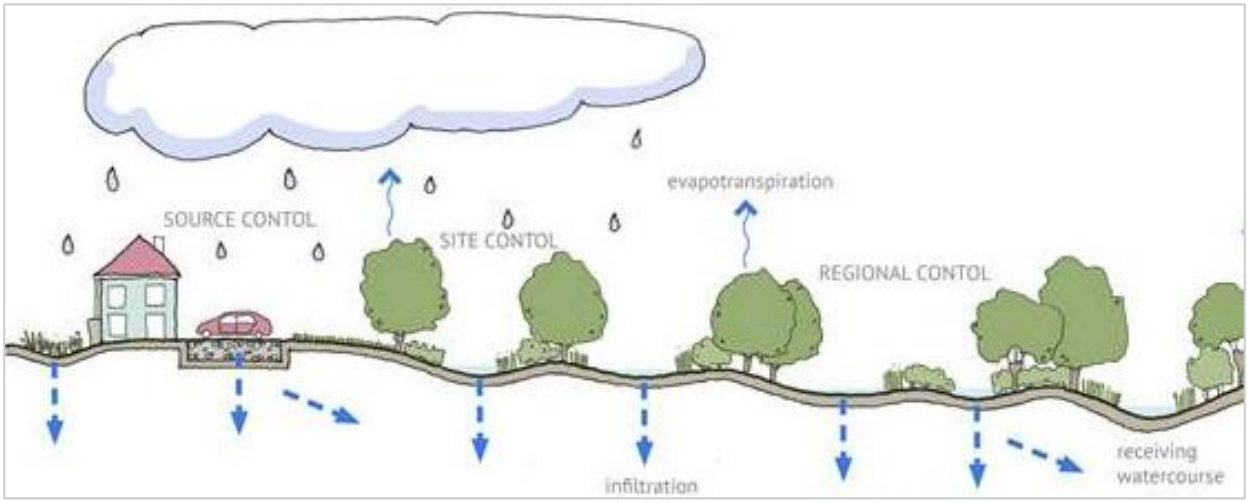


By considering the three functions of the triangle, the proposed SuDS system will allow for water quality treatment through natural processes by;

- Encouraging infiltration (where appropriate) and attenuating peak flows.
- Improving water quality by providing treatment to storm water throughout the proposed development and prior to discharge.
- Providing habitat and function where possible for those using the area (including wildlife)

The principles of a SuDS treatment train were used during the design of the surface water drainage system. The treatment train as illustrated in the image below provides an understanding of prevention and source control to reduced water run-off from a site and improve water quality.

Figure 2-2 - SuDS Treatment Train



The treatment train principles include;

- Prevention of surface water run-off from the proposed site by use of filter drains, swales, permeable paving, tree pits, extensive green roofs, intensive green courtyards and modular attenuation systems, forebays and attenuation ponds.
- Minimising impermeable paved areas using permeable paving, extensive green roofs and intensive green courtyards.
- Infiltration by use of filter drains, swales, permeable paving, tree pits, soakaways and pond forebays.

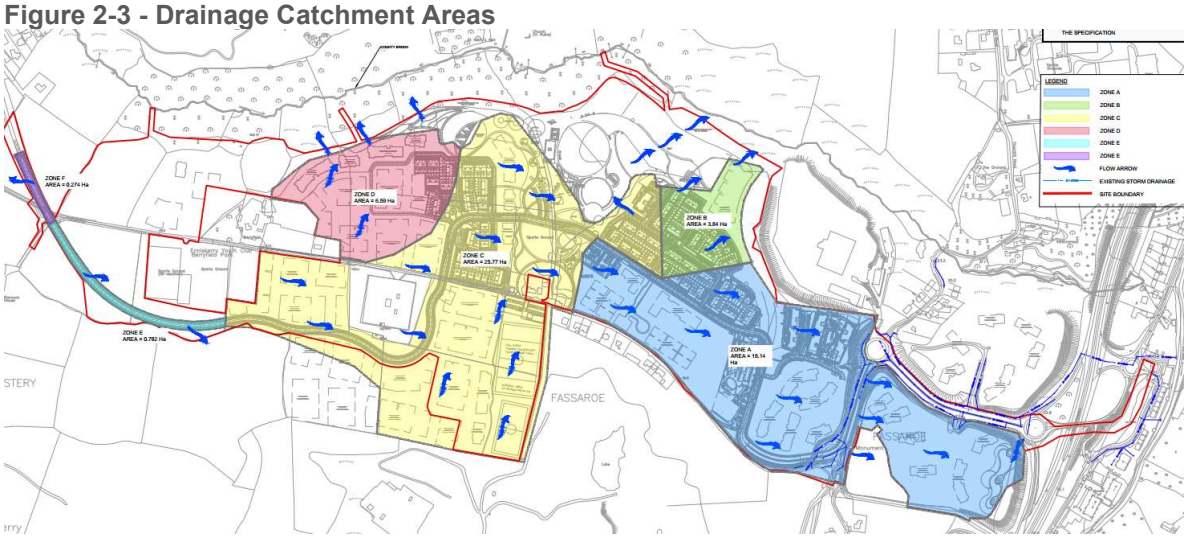
- Site control using underground modular attenuation storage, attenuation ponds and vortex flow control devices to manage flows and agreed final Qbar runoff rate.

Each of the items outlined above will help to improve water quality, reduce storm water runoff quantity from the proposed site and ensure that there is no increased risk to downstream flooding.

Drawings 5186693_HTR_01_DR_0501-0515 & 5186693_HTR_01_DR_0520-0523 inclusive outline the proposed details of the storm-water network and longitudinal sections for the proposed development.

For the purposes of designing the storm water network for the entire development and including associated Qbar calculations a total overall catchment area has been calculated as indicated below in Figure 2-3. 5186693_HTR_01_DR_0530. Refer to Appendix A - Site Characterisation Report for initial catchments area and discharge rates discussed and agreed with Bray Town Council / Wicklow County Council at pre planning stage.

Figure 2-3 - Drainage Catchment Areas



There are No. proposed drainage sub-catchment areas within the proposed phase 1 development for the purpose of site control. The outfall from each catchment is segregated by the use of a vortex control device to limit / manage discharge from each catchment. Section 7 of this report provides further details on catchment areas. It noted that for the purpose of discharge rates, the large open space (public park) has been removed for consistency of overall discharge rates.

The SuDS techniques proposed within the development are as outlined below:

- Landscape ponds with permanent water located within the proposed class 1 open space (public park) and to the east of the site adjacent to the N11 will be used to as storm water attenuation. It is noted that the storm water attenuation volume required is separate to permanent water level within the ponds as details by the landscape architect design.
- Swales are to be used within the site as conveyance systems for surface water runoff. Discharge into the swale will be via drop kerbs / side inlet gully's or over edge flows.
- Permeable paving will be used in light traffic areas to the front of residential units and parking areas. The permeable paving will allow for attenuation, infiltration to ground, reduction of peak flow rates and improved water quality. Roof run-off from the front roof area of residential housing units will also discharge directly into the subbase below each permeable paving area allowing for reduced runoff from these roof areas.
- Extensive green roof and intensive green courtyards will be provided on suitable buildings as indicated on drawing 5186693_HTR_01_DR_0540 in accordance with sustainable drainage best practice. The green roofs / courtyards will provide reduced peak flow rates, attenuation, evaporation, improved water quality and enhance biodiversity.
- Underground modular attenuation systems will be used to manage surface water runoff. The modular system will allow for storm water attenuation underground for storm events up to 1 in

100-year events and including for climate change. The modular systems will also allow for infiltration to ground to reduce surface water discharge quantity.

- Filter drains within rear gardens of the housing units will allow for infiltration to ground, reduced peak flow rates and improved water quality. Only roof run-off from the rear roof of the residential unit will discharge into the filter drain. The filter drain will allow for infiltration to ground to reduce surface water discharge quantity.
- Vortex flow control devices will be used throughout the site to allow for storm water control and reduce peak runoff.

The storm water drainage network will be assessed for compliance with the key design parameters as set out in Table 2-1 below.

Table 2-1 – Key Design Parameters

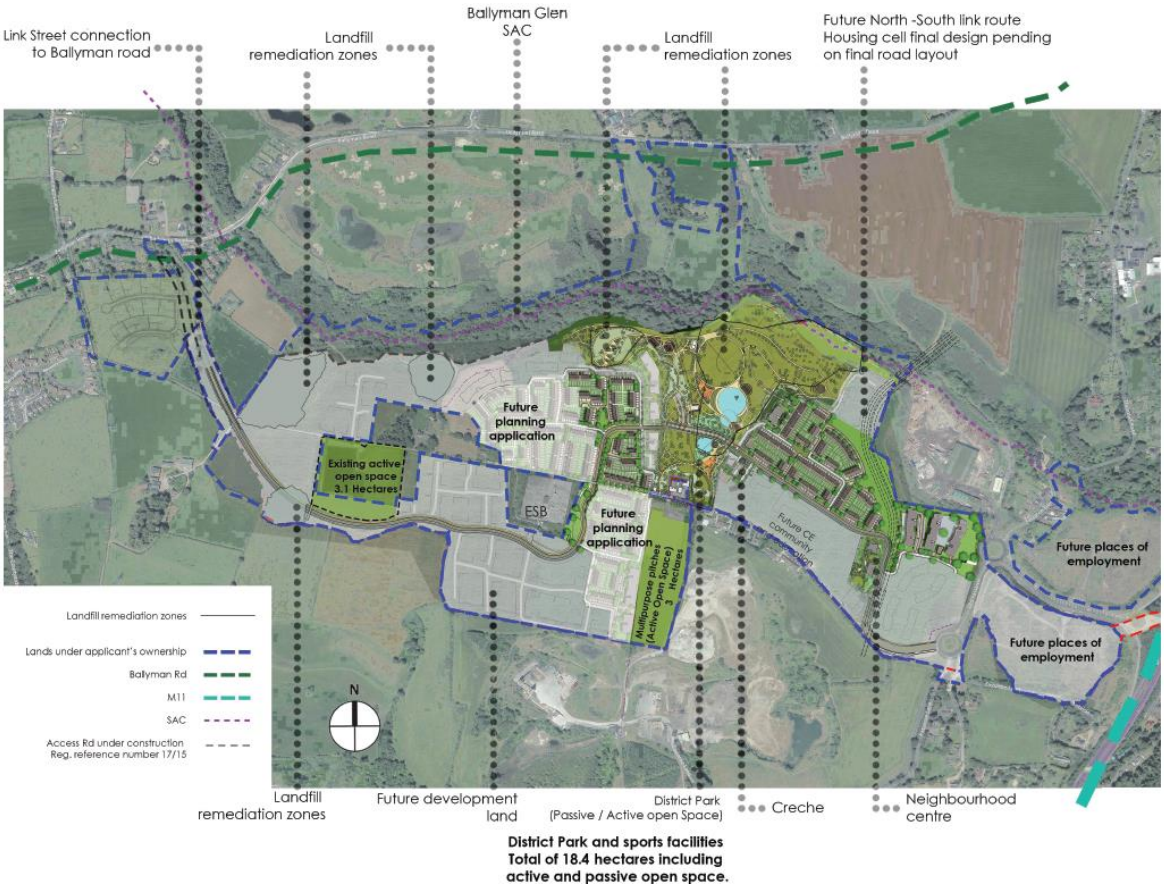
Parameter	Value/Requirement
Minimum depth	1.2m cover under highways 0.9m elsewhere*
Maximum depth	5.0m
Minimum sewer size for main drainage	225mm
Co-efficient runoff factors for pipe sizing and storage requirements as set out in the CIRIA report C753 The SuDS Manual-v6. (It is noted that similar values have been used with similar scaled developments within WCC and adjacent Local authorities).	100% - Roads / Cycle tracks / Footpaths / Roofs (when discharging directly to storm drainage network) 75% - Roads / Cycle tracks / Footpaths / Roofs when discharging directly swales, tree pits and filter drains 60% - Roads / Cycle tracks / Footpaths / Roofs when discharging directly to permeable paving 85% - Extensive Green Roof (> 150mm thk.) 70% - Intensive Green Courtyard (landscape courtyard areas with soil > 500mm thk.) 65% - Areas outside of the Phase 1 application to allow for sufficient pipe sizing and attenuation for future phases that will drain into the Phase 1 storm drainage network.
Max. velocity at pipe full	3.0 m/s
Min. velocity in	0.75 m/s (1.0 m/s used where achievable)
Roughness	0.6mm
Agreed maximum discharge rate	Qbar 3.5l/s/ha
Level of Service Critical Storm 1 in 2 yr return period	No surcharge within the pipe network, no flooding
Level of Service Critical Storm 1 in 30 yr return period	Surcharge allowed, no flooding
Level of Service Critical Storm 1 in 100 yr return period	No flooding unless planned and contained on site.

**Without recourse to concrete. Absolute minimum cover in roads is 0.9m. Pipes with cover between 0.9m and 1.2m shall be bedded and surrounded in concrete, 150mm thick, Class E, in accordance with Clause 1502 of the Specification for Roadworks.*

"Micro Drainage", which is an industry standard software for the design and assessment of gravity sewer drainage networks, has been used to simulate the proposed storm drainage network including flow controls and attenuation requirements. Outputs from the model for the proposed storm network are contained in Appendix H of this report.

It is noted that the proposed storm drainage network has been sized to allow for the future phases of the Fassaroe masterplan area within the control of Cosgrave Property Group.

Figure 2-4 – Fassaroe Masterplan area within the control of Cosgrave Property Group



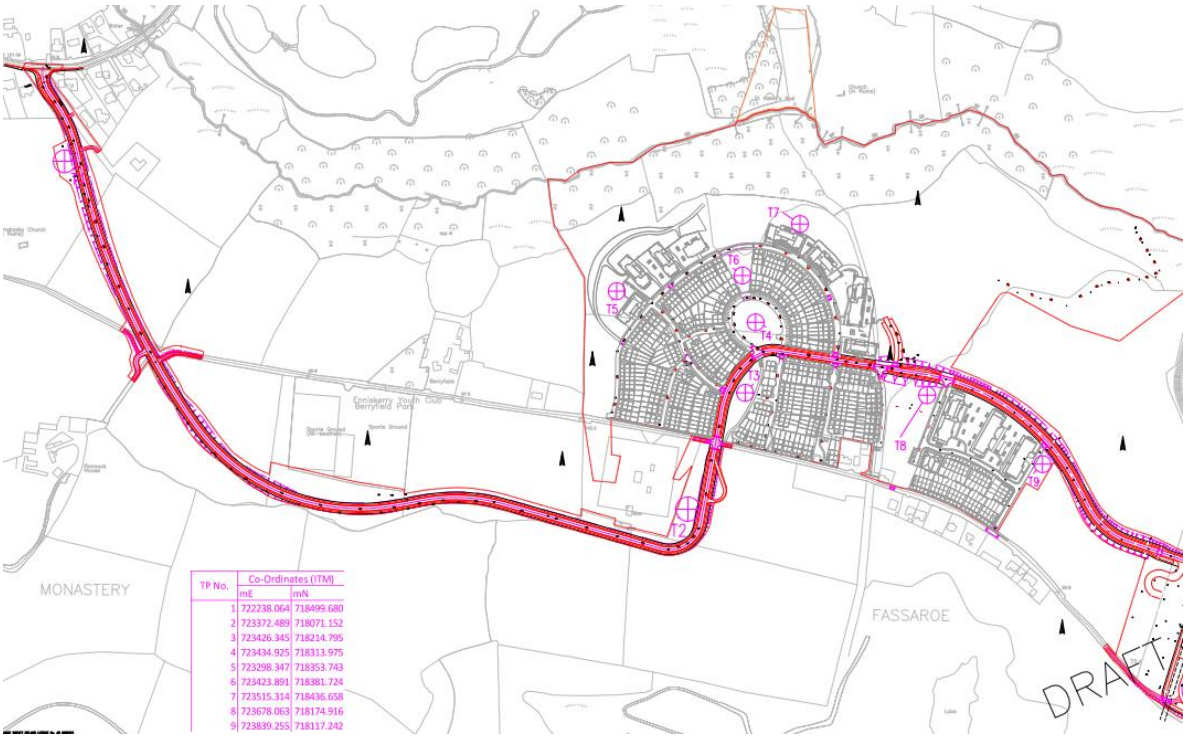
3. Site Investigations

Site Investigations were carried out by LOH Consulting in August 2016, refer to Appendix B of this report for further details.

The purpose of the site investigation was to determine the subsurface Soil Infiltration rates, the report also provides information on ground water levels, depth to bedrock and soil types. 9No. trial holes were excavated on the site and a soakaway tests were carried out as outlined in BRE Digest 365 Soak Away Design.

The findings of the report note that the main geological feature of this area is the presence of Ordovician Metasediments (OM); Soil Classification (BminSW); Tills derived chiefly from Limestone sands and gravels; Carboniferous. Bedrock mainly Deep Marine Slate, Schist and Minor Greywacke. From this information we can conclude that the main constituent of the subsoil is a Limestone sand & gravel till. The Aquifer in this area is classified as Locally important (Lg & Ll), bedrock which is moderately productive. The Vulnerability Rating is High for wastewater treatment systems; there is a low risk of contamination of the ground water from discharge from a Surface Water Soakaway. It is noted that no wastewater (foul) treatment systems are proposed within the development. The proposed foul water network will discharge into the existing Irish Water Network East of the N11 with falls by Gravity to the Bray Pumping Station.

Figure 3-1 - SI Testing Locations



**Note that layout indicated was a draft layout at time of site investigations being carried out. Locations of the site investigations including overall depths and existing ground water levels are indicated on Atkins Storm drainage drawings 5186693_HTR_01_DR_0501-0515.*

A review of the 9No. trial holes have indicated that no bedrock or groundwater was encountered to a depth of 2.4m. The location of trial pits, ground levels and ground water levels are indicated on the storm water layout drawings 5186693_HTR_01_DR_0501-0515.

Based on the information contained within the LOH report, there will be no perceptible impacts from existing groundwater levels on the proposed SuDS throughout the site.

The results of T1, T5, T6, T7 & T8 show that the soil will allow some level of infiltration due to the presence of the GRAVEL layer. The results of T2, T3, T4 & T9 show poor infiltration rates, GRAVEL was not encountered in these trial holes.

4. Existing Site Hydrology

There are several key hydrological features within the vicinity of the proposed development, refer to Figure 4-1 below. The Hydrological features include;

- The Dargle River (east of the N11) which flows in an easterly direction prior to discharging to the Dargle Estuary in Bray, which leads to the Irish Sea
- The County Brook which flows in a steeply sided valley along the northern boundary of the proposed development and discharges into the Dargle River
- The Glencullen River located to the south of the development and flows in an easterly direction also discharging into the Dargle River

Figure 4-1 - Site Hydrology Overview

5. Soil Type Classification

To determine the allowable Qbar discharge rate from the proposed development site and following a review of the site investigations as outlined in section 3 Site Investigations of this report, a SOIL type value of 3 has been determined.

6. Surface Water Storage Requirements

The www.uksuds.com surface water storage volume estimation tool was used to determine the maximum Qbar discharge rate from the site for a 1 in 100-year storm event. Site specific data was confirmed using Met Eireann rainfall data as indicated below;

Figure 6-1 – Met Eireann Rainfall Data

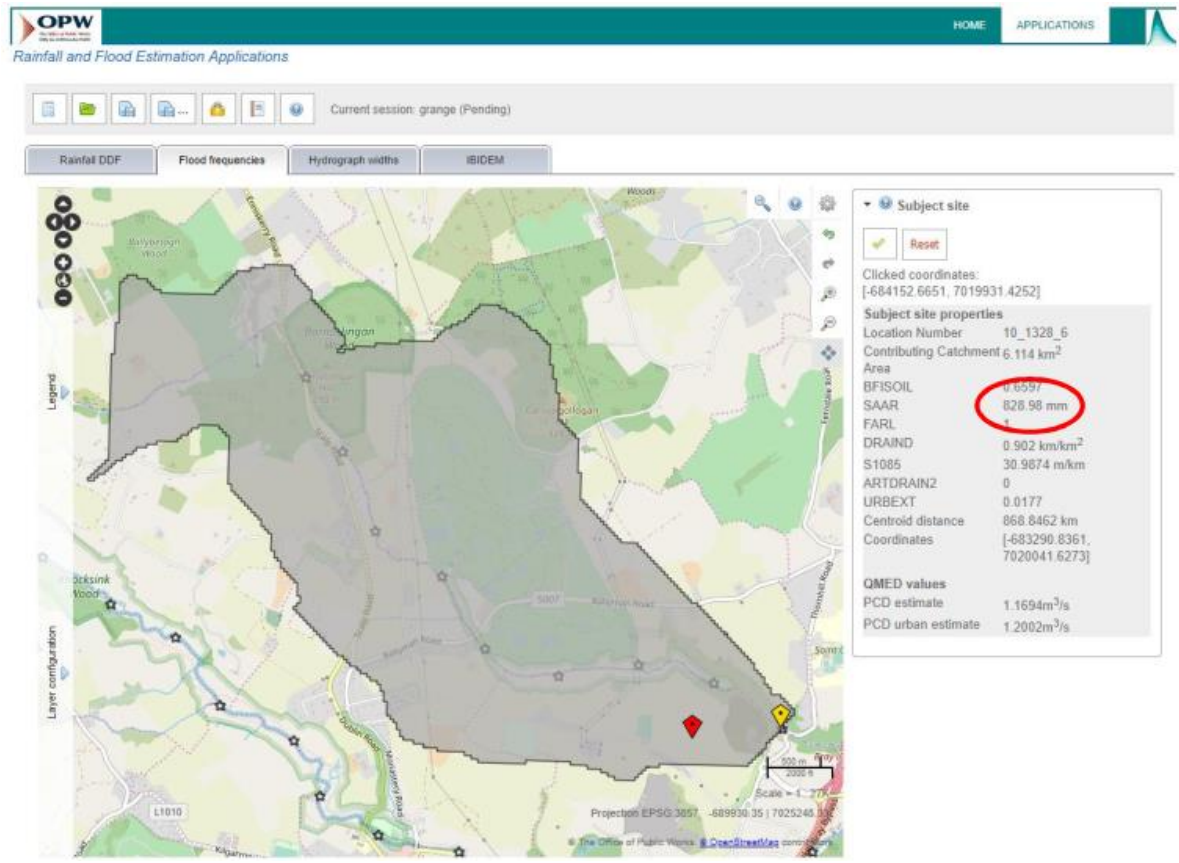
Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 326619, Northing: 219487,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.8,	3.9,	4.4,	5.3,	5.9,	6.3,	7.7,	9.3,	10.4,	11.8,	13.1,	14.1,	15.6,	16.8,	17.8,	N/A ,
10 mins	3.9,	5.4,	6.2,	7.4,	8.2,	8.8,	10.8,	13.0,	14.4,	16.5,	18.3,	19.6,	21.8,	23.4,	24.8,	N/A ,
15 mins	4.6,	6.4,	7.3,	8.7,	9.6,	10.3,	12.7,	15.3,	17.0,	19.4,	21.5,	23.1,	25.6,	27.5,	29.1,	N/A ,
30 mins	6.1,	8.3,	9.5,	11.2,	12.3,	13.2,	16.0,	19.2,	21.3,	24.1,	26.6,	28.6,	31.5,	33.8,	35.7,	N/A ,
1 hours	8.0,	10.8,	12.3,	14.4,	15.8,	16.9,	20.3,	24.2,	26.6,	30.0,	33.0,	35.3,	38.8,	41.5,	43.7,	N/A ,
2 hours	10.6,	14.1,	15.9,	18.5,	20.3,	21.6,	25.8,	30.4,	33.3,	37.4,	41.0,	43.7,	47.8,	50.9,	53.5,	N/A ,
3 hours	12.5,	16.5,	18.5,	21.5,	23.4,	24.9,	29.6,	34.7,	38.0,	42.5,	46.5,	49.4,	53.9,	57.4,	60.2,	N/A ,
4 hours	14.1,	18.4,	20.6,	23.9,	26.0,	27.6,	32.7,	38.2,	41.7,	46.6,	50.8,	54.0,	58.8,	62.5,	65.5,	N/A ,
6 hours	16.5,	21.5,	24.0,	27.7,	30.0,	31.8,	37.5,	43.7,	47.6,	53.0,	57.6,	61.1,	66.4,	70.4,	73.7,	N/A ,
9 hours	19.5,	25.1,	28.0,	32.1,	34.7,	36.8,	43.1,	50.0,	54.3,	60.2,	65.3,	69.2,	75.0,	79.4,	83.0,	N/A ,
12 hours	21.9,	28.0,	31.1,	35.6,	38.5,	40.7,	47.6,	55.0,	59.6,	66.0,	71.4,	75.6,	81.8,	86.4,	90.3,	N/A ,
18 hours	25.8,	32.8,	36.3,	41.3,	44.5,	47.0,	54.7,	62.8,	68.0,	75.0,	81.0,	85.5,	92.3,	97.5,	101.6,	N/A ,
24 hours	28.9,	36.6,	40.4,	45.8,	49.4,	52.0,	60.3,	69.1,	74.7,	82.2,	88.6,	93.4,	100.7,	106.1,	110.5,	125.5,
2 days	36.5,	45.4,	49.7,	55.9,	59.8,	62.8,	72.0,	81.6,	87.6,	95.7,	102.6,	107.8,	115.5,	121.2,	125.9,	141.5,
3 days	42.7,	52.5,	57.3,	64.0,	68.3,	71.5,	81.4,	91.7,	98.2,	106.8,	114.1,	119.5,	127.6,	133.7,	138.5,	154.9,
4 days	48.1,	58.7,	63.8,	71.0,	75.6,	79.1,	89.6,	100.6,	107.3,	116.4,	124.0,	129.7,	138.2,	144.5,	149.6,	166.5,
6 days	57.7,	69.6,	75.4,	83.4,	88.5,	92.3,	103.9,	115.9,	123.3,	133.1,	141.3,	147.5,	156.6,	163.3,	168.8,	186.8,
8 days	66.1,	79.2,	85.5,	94.3,	99.8,	103.9,	116.4,	129.3,	137.2,	147.6,	156.4,	162.9,	172.6,	179.7,	185.5,	204.4,
10 days	74.0,	88.1,	94.8,	104.2,	110.1,	114.5,	127.8,	141.4,	149.8,	160.8,	170.1,	176.9,	187.0,	194.5,	200.5,	220.4,
12 days	81.3,	96.3,	103.5,	113.4,	119.7,	124.3,	138.4,	152.7,	161.5,	173.0,	182.7,	189.9,	200.4,	208.2,	214.5,	235.1,
16 days	94.9,	111.6,	119.6,	130.5,	137.4,	142.4,	157.8,	173.4,	182.9,	195.4,	205.8,	213.5,	224.8,	233.2,	239.9,	261.9,
20 days	107.5,	125.8,	134.4,	146.2,	153.6,	159.1,	175.6,	192.3,	202.4,	215.8,	226.9,	235.1,	247.0,	255.9,	263.0,	286.2,
25 days	122.4,	142.3,	151.7,	164.6,	172.6,	178.5,	196.3,	214.2,	225.1,	239.3,	251.2,	259.9,	272.6,	282.0,	289.5,	314.1,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

A SAAR Value of 829mm was utilised to calculate the green field runoff rate as confirmed by WCC, see Figure 6-2 below.

Figure 6-2 – Extract from OPW Rainfall and Flood Estimation Tool



Refer to for the output from the www.uksuds.com surface water storage volume estimation tool and maximum Qbar discharge rate.

A summary of the calculations is outlined in Table 6-1 below.

As indicated above in Figure 2-3 - Drainage Catchment Areas, the overall drainage catchment areas have been divided into 6 catchments for phase 1 and future phases that drain into phase 1 network.

Total drained area is based on the Area size with large open spaces removed including rear gardens.

Table 6-1 - Qbar Calculation Summary

Catchment Area	Soil Type	Area Size (ha)	Total Drained Area (ha)	Resulting Qbar (l/s)
A	3	18.14	13.38	63.5
B	3	3.84	1.453	13.45
C	3	27.62	13.50	96.67
D	Future Phase (does not drain into current Phase 1 Network)			
E	3	0.782	0.782	Outfall to Soakaway
F	3	0.274	0.274	Outfall to existing pipe and flow control granted under planning WCC planning ref; 1715

7. Proposed Site Characteristics

The total Site Impermeable Areas and reduced Impermeable Areas based on coefficient runoff factors are indicated below in **Table 7-1**.

Table 7-1 – Site Impermeable Areas

	Total Impermeable Area	Impermeable Area based on co-efficient runoff factors (Table 2-1)
Roads / Cycle tracks / Footpaths / Roofs (when discharging directly to storm drainage network)	8.63 ha	8.63 ha
Roads / Cycle tracks / Footpaths / Roofs when discharging directly swales, tree pits and filter drains	2.24 ha	1.68 ha
Roads / Cycle tracks / Footpaths / Roofs when discharging directly to permeable paving	4.88 ha	2.93 ha
Extensive Green Roof (> 150mm thk.)	0.99 ha	0.84 ha
Intensive Green Courtyard (landscape courtyard areas with soil > 500mm thk.)	0.49 ha	0.34 ha
Phase 1 Total	**17.23 ha**	**14.42 ha**
Allowance made for future phases that will drain into the Phase 1 storm drainage network.	13.36 ha	8.68 ha
Gross Total	**30.59 ha**	**23.10 ha**

A controlled discharge will be via a vortex flow control device downstream of the attenuation systems. Each flow control device has been designed based on the maximum head of water within the attenuation system. The design head has been calculated for each catchment to ensure the flows rates indicated in Table 6-1 are not exceeded for the 1 in 100-year 6-hour storm event. It is noted that penstock will be installed within the hydro break chambers to allow maintenance when required.

Additional attenuation systems within the catchment areas have been included within the design to allow for management of surface water runoff at source, these additional tanks are indicated on the planning drawings 5186693_HTR_01_DR_0501-0515. The flow control downstream of these attenuation system allow for surface water runoff to be management locally within an area available and no impact on the overall final discharge rate from the site.

A catch pit manhole will be provided at all inlets to the attenuation systems to reduce the levels of silts entering the system. Forebays have also been provided prior to permanent ponds to provide additional treatment of surface water.

Where swales are provided, they are used for the conveyance of surface water runoff from the adjoining hard standing areas. Discharge into the swale will be via drop kerbs / side inlet gullies. Discharge from the swales to the storm water network will be via a perforated manhole cover. The manhole cover has been designed to be 50mm above the base on the swale to provide for interception volumes as indicated in Table 7-2

Porous paving provided will cater for runoff from the porous paving surface, adjacent roads / footpaths and roof runoff from the front of suitable residential units. The subbase below the porous paving will allow for infiltration, reduced peak flows and will have a minimum of 30% void ratio within the subbase. An orifice plate will be provided were suitable at the outfall chamber from each porous paving area to reduce the flow and increase the overall storage capacity of the subbase.

Filter Drains with a perforated pipe will be provided in private rear gardens to drain storm water from roof runoff from the rear of the proposed associated dwellings.

Tree pits will be used at locations as indicated. Runoff from adjacent roads / footpaths and excess runoff from adjoining impermeable surface will discharge into the pit via a dropped kerb. The tree pit will allow for interception and percolation to ground. An overflow pipe with a raised level of 50mm above the finished surface level will allow for overflow into the storm drainage network during high intensity rainfall events.

Extensive green roofs and Intensive green courtyards will be provided to suitable apartment blocks and retail units. A run-off factor of 85% for extensive and 70% for intensive has been used within the calculations.

It is noted that given the extents of SuDS provided within the proposed site as outlined above, sufficient treatment will be provided to prevent any impact on water quality of the receiving waters from the proposed development, petrol interceptor is not deemed necessary.

7.1. Compliance with GDSDS Design Criteria

Outfall Section 6.3.4 of the GDSDS Volume 2 New Development sets out four design criterion which are required to be met by the proposed drainage system. Compliance with these criteria are outlined below:

7.1.1. Interception Volume – Criterion 1.1

Interception storage volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 5mm of rainfall.

As set out in Table 24.6 - Interception Mechanisms of the CIRIA report C753 The SuDS Manual-v6, hard standing areas discharging into SuDS area deemed to be compliant for interception. As a result, the impermeable areas draining to these SuDS features can be subtracted from the total hardstanding area when calculating the interception volume requirement. The new hardstanding areas requiring interception storage for all phase 1 catchments is as described in Table 7-2 below.

7.1.1.1. Phase 1 Catchments

Table 7-2 – Total Hardstanding Area Requiring Interception Storage (Phase 1 only)

		Total Paved Site
Total Hardstanding Area		**16.83 ha**
Impermeable Areas deemed to be compliant as per Table 24.6 of the SuDS Manual	Extensive Green Roof (> 150mm thk.)	0.99ha
	Intensive Green Courtyard (landscape courtyard areas with soil > 500mm thk.)	0.49ha
	Total Hard standing area discharging to SuDS (tree pits, permeable paving, filter drains, tree pits)	6.72ha
Total Area deemed to be compliant		**8.20ha**
Total Remaining Hardstanding Area requiring interception storage		**16.83 – 8.20 = 8.63ha**

Table 7-3 – Interception Storage Volume Requirement

	Total
Total Hardstanding Area Not Discharging to SuDS Features	8.63ha
Volume of Interception Required	86300m^2 x 0.005m x 0.8 = 346m^3

Table 7-4 – Interception Volume Provided

SuDS	Volume
Underground modular attenuation system	Total Area of Tanks A, B, C = 1575m^2 0.25m (Depth of stone base) x 1575m^2 = 394m^3 394 x 30% Voids = 118m^3
Swales	340m (l) x 1m (w) x 0.05 (d) = 17 m^3
Filter drains (rear gardens)	1357m (l) x 0.5m (w) x 0.05 (d) = 34 m^3 34 x 30% Voids = 10.2 m^3
Forebay prior to Ponds 1, 2, and 3	Total Area = 1415 m^2 1415 x 0.15 (d) = 212m^3
Road Soakaway	75 (L) x 20 (w) x 1 (d) = 1500m^3 1500 x 30% Voids = 450 m^3
Total	807.2m^3 provided > 346m^3 required (OK)

Interception Volume for Phase 1 has been provided using a series of SuDS. The overall volume being provide is 807.2m^3 which exceeds the minimum required interception volume of 346m^3. Interception volume has been provided on the proposed site using the SuDS features noted below.

- Stone Based within the underground modular attenuation systems
- Conveyance Swales with raised outfall levels
- Filter Drains in rear gardens with outfall pipe higher than the base of the filter drain
- Forebay prior to Ponds 1, 2, and 3
- Road Soakaway

It is noted that additional Interception volume is also provided within the following SuDS features;

- Permeable pavement to parking bays
- Tree pits

7.1.2. Treatment Volume – Criterion 1.2

Treatment volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 15mm of rainfall.

Table 7-5 – Treatment Volume

	Total Paved Site
Paved surfaces (roads, footpaths, permeable paving & roof areas)	8.63ha
Volume of Treatment Storage Required	86300m2 x 0.015 x 0.8 = 1036m^3

Due to site constraints including demand for public open space requirements including play areas, playing pitches etc and planning density requirements there is insufficient area on site to provide the Treatment Volume (retention pond / wetland has not been provided). While it is noted that some treatment volume will be provided within the proposed Forebays prior to Ponds 1, 2, and 3 and also within the ponds were permanent water level is lower than the outfall pipe during certain times of the year. It is considered that the total volume of 1036m^3 could not be accommodated and therefore Criterion 1.2 cannot be successfully met for this site.

In accordance with Table 6.3 of the Regional Drainage Policies – Volume 2 New Development, as Criterion 1.1 is being fully achieved, Criterion 1.2 is therefore not required.

7.1.3. River Regime Protection – Criterion 2

River Regime Protection by limiting discharge to receiving waters

An allowable outflow rate for Qbar of 3.5l/s/ha has been calculated for the site and agreed at preplanning stage with WCC / Bray Town Council.

The overall Phase 1 site attenuation volume is > 6233 m^3 as outlined in the table below. The attenuation volumes provided also allow for part of the future phases that will discharge into the phase 1 storm drainage network and therefore the total attenuation volume available will not be used until future phases are constructed under a separate planning application. As the attenuation volume will not be used and design head within the flow control devices will not be reached, the allowable maximum discharge will remain lower than the allowable rate until future phases are constructed.

Table 7-6 – Phase 1 Attenuation Tanks / Ponds

Attenuation System	Volume Available
Pond 1	1875m^3
Pond 2	673m^3
Pond 3	726m^3
Pond 4	2445m^3
Tank A	620m^3
Tank B	100m^3
Tank C	400m^3
Total	**6,839m^3**

It is noted that additional Attenuation storage volume is also provided within the SuDS features throughout the site. These additional volumes are not indicated in the table above.

7.1.4. Levels of Service – Criterion 3

The four criteria for levels of service are as follows:

- Criterion 3.1: No external flooding (30 year high intensity rainfall event)
- Criterion 3.2: No internal flooding (100 year high intensity rainfall event)
- Criterion 3.3: No internal flooding (100 year river event and critical duration for site storage)
- Criterion 3.4: No flood routing off site except where specifically planned (100 year high intensity rainfall event)

Criteria 3.1, 3.2, 3.3 & 3.4: All potential flooding has been reviewed and modelled using micro drainage for up to the required 1 in 100 year storm event including 20% for climate change. Outputs from the model for the proposed storm network are contained in Appendix H of this report.

7.1.5. River Flood Protection – Criterion 4

Of the three methods referred to in the GDSDS for establishing River Flood Protection, by comparison of the pre and post development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 has been selected most suitable for use on this proposed site. An extract from the GDSDS for Criterion 4 is indicated in Figure 7-1 below.

Figure 7-1 - GDSDS River Flood Protection

Criterion 4 River flood protection (Criterion 4.1, or 4.2 or 4.3 to be applied)	4.1	100	"Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.
	4.2	100	Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100year, 6-hour duration storm to be used for assessment of the
	4.3	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.

Criterion 4.3 has been satisfied for the proposed site by providing an agreed Maximum discharge rate of Qbar (3.5l/s/ha) and on-site attenuation for up to the 1 in 100 year 6 hour storm event including 20% for climate change.

8. Flooding

8.1. Flood Risk Assessment

A Flood Risk Assessment (FRA) Atkins Document No. 51866993DG0062 has been undertaken for the site to satisfy the requirements of the Planning System and Flood Risk Management Guidelines. The report aimed at scoping sources of flooding, assessing whether any significant flood risk issues exist and proposing appropriate flood risk management measures as required.

The Stage 1 Flood Risk has concluded the following;

- There is no historic risk of flooding within the development site.
- The OPW CFRAM flood extent maps studies have not been carried out in the area of the site and therefore do not show any flood risk at the site.
- The NIFM illustrates that fluvial flooding for the 1 in 100 year event from the County Brook is contained within the steep valley of the watercourse beyond the northern boundary of the site.
- On the basis of the NIFM and the topographical surveys undertaken, the site is considered to be located within Zone C, low probability of flooding.
- Given that the proposed development site is located in Zone C, low probability of flooding, is thus appropriate from a flood risk perspective subject to the completion of this FRA which considers other sources of flood hazard than river flooding and subject to it meeting the normal range of proper planning and sustainable development requirements.
- Given that the proposed development is located in Zone C and is appropriate development, consideration of the Justification Test is not required.
- The proposed development is not at risk of flooding from the 1% AEP event.

9. SuDS Maintenance

Regular checks and maintenance of the SuDS systems is required and have been considered as part of the overall drainage design for the proposed development. This will ensure both the design life of the SuDS systems, ongoing improved water quality, reduced water runoff and reduce the risk of onsite flooding.

9.1. Permeable Paving

Paving should be inspected regularly, preferable during and after heavy rainfall to ensure effective operation.

Vacuum brushing or jetting of the permeable paving should be carried out once a year. Cleaning is generally carried out after Autumn leaf fall to remove silts and sediments.

9.2. Green Roofs / Green Courtyards

All components (soil substrate, vegetation, drains, membranes and rood structure) should be inspected annually and after severe storms.

Underside of roof should also be inspected annually and after severe storms for evidence of leakage.

Debris, fallen leaves and litter should be regularly removed to prevent clogging of inlet drains.

9.3. Underground modular attenuation system / Soakaway

Inspection of the system should be carried out monthly for the first 3 months and then annually to ensure the system is working correctly.

Debris should be removed monthly from the catchment surface where is may cause risk to the performance of the underground attenuation system

As required sediment from pre-treatment (catch pit) manholes prior to the attenuation system should be removed to ensure on going performance of the system.

The inside of the tank should be surveyed every 5 years or as required if performance is reduced. Sediment build up removed if necessary.

9.4. Tree Pits

Maintenance of trees will be greatest in the first few years, which will include regular inspection of tree condition including inlets and outlets, removal of invasive vegetation and possibly irrigation during long dry periods.

9.5. Swales

Mowing in the first year is critical to eliminate competition from weeds. Lawn-mowing to an ideal height of 100mm should be maintained as grasses tend to flatten down when water is flowing over them, reducing sedimentation. Maintenance of the swale should include:

- Periodic litter removal with the swale and self-clearing inlet grid.
- Occasional stabilisation of eroded side slopes and base.
- Check and Removal of Sediment build up.
- Ongoing maintenance should form part of the site landscaping proposals.

9.6. Filter Drains

Inspection of the system should be carried out monthly on the inlet / outlet pipework and any control systems for blockages.

Inspection of pre-treatment systems including should be carried out every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build-ups. Removal of silt build-up may be required more frequent.

Annual cleaning of roof runoff gutters etc should be part of the generally maintenance of the drainage system to ensure debris is removed prior to entering the network.

Perforated pipework should be cleared of blockage if required.

9.7. Ponds

Maintenance of the proposed Ponds and attenuation volumes within the public area should be carried out in accordance with the landscape maintenance plan and include;

- Periodic litter removal with the swale and self-clearing inlet grid.
- Occasional review and stabilisation of eroded side slopes and base.
- Check and Removal of Sediment build up.
- Ongoing maintenance should form part of the site landscaping proposals.

Appendices

Appendix A. Site Characterisation Report

Technical note

Project:	Fassaroe Development	**To:**	Wicklow County Council
Subject:	SuDS Site Characterisation	**From:**	Garry Hanratty
Date:	1 Aug 2019	**cc:**	Ailis Corrigan

The following table below outlines the Site Characteristics as set out in the CIRIA report C753 'The SuDS Manual V6 part C relating to the surface water management plans (SWMP).

Site Characterisation

Site topography	The site area is predominantly a steep sloping site, falling from a high point in Drainage Zone C in a north easterly direction to the south west.
Existing flow routes and discharge points	The existing flow routes for the site are predominantly in a north easterly direction with a small portion draining to the south west. The majority of the site discharges into the County Brook (EPA code 10C06) to the north with proposed drainage Zone F discharging to the Dargle Rvier (EPA code 10D01) to theSouth. An existing public storm drain is located to the East lower end of the site. The existing storm drain goes under the M11 prior to discharge into the Dargle River.
Existing Soils and Potential for Infiltration	A review of the SI information for the site indicates that the ground is predominantly sandy gravelly CLAY. Based on these findings CIRIA report C753 indicates a moderate runoff potential (soil type 3). Therefore, the soil type has is a poor infiltration media. The design of infiltration systems on this site is not recommended. Greenfield runoff rates are too be agreed with Wicklow County Council as outlined further in this report.
Potential for surface water discharge	It is assumed that the proposed surface water will discharge into the existing local water courses to mimic where possible to current surface water flow as is best practice. Surface water flow from the lower eastern end of the site will discharge into the existing public storm drain.
Site Flood Risks	An initial review of the OPW www.floodinfo.ie does not indicate existing flooding within the vicinity of the proposed site. A review of the existing CFRAM maps indicate that the project does not extend as far as the proposed site. The Wicklow SFRA – County Development Plan 2016 – 2022 indicates flooding to the North and South of the proposed site (not within the site extents) within both the Glencullen and Dargle river. A Flood Risk Assessment (FRA) is to be carried in accordance with the Flood risk assessment will encompass all Stages of assessment, from 1 to 3, as set out in the OPW "The Planning system and Flood risk management - Guidelines for Planning Authorities" November 2009.
Existing site land use	The site is predominantly existing green field land with a number of private single dwellings. A large recycling centre is located to the East of the proposed site.
Existing site infrastructure	A full review of existing site infrastructure will be carried out during the project. This will include all services and utilities A number of ESB HV overhead line are located within the site. Irish Water (IW) potable water supply infrastructure is also located within the site and require further consideration and discussions with IW Further consideration to all existing infrastructure will be taken into account during the planning design

Technical note

The site drainage will be designed in compliance with GDSDS Design Criteria and SuDS design criteria in accordance with CIRIA report C753

Interception Volume – Criterion 1.1

Interception storage volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 5mm of rainfall.

Treatment Volume – Criterion 1.2

Interception storage volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 15mm of rainfall.

River Regime Protection – Criterion 2

Allowable outflow rate for Qbar to be agreed with DLRCC drainage department.

Levels of Service – Criterion 3

There are four criteria for levels of service. These are:

Criterion 3.1: No external flooding (30-year high intensity rainfall event)

Criterion 3.2: No internal flooding. (100-year high intensity rainfall event).

Criterion 3.3: No internal flooding. (100-year river event and critical duration for site storage)

Criterion 3.4: No flood routing off site except where specifically planned. (100-year high intensity rainfall event)

River Flood Protection – Criterion 4

Of the three methods referred to in the GDSDS for establishing River Flood Protection, by comparison of the pre and post development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 has been selected most suitable for use on this proposed site. An extract from the GDSDS, section E2.4 details the long-term formula for which Qbar Rural is applicable:

$$Vol_{xs} = RD.A.10\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta SOIL) - SOIL\right]$$

where:

Vol_{XS}	is the extra runoff volume (m^3) of development runoff over Greenfield runoff
RD	is the rainfall depth for the 100 year, 6-hour event (mm)
PIMP	is the impermeable area as a percentage of the total area (values from 0 to100)
A	is the area of the site (ha)
SOIL	is the "SPR" index from FSR
$\alpha 0.8$	is the proportion of paved area draining to the network or directly to the river (values from 0 to1) with 80 percent runoff
β	is the proportion of pervious area draining to the network or directly to the river (values from 0 to1)

Technical note

Site SuDS design (sample to be confirmed at project stage)

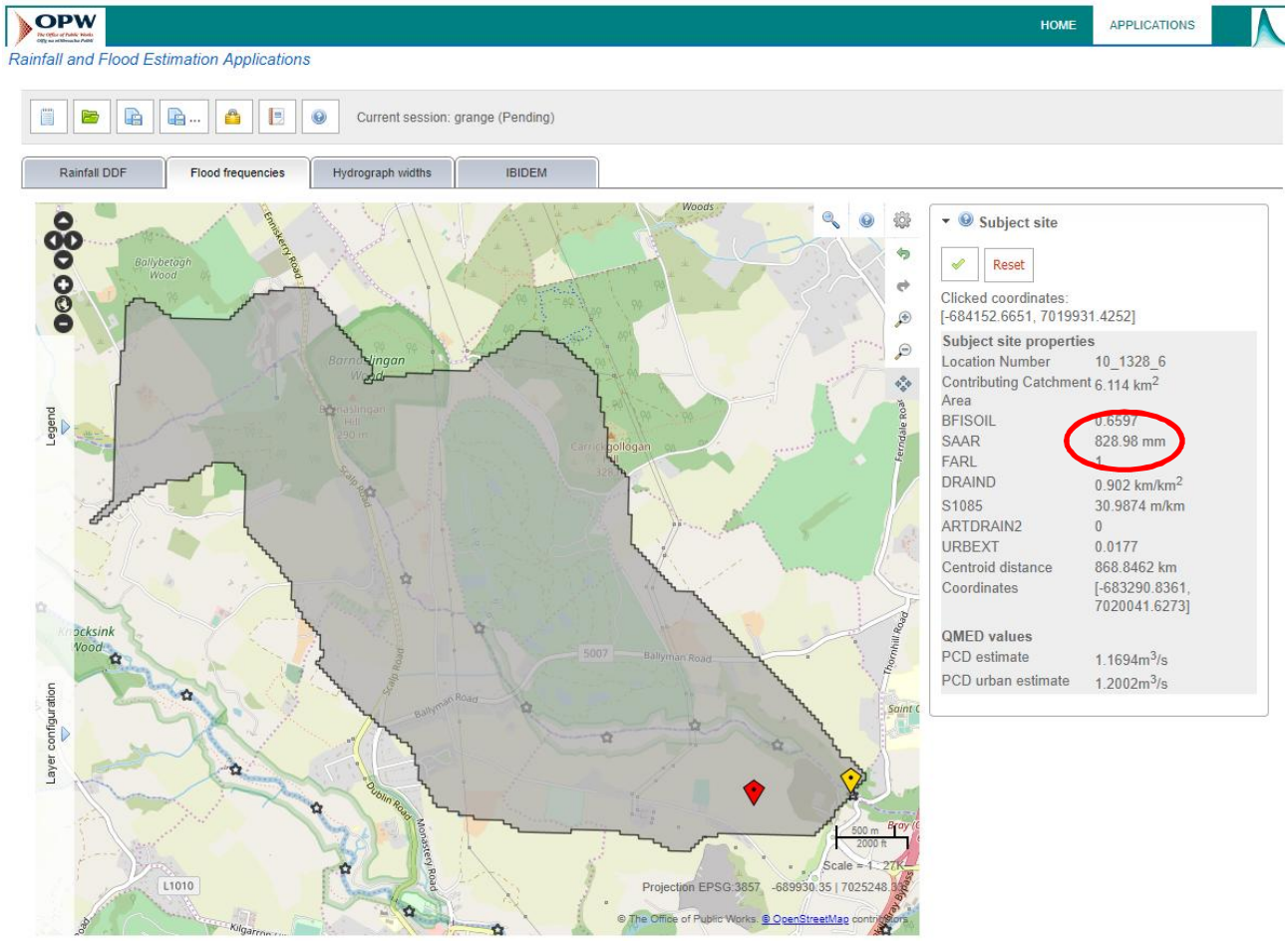
Water quantity	1. Use Tree pits where suitable 2. Lateral inflows from roads and parking areas to drain to swales. 3. Use of perforated pipe under light vehicle parking areas to encourage infiltration. 4. Control Peak runoff rates from the site for the critical 1 in 100-year storm events including 10% for climate change in accordance with the GDSDS by using sub-catchments. 5. Control runoff volumes from the site for an appropriate 1 in 100-year events using long-term storage where suitable. 6. Control peak run off rates from the site for the critical 1 in 1 year by use of infiltration, dry detention basins and ponds prior to discharge to local water course.
Water quality	1. Use of perforated pipe under light vehicle parking areas to encourage infiltration. 2. Catch pits to be provided prior to discharge into attenuation systems. 3. Provide treatment of surface water runoff using swales and bio-retention areas where suitable
Amenity	1. Water features such as swales and detention basins to be kept shallow to allow for ease of maintenance. 2. Keep water at surface level where practical. 3. Water features to be within public open spaces where practical.

Technical note

Qbar discharge rates calculations

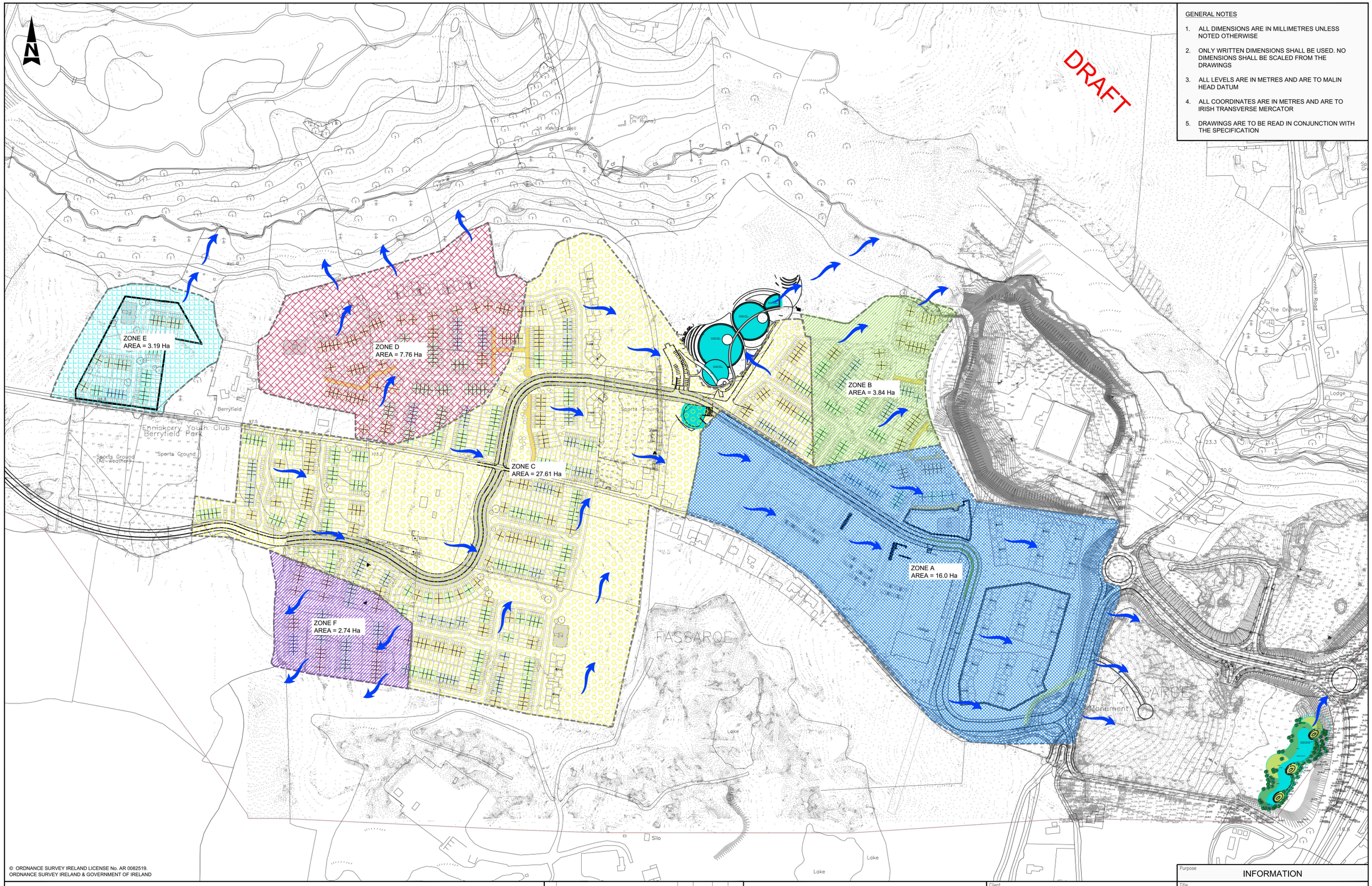
The following calculations for Qbar greenfield runoff have been carried out using www.uksuds.com. A number of edits have been carried out based on the Site Characterisation table including;

- Soil Type changed to Type 3 from the default Type 2 based on SI findings
- Hydrological characteristics SAAR values have been changed to 829mm from the default of 1041mm. SAAR values are based on OPW data as indicated below



Drainage Zone – Maximum Greenfield runoff rates (Qbar)

Drainage Zone	Area (ha)	Qbar Discharge rate (l/s)
A	16.0	56.02
B	3.84	13.45
C	27.61	96.67
D	7.76	27.17
E	3.19	11.17
F	2.74	8.65



GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

NOTES:

1. THE SURFACE WATER DRAINAGE NETWORK IS TO BE DESIGNED AND CONSTRUCTED IN COMPLIANCE WITH THE 'REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS VERSION 6.0'
2. NO SURFACE WATER/RAINWATER TO DISCHARGE INTO THE FOUL SEWER SYSTEM UNDER ANY CIRCUMSTANCES.
3. ALL RWP, GULLY AND CHANNEL DRAIN CONNECTIONS TO THE MAIN SURFACE WATER DRAINAGE SYSTEM ARE TO BE ACHIEVED VIA DIRECT CONNECTION TO THE MANHOLE AT LEVELS SOFFITS OR VIA SADDLE CONNECTION TO THE STORM SEWER PIPE.
4. ALL GULLIES TO HAVE SEPARATE CONNECTIONS TO THE STORM DRAINAGE NETWORK.

Rev	Description	By	Date	Chk'd	Auth
-	FOR INFORMATION	PS	01.08.19	AC	GH

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Client: COSGRAVE PROPERTY GROUP

Project: FASSAROE DEVELOPMENT

Purpose: INFORMATION

Title: DRAIANGE CATCHMENTS

Original Scale	Design/Drawn	Checked	Authorised
AS SHOWN	PS	AC	GH
	Date 01.08.19	Date 01.08.19	Date 01.08.19

Status	Drawing Number	Rev
I	5186693_HTR_SK_0003	-

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Garry Hanratty
Site name:	Fassaroe Development
Site location:	Zone A

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.19692° N
Longitude:	6.14207° W

Reference:	
Date:	2019-08-01 15:41

Methodology	IH124

Site characteristics

Total site area (ha)	16

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	1041	829
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	46.39	56.02
1 in 1 year (l/s)	39.43	47.62
1 in 30 years (l/s)	98.81	119.33
1 in 100 years (l/s)	121.08	146.22

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Greenfield runoff estimation for sites

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Calculated by:	Garry Hanratty
Site name:	Fassaroe Development
Site location:	Zone B

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.19692° N
Longitude:	6.14207° W

Reference:	
Date:	2019-08-01 15:42

Methodology	IH124

Site characteristics

Total site area (ha)	3.84

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	1041	829
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	11.13	13.45
1 in 1 year (l/s)	9.46	11.43
1 in 30 years (l/s)	23.71	28.64
1 in 100 years (l/s)	29.06	35.09

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Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Garry Hanratty
Site name:	Fassaroe Development
Site location:	Zone C

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.19692° N
Longitude:	6.14207° W

Reference:	
Date:	2019-08-01 15:44

Methodology	IH124

Site characteristics

Total site area (ha)	27.61

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	1041	829
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	80.05	96.67
1 in 1 year (l/s)	68.04	82.17
1 in 30 years (l/s)	170.51	205.92
1 in 100 years (l/s)	208.94	252.32

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Garry Hanratty
Site name:	Fassaroe Development
Site location:	Zone D

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.19692° N
Longitude:	6.14207° W

Reference:	
Date:	2019-08-01 15:45

Methodology	IH124

Site characteristics

Total site area (ha)	7.76

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	1041	829
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	22.5	27.17
1 in 1 year (l/s)	19.12	23.1
1 in 30 years (l/s)	47.92	57.87
1 in 100 years (l/s)	58.72	70.92

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Garry Hanratty
Site name:	Fassaroe Development
Site location:	Zone E

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.19692° N
Longitude:	6.14207° W

Reference:	
Date:	2019-08-01 15:51

Methodology	IH124

Site characteristics

Total site area (ha)	3.19

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	1041	829
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	9.25	11.17
1 in 1 year (l/s)	7.86	9.49
1 in 30 years (l/s)	19.7	23.79
1 in 100 years (l/s)	24.14	29.15

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Garry Hanratty
Site name:	Fassaroe Development
Site location:	Zone F

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.19692° N
Longitude:	6.14207° W

Reference:	
Date:	2019-08-01 15:52

Methodology	IH124

Site characteristics

Total site area (ha)	2.47

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	3
HOST class	---	---
SPR/SPRHOST	0.3	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	1041	829
Hydrological region	12	12
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.13	2.13
Growth curve factor: 100 year	2.61	2.61

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	7.16	8.65
1 in 1 year (l/s)	6.09	7.35
1 in 30 years (l/s)	15.25	18.42
1 in 100 years (l/s)	18.69	22.57

Appendix B. Site Infiltration Report

Soil Infiltration Report

Client:

Cosgrave Property Group

Site Address:

Fassaroe,
Bray
Co. Wicklow.

Date of Report:

28th August 2016

Report produced by:

L O H Consulting Ltd
Ballinderrin,
Enfield,
Co. Meath.

Phone : 046 9549728
Mobile : (087) 6342494
E-mail : larryholton1@eircom.net

Introduction:

This report was commissioned to determine the Soil Infiltration rate for trial holes for Fassaroe Phase 1 Development.

9 trial holes were excavated on the site and a soak away tests was carried out as outlined in BRE Digest 365 Soak Away Design. The soil infiltration rate was determined by the method outlined in this document.

The main geological feature of this area is the presence of Ordovician Metasediments (OM) ; Soil Classification (BminSW) Tills derived chiefly from Limestone sands and gravels; Carboniferous. Bedrock mainly Deep Marine Slate, Schist and Minor Greywacke. From this information we can conclude that the main constituent of the subsoil is a Limestone sand & gravel till.

The Aquifer in this area is classified as Locally important (Lg & Ll), bedrock which is moderately productive. The Vulnerability Rating is High for wastewater treatment systems; there is a low risk of contamination of the ground water from discharge from a Surface Water Soak Away.

This report will present the results of the site soak away tests and provide the Soil Infiltration rate for the soil, and confirm if the storm water generated from the proposed development can be discharged to ground water through the proposed Soak Aways without causing ponding of the site.

Scope of Report:

The findings of this report are the result of a desk study and geological field interpretation. Interpretations and conclusions included in this report are based on knowledge of the ground conditions following limited investigation of the site, as well as the regional soils, subsoil and bedrock geology, and the experience of the author. Mr. Larry Holton has prepared this report in line with current best practice and with all reasonable skill, care and diligence in consideration of the limits imposed by the survey techniques used and the resources devoted to it by agreement with the client. The interpretative basis of the conclusions contained in this report should be taken into account in any future use of this report.

Trial Hole 1

Trial Hole 1 Log

(ITM Co-ordinates mE 722470.338, mN 718539.890)

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 12:40pm
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m					
0.4 m					
0.5 m					
0.6 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m	Sandy GRAVEL	Granular	Loose	Grey	Between grains
2.4 m	END of Trial Hole @ 2.4m				
2.5 m					

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2m X 1m at an IL of 0.9m below Ground Level.

1.5m X 2mX 1m, size of soak away tests hole

Trial Hole 2

Trial Hole 2 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 11:16am
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m					
0.4 m					
0.5 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.6 m					
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m					
1.3 m					
1.4 m					
1.5 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.6 m					
1.7 m					
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m				

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 1.8m X 1.250m at an IL of 0.9m below Ground Level.

1.5m X 1.8mX 1.250m, size of soak away tests hole

Trial Hole 3

Trial Hole 3 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 11:37am
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m					
0.4 m					
0.5 m					
0.6 m					
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m				

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.6m X 1.2m at an IL of 0.9m below Ground Level.

1.5m X 2.6mX 1.2m, size of soak away tests hole

Trial Hole 4

Trial Hole 4 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 9:15am
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m					
0.4 m					
0.5 m					
0.6 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m				

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.2m X 1.2m at an IL of 0.9m below Ground Level.

1.5m X 2.2mX 1.2m, size of soak away tests hole

Trial Hole 5

Trial Hole 5 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 10:11am
Depth from ground surface to bedrock (m) (if present):		> 2.4m (Not Encountered)			
Depth from ground surface to water table (m) (if present):		> 2.4m (Not Encountered)			

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m					
0.4 m					
0.5 m					
0.6 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m					
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.9 m					
2.0 m					
2.1 m					
2.2 m	Sandy GRAVEL	Granular	Loose	Grey	Between grains
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m				

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.6m X 1.2m at an IL of 0.9m below Ground Level.

1.5m X 2.6mX 1.2m, size of soak away tests hole

Trial Hole 6

Trial Hole 6 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 10:06am
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m	_____	_____	_____	_____	_____
0.4 m					
0.5 m					
0.6 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m	_____	_____	_____	_____	_____
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m	Sandy GRAVEL	Granular	Loose	Grey	Between grains
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m	_____	_____	_____	_____

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.2m X 1.2m at an IL of 0.9m below Ground Level.

1.5m X 2.2mX 1.2m, size of soak away tests hole.

Trial Hole 7

Trial Hole 7 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 10:00am
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m	_____	_____	_____	_____	_____
0.4 m					
0.5 m					
0.6 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.7 m					
0.8 m					
0.9 m					
1.0 m	Top of Test Water 900mm				
1.1 m	_____	_____	_____	_____	_____
1.2 m					
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m	Sandy GRAVEL	Granular	Loose	Grey	Between grains
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m	_____	_____	_____	_____

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.4m X 1.2m at an IL of 0.9m below Ground Level.

1.5m X 2.4mX 1.2m, size of soak away tests hole.

Trial Hole 8

Trial Hole 8 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 8:54am
Depth from ground surface to bedrock (m) (if present):			> 2.4m (Not Encountered)		
Depth from ground surface to water table (m) (if present):			> 2.4m (Not Encountered)		

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.4 m					
0.5 m					
0.6 m					
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m					
1.3 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m	Sandy GRAVEL	Granular	Loose	Grey	Between grains
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m				

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.0m X 1.3m at an IL of 0.9m below Ground Level.

1.5m X 2.0mX 1.3m, size of soak away tests hole.

Trial Hole 9

Trial Hole 9 Log

Depth of trial hole (m):	2.4 Meters	**Date and time of excavation:**	27th Aug '16	**Date and time of examination:**	27th Aug '16 8:41am
Depth from ground surface to bedrock (m) (if present):		> 2.4m (Not Encountered)			
Depth from ground surface to water table (m) (if present):		> 2.4m (Not Encountered)			

	Soil/Subsoil Texture & Classification**	Soil Structure	Density/ Compactness	Colour ***	Preferential flow paths
0.1 m	Topsoil	Crumb	Loose	Brown	Abundant roots
0.2 m					
0.3 m					
0.4 m					
0.5 m	Sandy Gravely SILT	Massive	Firm	Light Brown	None Observed
0.6 m					
0.7 m					
0.8 m					
0.9 m	Top of Test Water 900mm				
1.0 m					
1.1 m					
1.2 m	Sandy Gravely SILT	Massive	Uncompact	Grey Brown	None Observed
1.3 m					
1.4 m					
1.5 m					
1.6 m					
1.7 m					
1.8 m					
1.9 m					
2.0 m					
2.1 m					
2.2 m					
2.3 m					
2.4 m					
2.5 m	END of Trial Hole @ 2.4m				

Test Hole dimensions:

Overall Depth 2.4m

Plan dimensions 2.5m X 1.2m at an IL of 0.9m below Ground Level.

1.5m X 2.5mX 1.2m, size of soak away tests hole

Tests Results

TEST Results T1 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	12:43	0				
1.0	-	-				
1.1	12:55	12				
1.2	-	-				
1.3	-	-				
1.4	13:28	33				
1.5	-					
1.6	14:04	36				
1.7	14:28	24				
1.8	14:59	31				
1.9	15:42	43				
2.0	END	END				
2.1						
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 1.0mX2mX1.0m effective depth.

$Vp = 1.0X2.0X1.0 = 2m3$

$Ap = 2(1.0X2.0)+2(1.0X1.0) + (1X2) = 7.0m2$

$Tp = from\ table = 179min$

$$F = \frac{2}{7.0X179X60} = 0.0000266m/s = 0.09576m/hr.$$

TEST Results T2 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	11:16	0				
1.0	-	-				
1.1	13:37	141				
1.2	15:40	123				
1.3	END					
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 1.8mX1.250mX0.3m effective depth.

$Vp = 1.8X1.250X0.3 = 0.675m3$

$Ap = 2(1.8X0.3)+2(1.250X0.3) + (1.8X1.250) = 4.08m2$

$Tp = from\ table = 264min$

$$F = \frac{0.675}{4.08X264X60} = 0.0000104m/s = 0.03744m/hr.$$

TEST Results T3 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	11:37	0				
1.0	13:15	98				
1.1	13:37	176				
1.2	END					
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.6mX1.2mX0.2m effective depth.

$Vp = 2.6X1.2X0.2 = 0.624m3$

$Ap = 2(2.6X0.2)+2(1.2X0.2) + (2.6X1.2) = 4.64m2$

$Tp = from\ table = 274min$

$$F = \frac{0.624}{4.64X274X60} = 0.0000081m/s = 0.02916m/hr.$$

TEST Results T4 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	9:15	0				
1.0	10:44	98				
1.1	14:12	208				
1.2	END					
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.2mX1.2mX0.2m effective depth.

$Vp = 2.2X1.2X0.2 = 0.528m3$

$Ap = 2(2.2X0.2)+2(1.2X0.2) + (2.2X1.2) = 4m2$

$Tp = from\ table = 306min$

$$F = \frac{0.528}{4X306X60} = 0.0000071m/s = 0.02556m/hr.$$

TEST Results T5 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	10:11	0				
1.0	-	-				
1.1	10:26	15				
1.2	-	-				
1.3	10:42	16				
1.4	-	-				
1.5	-					
1.6	-	-				
1.7	-	-				
1.8	-	-				
1.9	11:40	58				
2.0	-	-				
2.1	13:45	125				
2.2	END	END				
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.6mX1.2mX1.2m effective depth.

$Vp = 2.6X1.2X1.2 = 3.744m3$

$Ap = 2(2.6X1.2)+2(1.20X1.2) + (2.6X1.2) = 12.24m2$

$Tp = from\ table = 214min$

$$F = \frac{3.744}{12.24X214X60} = 0.0000238m/s = 0.08568m/hr.$$

TEST Results T6 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	10:06	0				
1.0	-	-				
1.1	10:13	7				
1.2	-	-				
1.3	-	-				
1.4	-	-				
1.5	10:37	24				
1.6	10:47	10				
1.7	-	-				
1.8	-	-				
1.9	-	-				
2.0	-	-				
2.1	11:26	39				
2.2	11:43	17				
2.3	-	-				
2.4	13.06	83				
2.5	END	END				

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.2mX1.2mX1.5m effective depth.

$Vp = 2.2X1.2X1.5 = 3.96m3$

$Ap = 2(2.2X1.5)+2(1.2X1.5) + (2.2X1.2) = 12.24m2$

$Tp = from\ table = 180min$

$$F = \frac{3.96}{12.84X180X60} = 0.0000285m/s = 0.1026m/hr.$$

TEST Results T7 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	10:00	0				
1.0	10:02	2				
1.1	-	-				
1.2	-	-				
1.3	10:17	15				
1.4	-	-				
1.5	10:48	31				
1.6	-	-				
1.7	11:45	57				
1.8	-	-				
1.9	13:02	77				
2.0	13:57	55				
2.1	END	END				
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.4mX1.2mX1.1m effective depth.

$Vp = 2.4X1.2X1.1 = 3.168m3$

$Ap = 2(2.4X1.1)+2(1.2X1.1) + (2.4X1.2) = 10.8m2$

$Tp = from\ table = 237min$

$$F = \frac{3.168}{10.8X237X60} = 0.0000206m/s = 0.07416m/hr.$$

TEST Results T8 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	8:54	0				
1.0	-	-				
1.1	-	-				
1.2	-	-				
1.3	9:55	61				
1.4	-	-				
1.5	10:53	58				
1.6	11:34	41				
1.7	-	-				
1.8	13:09	95				
1.9	14:16	67				
2.0	END	END				
2.1						
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.0mX1.3mX1.0m effective depth.

$Vp = 2.0X1.3X1.0 = 2.6m3$

$Ap = 2(2.0X1.0)+2(1.3X1.0) + (2.0X1.3) = 9.2m2$

$Tp = from\ table = 322min$

$$F = \frac{2.6}{9.2X322X60} = 0.0000146m/s = 0.05256m/hr.$$

TEST Results T9 27th August 2016

Depth (m)	T1	Min	T2	Min	T3	Min
0.0						
0.1						
0.2						
0.3						
0.4						
0.5						
0.6						
0.7						
0.8						
0.9	8:41	0				
1.0	10:55	134				
1.1	13:49	174				
1.2	END	END				
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						

Infiltration test result:

$$\text{Soil Infiltration } f = \frac{Vp_{75\text{-}25}}{Ap_{50} X\ tp_{75\text{-}25}}$$

The test hole dimensions are 2.5mX1.2mX0.2m effective depth.

$Vp = 2.5X1.2X0.2 = 0.6m3$

$Ap = 2(2.5X0.2)+2(1.2X0.2) + (2.5X1.2) = 4.48m2$

$Tp = from\ table = 308min$

$$F = \frac{0.6}{4.48X308X60} = 0.0000072m/s = 0.02592m/hr.$$

Summary of Test Results:

T1 Infiltration Rate (f)= *0.0000266m/s= 0.09576m/hr.*
T2 Infiltration Rate (f)= *0.0000104m/s= 0.03744m/hr.*
T3 Infiltration Rate (f)= *0.0000081m/s= 0.02916m/hr.*
T4 Infiltration Rate (f)= *0.0000071m/s= 0.02556m/hr.*
T5 Infiltration Rate (f)= *0.0000238m/s= 0.08568m/hr.*
T6 Infiltration Rate (f)= *0.0000285m/s= 0.1026m/hr.*
T7 Infiltration Rate (f)= *0.0000206m/s= 0.07416m/hr.*
T8 Infiltration Rate (f)= *0.0000146m/s= 0.05256m/hr.*
T9 Infiltration Rate (f)= *0.0000072m/s= 0.02592m/hr.*

Conclusion:

Variable conditions encountered on the site.

The results of T1, T5, T6, T7 & T8 show that the soil will allow some level of infiltration due to the presence of the GRAVEL layer.

The results of T2, T3, T4 & T9 show poor infiltration rates, GRAVEL was not encountered in these trial holes.

The Soil Infiltration Rate recorded from the site test shows that the subsoil will allow for some infiltration to the ground water. It should be noted that these results are based on 1 infiltration tests in each trial hole.

References:

- BRE Digest 365 Soakaway Design

Online Sources:

- Environmental Protection Agency - www.epa.ie
- Geological Survey of Ireland – www.gsi.ie

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Chartered Engineer.
For and on behalf of L O H Consulting Ltd.

Date: ……28th August 2016……

Appendix C. Simulation Criteria

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	12	Number of Storage Structures	13	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	30
Ratio R	0.269		

As per Met Eireann Information

Appendix D. Outfall Details

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S1.036	S91	23.520	22.070	0.000	0	0	Outfall from Pond 4 to existing drainage network

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S11.005	S119	92.200	90.539	0.000	0	0	Outfall from future catchment not required for this Phase 1 application

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S17.015	S271	49.200	47.741	45.000	0	0	Outfall from Pond 1 and Attenuation Tank A

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S36.008	S292	95.000	92.927	0.000	0	0	Outfall from future catchment not required for this Phase 1 application

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S39.004	S300	97.000	94.720	0.000	0	0	Outfall from future catchment not required for this Phase 1 application

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S42.010	S336	96.407	93.629	0.000	0	0	Outfall to proposed Soakaway

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	
S46.005	S343	101.000	99.671	0.000	0	0	Outfall to existing storm drainage network construction under WCC planning ref;1715

Appendix E. Pipe Schedules

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	85.635	84.210	1.200	Open Manhole	1200
S1.001	o	300	S2	84.315	82.815	1.200	Open Manhole	1200
S1.002	o	300	S3	81.500	79.566	1.634	Open Manhole	1200
S1.003	o	375	S4	77.818	74.879	2.564	Open Manhole	1200
S1.004	o	375	S5	74.208	72.389	1.444	Open Manhole	1200
S2.000	o	300	S6	80.591	79.166	1.125	Open Manhole	1200
S3.000	o	225	S7	81.058	79.302	1.531	Open Manhole	1200
S3.001	o	225	S8	80.378	78.934	1.219	Open Manhole	1200
S3.002	o	225	S9	80.151	78.726	1.200	Open Manhole	1200
S2.001	o	225	S10	79.511	76.850	2.436	Open Manhole	1200
S2.002	o	300	S11	76.271	74.363	1.608	Open Manhole	1200
S2.003	o	300	S12	75.193	73.618	1.275	Open Manhole	1200
S4.000	o	225	S13	76.900	75.275	1.400	Open Manhole	1200
S2.004	o	375	S14	75.012	73.227	1.410	Open Manhole	1200
S2.005	o	375	S15	74.762	73.112	1.275	Open Manhole	1200
S5.000	o	225	S16	78.320	76.895	1.200	Open Manhole	1200
S5.001	o	225	S17	77.907	76.407	1.275	Open Manhole	1200
S5.002	o	300	S18	77.700	76.125	1.275	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	37.681	28.5	S2	84.315	82.890	1.200	Open Manhole	1200
S1.001	90.000	27.7	S3	81.500	79.566	1.634	Open Manhole	1200
S1.002	90.000	27.7	S4	77.818	76.318	1.200	Open Manhole	1200
S1.003	89.834	40.0	S5	74.208	72.633	1.200	Open Manhole	1200
S1.004	56.548	40.0	S32	72.550	70.975	1.200	Open Manhole	1500
S2.000	49.550	45.9	S10	79.511	78.086	1.125	Open Manhole	1200
S3.000	28.076	76.2	S8	80.378	78.934	1.219	Open Manhole	1200
S3.001	9.845	47.4	S9	80.151	78.726	1.200	Open Manhole	1200
S3.002	27.062	42.3	S10	79.511	78.086	1.200	Open Manhole	1200
S2.001	88.312	40.0	S11	76.271	74.642	1.404	Open Manhole	1200
S2.002	29.802	40.0	S12	75.193	73.618	1.275	Open Manhole	1200
S2.003	8.148	45.0	S14	75.012	73.437	1.275	Open Manhole	1200
S4.000	69.157	41.0	S14	75.012	73.587	1.200	Open Manhole	1200
S2.004	6.336	55.1	S15	74.762	73.112	1.275	Open Manhole	1200
S2.005	14.784	59.1	S25	74.512	72.862	1.275	Open Manhole	1350
S5.000	33.359	80.8	S17	77.907	76.482	1.200	Open Manhole	1200
S5.001	10.689	51.6	S18	77.700	76.200	1.275	Open Manhole	1200
S5.002	31.601	70.7	S19	77.253	75.678	1.275	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S5.003	o	300	S19	77.253	75.663	1.290	Open Manhole	1200
S5.004	o	300	S20	76.464	74.835	1.329	Open Manhole	1200
S5.005	o	300	S21	75.384	73.884	1.200	Open Manhole	1200
S5.006	o	375	S22	74.304	72.729	1.200	Open Manhole	1200
S5.007	o	375	S23	73.500	71.676	1.449	Open Manhole	1200
S5.008	o	375	S24	73.762	71.400	1.987	Open Manhole	1200
S2.006	o	450	S25	74.512	71.248	2.814	Open Manhole	1350
S2.007	o	375	S26	74.077	71.200	2.502	Open Manhole	1350
S2.008	o	300	S27	72.775	70.825	1.650	Open Manhole	1350
S2.009	o	300	S28	72.450	70.785	1.365	Open Manhole	1350
S2.010	o	300	S29	72.255	70.600	1.355	Open Manhole	1350
S2.011	o	375	S30	72.200	70.100	1.725	Open Manhole	1350
S2.012	o	375	S31	72.520	69.900	2.245	Open Manhole	1350
S1.005	o	525	S32	72.550	69.593	2.432	Open Manhole	1500
S1.006	o	525	S33	72.042	69.228	2.289	Open Manhole	1500
S1.007	o	525	S34	71.349	68.968	1.856	Open Manhole	1500
S1.008	o	525	S35	71.100	68.842	1.733	Open Manhole	1500
S1.009	o	525	S36	70.700	68.517	1.658	Open Manhole	1500
S1.010	o	525	S37	70.250	68.068	1.657	Open Manhole	1500
S6.000	o	675	S38	77.	Future Phase		pen Manhole	1350
S6.001	o	300	S39	77.			pen Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S5.003	23.221	30.0	S20	76.464	74.889	1.275	Open Manhole	1200
S5.004	28.515	30.0	S21	75.384	73.884	1.200	Open Manhole	1200
S5.005	30.346	28.1	S22	74.304	72.804	1.200	Open Manhole	1200
S5.006	36.190	37.0	S23	73.500	71.750	1.375	Open Manhole	1200
S5.007	28.146	102.0	S24	73.762	71.400	1.987	Open Manhole	1200
S5.008	27.665	182.0	S25	74.512	71.248	2.889	Open Manhole	1350
S2.006	10.802	225.0	S26	74.077	71.200	2.427	Open Manhole	1350
S2.007	45.275	150.9	S27	72.775	70.900	1.500	Open Manhole	1350
S2.008	8.820	220.5	S28	72.450	70.785	1.365	Open Manhole	1350
S2.009	14.495	78.4	S29	72.255	70.600	1.355	Open Manhole	1350
S2.010	38.139	95.3	S30	72.200	70.200	1.700	Open Manhole	1350
S2.011	34.132	170.7	S31	72.520	69.900	2.245	Open Manhole	1350
S2.012	9.849	98.5	S32	72.550	69.800	2.375	Open Manhole	1500
S1.005	17.496	499.9	S33	72.042	69.558	1.959	Open Manhole	1500
S1.006	14.545	171.1	S34	71.349	69.143	1.681	Open Manhole	1500
S1.007	18.026	200.3	S35	71.100	68.878	1.697	Open Manhole	1500
S1.008	90.930	279.8	S36	70.700	68.517	1.658	Open Manhole	1500
S1.009	76.741	170.5	S37	70.250	68.067	1.658	Open Manhole	1500
S1.010	10.226	120.3	S42	69.933	67.983	1.425	Open Manhole	1500
S6.000	10.423	70.0	S39	7	Future Phase	8	Open Manhole	1350
S6.001	27.188	50.3	S40	7		7	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.002	o	300	S40	74.900	72.229	2.371	Open Manhole	1200
S6.003	o	300	S41	73.000	69.088	3.612	Open Manhole	1200
S1.011	o	675	S42	69.933	67.833	1.425	Open Manhole	1500
S1.012	o	675	S43	69.933	66.643	2.615	Open Manhole	1500
S1.013	o	675	S44	68.300	64.605	3.020	Open Manhole	1500
S1.014	o	675	S45	66.239	62.697	2.867	Open Manhole	1500
S1.015	o	675	S46	64.289	60.684	2.930	Open Manhole	1500
S1.016	o	675	S47	62.339	57.512	4.152	Open Manhole	1500
S1.017	o	675	S48	59.089	54.490	3.924	Open Manhole	1500
S1.018	o	675	S49	56.159	53.599	1.885	Open Manhole	1500
S1.019	o	750	S50	55.321	49.286	5.285	Open Manhole	1500
S1.020	o	750	S51	50.500	48.475	1.275	Open Manhole	1500
S1.021	o	750	S52	49.800	47.975	1.075	Open Manhole	1500
S1.022	o	750	S53	49.800	43.350	5.700	Open Manhole	1500
S1.023	o	750	S54	45.500	40.456	4.294	Open Manhole	1500
S1.024	o	750	S55	42.000	37.690	3.560	Open Manhole	1500
S7.000	o	225	S56	70.500	68.647	1.628	Open Manhole	1200
S7.001	o	225	S57	69.600	67.940	1.435	Open Manhole	1200
S7.002	o	225	S58	69.200	67.596	1.379	Open Manhole	1200
S7.003	o	225	S59	68.900	66.796	1.879	Open Manhole	1200
S7.004	o	225	S60	67.500	65.364	1.911	Open Manhole	1200
S7.005	o	225	S61	66.000	64.087	1.688	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.002	29.175	35.8	S41	73.000	71.414	1.286	Open Manhole	1200
S6.003	37.067	53.4	S42	69.933	68.395	1.238	Open Manhole	1500
S1.011	13.117	100.1	S43	69.933	67.702	1.556	Open Manhole	1500
S1.012	29.275	99.9	S44	68.300	66.350	1.275	Open Manhole	1500
S1.013	31.584	99.9	S45	66.239	64.289	1.275	Open Manhole	1500
S1.014	35.824	100.1	S46	64.289	62.339	1.275	Open Manhole	1500
S1.015	29.515	100.1	S47	62.339	60.389	1.275	Open Manhole	1500
S1.016	75.652	99.9	S48	59.089	56.755	1.659	Open Manhole	1500
S1.017	28.115	100.1	S49	56.159	54.209	1.275	Open Manhole	1500
S1.018	22.820	100.1	S50	55.321	53.371	1.275	Open Manhole	1500
S1.019	73.577	100.0	S51	50.500	48.550	1.200	Open Manhole	1500
S1.020	48.546	97.1	S52	49.800	47.975	1.075	Open Manhole	1500
S1.021	37.142	212.2	S53	49.800	47.800	1.250	Open Manhole	1500
S1.022	30.432	121.7	S54	45.500	43.100	1.650	Open Manhole	1500
S1.023	30.148	100.2	S55	42.000	40.155	1.095	Open Manhole	1500
S1.024	28.361	120.2	S79	39.000	37.454	0.796	Open Manhole	1800
S7.000	14.157	30.0	S57	69.600	68.175	1.200	Open Manhole	1200
S7.001	4.964	30.1	S58	69.200	67.775	1.200	Open Manhole	1200
S7.002	3.635	30.0	S59	68.900	67.475	1.200	Open Manhole	1200
S7.003	21.629	30.0	S60	67.500	66.075	1.200	Open Manhole	1200
S7.004	23.665	30.0	S61	66.000	64.575	1.200	Open Manhole	1200
S7.005	21.374	30.0	S65	64.800	63.375	1.200	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.000	o	225	S62	65.400	63.865	1.310	Open Manhole	1200
S8.001	o	300	S63	65.300	63.668	1.332	Open Manhole	1200
S8.002	o	300	S64	64.796	63.111	1.385	Open Manhole	1200
S7.006	o	375	S65	64.800	61.323	3.102	Open Manhole	1200
S7.007	o	375	S66	62.200	59.188	2.637	Open Manhole	1200
S7.008	o	375	S67	60.200	57.481	2.344	Open Manhole	1200
S7.009	o	375	S68	58.600	56.449	1.776	Open Manhole	1200
S7.010	o	375	S69	57.749	50.617	6.757	Open Manhole	1200
S7.011	o	375	S70	51.876	47.562	3.939	Open Manhole	1200
S7.012	o	375	S71	49.007	45.503	3.129	Open Manhole	1200
S7.013	o	450	S72	47.200	45.210	1.540	Open Manhole	1350
S7.014	o	450	S73	46.866	45.141	1.275	Open Manhole	1350
S9.000	o	225	S74	50.800	49.375	1.200	Open Manhole	1200
S7.015	o	450	S75	48.000	43.337	4.213	Open Manhole	1350
S10.000	o	225	S76	48.800	45.309	3.266	Open Manhole	1200
S7.016	o	450	S77	44.500	39.785	4.265	Open Manhole	1350
S7.017	o	450	S78	41.000	37.965	2.585	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.000	9.260	76.2	S63	65.300	63.743	1.332	Open Manhole	1200
S8.001	52.582	104.3	S64	64.796	63.164	1.332	Open Manhole	1200
S8.002	34.179	96.7	S65	64.800	62.758	1.742	Open Manhole	1200
S7.006	38.417	55.0	S66	62.200	60.625	1.200	Open Manhole	1200
S7.007	30.960	55.0	S67	60.200	58.625	1.200	Open Manhole	1200
S7.008	25.090	55.0	S68	58.600	57.025	1.200	Open Manhole	1200
S7.009	15.113	55.0	S69	57.749	56.174	1.200	Open Manhole	1200
S7.010	14.144	39.4	S70	51.876	50.258	1.243	Open Manhole	1200
S7.011	6.573	38.0	S71	49.007	47.389	1.243	Open Manhole	1200
S7.012	5.434	38.0	S72	47.200	45.360	1.465	Open Manhole	1350
S7.013	23.911	346.5	S73	46.866	45.141	1.275	Open Manhole	1350
S7.014	40.714	496.5	S75	48.000	45.059	2.491	Open Manhole	1350
S9.000	55.535	19.8	S75	48.000	46.575	1.200	Open Manhole	1350
S7.015	45.947	80.0	S77	44.500	42.763	1.287	Open Manhole	1350
S10.000	56.150	25.0	S77	44.500	43.063	1.212	Open Manhole	1350
S7.016	41.977	72.9	S78	41.000	39.209	1.341	Open Manhole	1350
S7.017	42.717	60.0	S79	39.000	37.253	1.297	Open Manhole	1800

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.025	o	750	S79	39.000	35.327	2.923	Open Manhole	1800
S1.026	o	750	S80	37.000	33.200	3.050	Open Manhole	1875
S1.027	o	825	S81	36.000	32.759	2.416	Open Manhole	1875
S1.028	o	825	S82	35.500	32.269	2.406	Open Manhole	1875
S1.029	o	825	S83	35.000	32.177	1.998	Open Manhole	1875
S1.030	o	825	S84	34.500	32.013	1.662	Open Manhole	1875
S1.031	o	825	S85	34.000	31.760	1.415	Open Manhole	1875
S1.032	o	825	S86	34.000	31.567	1.608	Open Manhole	1875
S1.033	o	375	S87	34.000	31.400	2.225	Open Manhole	1875
S1.034	o	300	S88	34.000	24.917	8.783	Open Manhole	1200
S1.035	o	300	S89	25.500	23.978	1.222	Open Manhole	1200
S1.036	o	300	S90	25.800	22.808	2.692	Open Manhole	1200
S11.000	o	300	S92	96.000	94.500	1.200	Open Manhole	1200
S12.000	o	225	S93	100.000	98.575	1.200	Open Manhole	1200
S12.001	o	300	S94	99.000	97.500	1.200	Open Manhole	1200
S13.000	o	225	S95	10			Open Manhole	1200
S13.001	o	225	S96	100.732	98.222	2.285	Open Manhole	1200
S13.002	o	375	S97	98.542	96.967	1.200	Open Manhole	1200
S12.002	o	300	S98	98.542	96.448	1.794	Open Manhole	1200

Future Phase

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.025	30.324	131.3	S80	37.000	35.096	1.154	Open Manhole	1875
S1.026	29.994	131.0	S81	36.000	32.971	2.279	Open Manhole	1875
S1.027	10.764	119.6	S82	35.500	32.669	2.006	Open Manhole	1875
S1.028	11.099	120.6	S83	35.000	32.177	1.998	Open Manhole	1875
S1.029	18.295	111.6	S84	34.500	32.013	1.662	Open Manhole	1875
S1.030	30.400	120.2	S85	34.000	31.760	1.415	Open Manhole	1875
S1.031	29.670	153.7	S86	34.000	31.567	1.608	Open Manhole	1875
S1.032	15.460	119.8	S87	34.000	31.438	1.737	Open Manhole	1875
S1.033	11.133	30.0	S88	34.000	31.029	2.596	Open Manhole	1200
S1.034	27.782	30.0	S89	25.500	23.991	1.209	Open Manhole	1200
S1.035	22.033	30.0	S90	25.800	23.244	2.256	Open Manhole	1200
S1.036	22.127	30.0	S91	23.520	22.070	1.150	Open Manhole	0
S11.000	71.681	250.0	S102	97.000	94.213	2.487	Open Manhole	1200
S12.000	29.209	29.2	S94	99.000	97.575	1.200	Open Manhole	1200
S12.001	80.504	175.8	S98	98.542	97.042	1.200	Open Manhole	1200
S13.000	53.922	26.2	S96			00	Open Manhole	1200
S13.001	27.627	25.0	S97	98.542	97.117	1.200	Open Manhole	1200
S13.002	52.508	500.0	S98	98.542	96.862	1.305	Open Manhole	1200
S12.002	17.238	47.5	S100	97.700	96.085	1.315	Open Manhole	1200

Future Phase

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S14.000	o	375	S99	97.893	96.318	1.200	Open Manhole	1200
S12.003	o	375	S100	97.700	95.895	1.430	Open Manhole	1200
S12.004	o	450	S101	97.400	94.152	2.798	Open Manhole	1200
S11.001	o	450	S102	97.000	93.928	2.622	Open Manhole	1200
S15.000	o	225	S103	98.776	97.351	1.200	Open Manhole	1200
S15.001	o	225	S104	97.600	96.175	1.200	Open Manhole	1200
S15.002	o	225	S105	97.500	96.075	1.200	Open Manhole	1200
S15.003	o	300	S106	97.	Future Phase		pen Manhole	1200
S15.004	o	300	S107	96.			pen Manhole	1200
S15.005	o	300	S108	96.069	94.569	1.200	Open Manhole	1200
S15.006	o	300	S109	95.331	93.831	1.200	Open Manhole	1200
S11.002	o	525	S110	94.628	92.726	1.377	Open Manhole	1350
S16.000	o	225	S111	97.950	96.448	1.277	Open Manhole	1200
S16.001	o	300	S112	97.409	95.806	1.303	Open Manhole	1200
S16.002	o	300	S113	96.087	94.484	1.303	Open Manhole	1200
S16.003	o	375	S114	95.462	93.399	1.688	Open Manhole	1200
S16.004	o	450	S115	94.330	92.529	1.351	Open Manhole	1200
S11.003	o	600	S116	94.350	92.042	1.708	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S14.000	80.054	414.8	S100	97.700	96.125	1.200	Open Manhole	1200
S12.003	5.683	40.0	S101	97.400	95.753	1.272	Open Manhole	1200
S12.004	9.403	63.1	S102	97.000	94.003	2.547	Open Manhole	1200
S11.001	67.792	71.4	S110	94.628	92.978	1.200	Open Manhole	1350
S15.000	38.813	33.0	S104	97.600	96.175	1.200	Open Manhole	1200
S15.001	9.718	97.2	S105	97.500	96.075	1.200	Open Manhole	1200
S15.002	18.854	37.7	S106	97.000	95.575	1.200	Open Manhole	1200
S15.003	17.080	38.9	S107	9	Future Phase		Open Manhole	1200
S15.004	19.958	40.6	S108	9			Open Manhole	1200
S15.005	29.946	40.6	S109	95.331	93.831	1.200	Open Manhole	1200
S15.006	32.889	46.8	S110	94.628	93.128	1.200	Open Manhole	1350
S11.002	8.096	80.2	S116	94.350	92.625	1.200	Open Manhole	1350
S16.000	35.143	62.0	S112	97.409	95.881	1.303	Open Manhole	1200
S16.001	39.927	30.2	S113	96.087	94.484	1.303	Open Manhole	1200
S16.002	18.620	29.8	S114	95.462	93.859	1.303	Open Manhole	1200
S16.003	64.328	80.9	S115	94.330	92.604	1.351	Open Manhole	1200
S16.004	10.768	500.0	S116	94.350	92.507	1.393	Open Manhole	1350
S11.003	14.227	100.2	S117	93.500	91.900	1.000	Open Manhole	1350

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S11.004	o	225	S117	93.500	91.900	1.375	Open Manhole	1350
S11.005	o	225	S118	92.844	91.150	1.469	Open Manhole	1200
S17.000	o	225	S120	79.300	77.654	1.421	Open Manhole	1200
S18.000	o	225	S121	85.800	84.081	1.494	Open Manhole	1200
S18.001	o	225	S122	84.551	82.881	1.445	Open Manhole	1200
S18.002	o	225	S123	83.471	80.750	2.496	Open Manhole	1200
S18.003	o	300	S124	81.500	79.091	2.109	Open Manhole	1200
S18.004	o	375	S125	80.078	77.963	1.740	Open Manhole	1200
S17.001	o	375	S126	78.568	76.784	1.409	Open Manhole	1200
S17.002	o	375	S127	77.800	70.404	7.021	Open Manhole	1200
S19.000	o	225	S128	77.220	75.733	1.261	Open Manhole	1200
S19.001	o	225	S129	76.988	75.502	1.261	Open Manhole	1200
S19.002	o	225	S130	76.960	75.347	1.388	Open Manhole	1200
S20.000	o	225	S131	77.[illegible]	[illegible]	[illegible]	Open Manhole	1200
S20.001	o	225	S132	77.	Future Phase		pen Manhole	1200
S20.002	o	225	S133	77.[illegible]	[illegible]	[illegible]	Open Manhole	1200
S19.003	o	300	S134	76.900	75.012	1.588	Open Manhole	1200
S19.004	o	300	S135	76.706	70.321	6.085	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S11.004	90.000	120.0	S118	92.844	91.150	1.469	Open Manhole	1200
S11.005	68.557	112.2	S119	92.200	90.539	1.436	Open Manhole	0
S17.000	37.559	64.6	S126	78.568	77.073	1.270	Open Manhole	1200
S18.000	34.508	34.8	S122	84.551	83.090	1.236	Open Manhole	1200
S18.001	37.935	36.6	S123	83.471	81.844	1.402	Open Manhole	1200
S18.002	47.505	30.0	S124	81.500	79.166	2.109	Open Manhole	1200
S18.003	37.125	37.5	S125	80.078	78.100	1.678	Open Manhole	1200
S18.004	35.808	30.8	S126	78.568	76.800	1.393	Open Manhole	1200
S17.001	19.365	40.0	S127	77.800	76.300	1.125	Open Manhole	1200
S17.002	21.129	30.0	S136	71.200	69.700	1.125	Open Manhole	1200
S19.000	15.744	67.9	S129	76.988	75.502	1.261	Open Manhole	1200
S19.001	3.130	113.7	S130	76.960	75.474	1.261	Open Manhole	1200
S19.002	6.438	42.5	S134	76.900	75.196	1.479	Open Manhole	1200
S20.000	39.137	294.4	S132	[illegible]	[illegible]	[illegible]	Open Manhole	1200
S20.001	39.137	294.4	S133	[illegible]	Future Phase		Open Manhole	1200
S20.002	23.955	294.4	S134	76.900	75.228	1.447	Open Manhole	1200
S19.003	29.550	250.4	S135	76.706	74.894	1.512	Open Manhole	1200
S19.004	36.856	99.3	S136	71.200	69.950	0.950	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S17.003	o	450	S136	71.200	69.337	1.413	Open Manhole	1200
S17.004	o	450	S137	70.500	68.599	1.451	Open Manhole	1200
S17.005	o	225	S138	69.900	68.200	1.475	Open Manhole	1200
S17.006	o	225	S139	69.200	67.482	1.493	Open Manhole	1200
S21.000	o	300	S140	95.300	93.744	1.256	Open Manhole	1200
S21.001	o	300	S141	96.847	93.342	3.205	Open Manhole	1200
S21.002	o	300	S142	97.091	93.138	3.653	Open Manhole	1200
S21.003	o	375	S143	96.512	92.888	3.249	Open Manhole	1200
S21.004	o	375	S144	94.735	92.377	1.983	Open Manhole	1200
S21.005	o	375	S145	94.135	92.014	1.746	Open Manhole	1200
S21.006	o	375	S146	91.836	90.249	1.212	Open Manhole	1200
S22.000	o	300	S147	101.265	99.719	1.246	Open Manhole	1200
S22.001	o	300	S148	101.143	99.558	1.285	Open Manhole	1200
S22.002	o	300	S149	100.873	99.255	1.318	Open Manhole	1200
S22.003	o	300	S150	100.131	98.631	1.200	Open Manhole	1200
S22.004	o	300	S151	99.231	97.731	1.200	Open Manhole	1200
S22.005	o	300	S152	98.331	96.831	1.200	Open Manhole	1200
S22.006	o	375	S153	97.600	95.856	1.369	Open Manhole	1200
S22.007	o	375	S154	97.200	95.414	1.411	Open Manhole	1200
S22.008	o	375	S155	97.335	95.308	1.652	Open Manhole	1200
S22.009	o	375	S156	97.289	95.214	1.700	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S17.003	6.498	19.3	S137	70.500	69.000	1.050	Open Manhole	1200
S17.004	11.235	41.0	S138	69.900	68.325	1.125	Open Manhole	1200
S17.005	10.686	35.0	S139	69.200	67.895	1.080	Open Manhole	1200
S17.006	41.981	33.8	S262	67.500	66.240	1.035	Open Manhole	1200
S21.000	55.204	137.3	S141	96.847	93.342	3.205	Open Manhole	1200
S21.001	19.629	96.2	S142	97.091	93.138	3.653	Open Manhole	1200
S21.002	20.013	114.4	S143	96.512	92.963	3.249	Open Manhole	1200
S21.003	59.856	134.2	S144	94.735	92.442	1.918	Open Manhole	1200
S21.004	21.053	58.2	S145	94.135	92.014	1.746	Open Manhole	1200
S21.005	83.140	47.1	S146	91.836	90.249	1.212	Open Manhole	1200
S21.006	19.451	57.7	S183	91.525	89.912	1.238	Open Manhole	1350
S22.000	25.411	157.8	S148	101.143	99.558	1.285	Open Manhole	1200
S22.001	29.977	98.9	S149	100.873	99.255	1.318	Open Manhole	1200
S22.002	59.895	96.0	S150	100.131	98.631	1.200	Open Manhole	1200
S22.003	29.770	33.1	S151	99.231	97.731	1.200	Open Manhole	1200
S22.004	29.788	33.1	S152	98.331	96.831	1.200	Open Manhole	1200
S22.005	29.523	32.8	S153	97.600	95.931	1.369	Open Manhole	1200
S22.006	32.596	73.7	S154	97.200	95.414	1.411	Open Manhole	1200
S22.007	6.457	60.9	S155	97.335	95.308	1.652	Open Manhole	1200
S22.008	5.085	54.1	S156	97.289	95.214	1.700	Open Manhole	1200
S22.009	7.499	32.7	S157	97.200	94.985	1.840	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S22.010	o	375	S157	97.200	94.985	1.840	Open Manhole	1200
S22.011	o	375	S158	96.900	94.823	1.702	Open Manhole	1200
S22.012	o	450	S159	96.800	94.580	1.770	Open Manhole	1200
S22.013	o	450	S160	96.750	94.447	1.853	Open Manhole	1200
S22.014	o	450	S161	96.650	94.249	1.951	Open Manhole	1200
S22.015	o	450	S162	96.550	94.044	2.056	Open Manhole	1200
S22.016	o	450	S163	96.450	93.848	2.152	Open Manhole	1200
S22.017	o	450	S164	95.930	92.948	2.532	Open Manhole	1200
S22.018	o	450	S165	95.203	92.752	2.001	Open Manhole	1200
S23.000	o	225	S166	96.700	95.005	1.470	Open Manhole	1200
S24.000	o	300	S167	97.	Future Phase		pen Manhole	1200
S24.001	o	300	S168	97.			pen Manhole	1200
S24.002	o	300	S169	97.609	95.063	2.246	Open Manhole	1200
S23.001	o	300	S170	95.733	93.963	1.470	Open Manhole	1200
S23.002	o	300	S171	95.026	93.526	1.200	Open Manhole	1200
S22.019	o	450	S172	94.405	92.656	1.299	Open Manhole	1200
S22.020	o	450	S173	94.405	92.000	1.955	Open Manhole	1200
S25.000	o	300	S174	96.578	95.017	1.261	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S22.010	5.819	35.9	S158	96.900	94.823	1.702	Open Manhole	1200
S22.011	11.746	70.1	S159	96.800	94.655	1.770	Open Manhole	1200
S22.012	13.258	99.7	S160	96.750	94.447	1.853	Open Manhole	1200
S22.013	19.809	100.0	S161	96.650	94.249	1.951	Open Manhole	1200
S22.014	20.476	100.0	S162	96.550	94.044	2.056	Open Manhole	1200
S22.015	19.614	100.0	S163	96.450	93.848	2.152	Open Manhole	1200
S22.016	90.000	100.0	S164	95.930	92.948	2.532	Open Manhole	1200
S22.017	19.639	100.0	S165	95.203	92.752	2.001	Open Manhole	1200
S22.018	9.637	100.4	S172	94.405	92.656	1.299	Open Manhole	1200
S23.000	38.846	40.2	S170	95.733	94.038	1.470	Open Manhole	1200
S24.000	70.000	200.0	S168	9	Future Phase	2	Open Manhole	1200
S24.001	44.300	200.0	S169				Open Manhole	1200
S24.002	54.228	65.1	S170	95.733	94.231	1.202	Open Manhole	1200
S23.001	16.031	36.7	S171	95.026	93.526	1.200	Open Manhole	1200
S23.002	17.587	24.4	S172	94.405	92.806	1.299	Open Manhole	1200
S22.019	10.912	60.0	S173	94.405	92.474	1.481	Open Manhole	1200
S22.020	18.268	99.8	S182	93.605	91.817	1.338	Open Manhole	1350
S25.000	66.881	48.1	S180	95.188	93.627	1.261	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S26.000	o	225	S175	97.449	96.024	1.200	Open Manhole	1200
S26.001	o	225	S176	96.868	95.271	1.372	Open Manhole	1200
S26.002	o	225	S177	96.532	94.974	1.333	Open Manhole	1200
S26.003	o	225	S178	96.196	94.771	1.200	Open Manhole	1200
S26.004	o	225	S179	96.196	94.686	1.285	Open Manhole	1200
S25.001	o	300	S180	95.188	93.308	1.580	Open Manhole	1200
S25.002	o	300	S181	94.100	92.090	1.710	Open Manhole	1200
S22.021	o	525	S182	93.605	90.500	2.580	Open Manhole	1350
S21.007	o	675	S183	91.525	89.585	1.265	Open Manhole	1350
S27.000	o	225	S184	92.813	91.313	1.275	Open Manhole	1200
S21.008	o	675	S185	91.256	87.900	2.681	Open Manhole	1350
S21.009	o	750	S186	89.500	87.100	1.650	Open Manhole	1350
S21.010	o	750	S187	89.000	86.841	1.409	Open Manhole	1350
S21.011	o	750	S188	88.982	86.743	1.489	Open Manhole	1350
S21.012	o	750	S189	88.724	86.623	1.351	Open Manhole	1350
S21.013	o	750	S190	88.414	86.526	1.138	Open Manhole	1350
S21.014	o	750	S191	88.240	86.454	1.036	Open Manhole	1350
S21.015	o	750	S192	87.500	86.191	0.559	Open Manhole	1350
S21.016	o	750	S193	87.000	86.090	0.160	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S26.000	16.274	28.0	S176	96.868	95.443	1.200	Open Manhole	1200
S26.001	4.925	30.0	S177	96.532	95.107	1.200	Open Manhole	1200
S26.002	6.102	30.1	S178	96.196	94.771	1.200	Open Manhole	1200
S26.003	8.512	100.0	S179	96.196	94.686	1.285	Open Manhole	1200
S26.004	33.107	33.6	S180	95.188	93.702	1.261	Open Manhole	1200
S25.001	32.076	42.8	S181	94.100	92.559	1.241	Open Manhole	1200
S25.002	22.697	64.5	S182	93.605	91.738	1.567	Open Manhole	1350
S22.021	49.737	65.0	S183	91.525	89.735	1.265	Open Manhole	1350
S21.007	6.679	99.7	S185	91.256	89.518	1.063	Open Manhole	1350
S27.000	57.012	36.6	S185	91.256	89.756	1.275	Open Manhole	1350
S21.008	52.610	100.0	S186	89.500	87.374	1.451	Open Manhole	1350
S21.009	31.023	119.8	S187	89.000	86.841	1.409	Open Manhole	1350
S21.010	11.832	120.7	S188	88.982	86.743	1.489	Open Manhole	1350
S21.011	10.570	88.1	S189	88.724	86.623	1.351	Open Manhole	1350
S21.012	13.703	141.3	S190	88.414	86.526	1.138	Open Manhole	1350
S21.013	8.915	123.8	S191	88.240	86.454	1.036	Open Manhole	1350
S21.014	14.666	55.8	S192	87.500	86.191	0.559	Open Manhole	1350
S21.015	17.813	176.4	S193	87.000	86.090	0.160	Open Manhole	1350
S21.016	20.188	224.3	S194	87.000	86.000	0.250	Open Manhole	1350

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S21.017	o	750	S194	87.000	86.000	0.250	Open Manhole	1350
S21.018	o	750	S195	87.000	85.840	0.410	Open Manhole	1350
S21.019	o	450	S196	87.100	85.650	1.000	Open Manhole	1350
S21.020	o	375	S197	86.300	84.918	1.007	Open Manhole	1200
S21.021	o	375	S198	85.300	84.500	0.425	Open Manhole	1200
S21.022	o	450	S199	85.300	83.300	1.550	Open Manhole	1200
S28.000	o	225	S200	89.500	87.439	1.836	Open Manhole	1200
S29.000	o	225	S201	91	Future Phase		Open Manhole	1200
S29.001	o	300	S202	91			Open Manhole	1200
S29.002	o	300	S203	91.400	88.515	2.585	Open Manhole	1200
S28.001	o	450	S204	88.400	86.658	1.292	Open Manhole	1200
S30.000	o	300	S205	94.300	92.800	1.200	Open Manhole	1200
S30.001	o	300	S206	95.080	92.672	2.108	Open Manhole	1200
S30.002	o	300	S207	94.001	91.880	1.821	Open Manhole	1200
S30.003	o	300	S208	92.400	90.598	1.502	Open Manhole	1200
S30.004	o	300	S209	91.493	89.725	1.468	Open Manhole	1200
S30.005	o	300	S210	91.043	89.153	1.590	Open Manhole	1200
S30.006	o	300	S211	90.143	86.734	3.109	Open Manhole	1200
S28.002	o	450	S212	89.850	86.350	3.125	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S21.017	18.100	98.9	S195	87.000	85.817	0.433	Open Manhole	1350
S21.018	16.274	94.1	S196	87.100	85.667	0.683	Open Manhole	1350
S21.019	19.201	96.0	S197	86.300	85.450	0.400	Open Manhole	1200
S21.020	23.551	106.6	S198	85.300	84.697	0.228	Open Manhole	1200
S21.021	29.635	70.6	S199	85.300	84.080	0.845	Open Manhole	1200
S21.022	19.362	86.8	S260	84.000	83.077	0.473	Open Manhole	1200
S28.000	33.319	59.9	S204	88.400	86.883	1.292	Open Manhole	1200
S29.000	33.975	30.0	S202	Future Phase		00	Open Manhole	1200
S29.001	36.027	30.0	S203			07	Open Manhole	1200
S29.002	47.717	29.5	S204	88.400	86.900	1.200	Open Manhole	1200
S28.001	43.238	140.4	S212	89.850	86.350	3.050	Open Manhole	1200
S30.000	36.252	283.2	S206	95.080	92.672	2.108	Open Manhole	1200
S30.001	36.825	215.2	S207	94.001	92.501	1.200	Open Manhole	1200
S30.002	39.210	40.0	S208	92.400	90.900	1.200	Open Manhole	1200
S30.003	24.187	40.0	S209	91.493	89.993	1.200	Open Manhole	1200
S30.004	7.271	40.0	S210	91.043	89.543	1.200	Open Manhole	1200
S30.005	20.399	40.0	S211	90.143	88.643	1.200	Open Manhole	1200
S30.006	9.355	40.0	S212	89.850	86.500	3.050	Open Manhole	1200
S28.002	17.737	64.5	S251	87.000	86.074	0.551	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S31.000	o	300	S213	96.000	93.500	2.200	Open Manhole	1200
S31.001	o	300	S214	94.800	93.186	1.314	Open Manhole	1200
S31.002	o	300	S215	94.600	92.938	1.362	Open Manhole	1200
S32.000	o	225	S216	98.600	97.175	1.200	Open Manhole	1200
S32.001	o	225	S217	98.500	97.075	1.200	Open Manhole	1200
S32.002	o	225	S218	97.900	96.475	1.200	Open Manhole	1200
S32.003	o	225	S219	97.600	96.163	1.212	Open Manhole	1200
S32.004	o	225	S220	97.400	95.866	1.309	Open Manhole	1200
S32.005	o	225	S221	97	Future Phase		Open Manhole	1200
S33.000	o	225	S222	95.830	94.405	1.200	Open Manhole	1200
S33.001	o	225	S223	95.400	93.975	1.200	Open Manhole	1200
S33.002	o	300	S224	95.320	93.773	1.247	Open Manhole	1200
S33.003	o	375	S225	95.250	93.595	1.280	Open Manhole	1200
S33.004	o	375	S226	95.340	93.486	1.479	Open Manhole	1200
S32.006	o	450	S227	95.256	93.318	1.488	Open Manhole	1200
S32.007	o	450	S228	95.200	93.123	1.627	Open Manhole	1200
S32.008	o	450	S229	95.512	92.472	2.590	Open Manhole	1200
S32.009	o	450	S230	94.800	92.159	2.191	Open Manhole	1200
S31.003	o	525	S231	94.509	92.042	1.942	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S31.000	78.548	250.2	S214	94.800	93.186	1.314	Open Manhole	1200
S31.001	62.125	250.0	S215	94.600	92.938	1.362	Open Manhole	1200
S31.002	13.794	151.6	S231	94.509	92.847	1.362	Open Manhole	1350
S32.000	23.310	233.1	S217	98.500	97.075	1.200	Open Manhole	1200
S32.001	55.929	93.2	S218	97.900	96.475	1.200	Open Manhole	1200
S32.002	7.906	25.3	S219	97.600	96.163	1.212	Open Manhole	1200
S32.003	22.292	75.1	S220	97.400	95.866	1.309	Open Manhole	1200
S32.004	9.274	46.4	S221	97.200	95.666	1.309	Open Manhole	1200
S32.005	22.980	30.0	S227	Future Phase		0	Open Manhole	1200
S33.000	90.000	209.3	S223	95.400	93.975	1.200	Open Manhole	1200
S33.001	37.968	298.2	S224	95.320	93.848	1.247	Open Manhole	1200
S33.002	30.582	296.9	S225	95.250	93.670	1.280	Open Manhole	1200
S33.003	27.213	249.7	S226	95.340	93.486	1.479	Open Manhole	1200
S33.004	23.267	250.0	S227	95.256	93.393	1.488	Open Manhole	1200
S32.006	48.743	250.0	S228	95.200	93.123	1.627	Open Manhole	1200
S32.007	12.440	250.0	S229	95.512	93.073	1.989	Open Manhole	1200
S32.008	59.543	190.1	S230	94.800	92.159	2.191	Open Manhole	1200
S32.009	10.370	250.0	S231	94.509	92.117	1.942	Open Manhole	1350
S31.003	16.867	250.0	S232	94.509	91.975	2.009	Open Manhole	1350

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S31.004	o	525	S232	94.509	91.975	2.009	Open Manhole	1350
S34.000	o	225	S233	96.509	94.750	1.534	Open Manhole	1200
S34.001	o	300	S234	95.750	94.250	1.200	Open Manhole	1200
S34.002	o	300	S235	95.750	93.685	1.765	Open Manhole	1200
S34.003	o	300	S236	94.509	92.603	1.606	Open Manhole	1200
S34.004	o	300	S237	94.109	91.962	1.847	Open Manhole	1200
S31.005	o	600	S238	94.109	91.292	2.217	Open Manhole	1350
S31.006	o	600	S239	93	Future Phase		Open Manhole	1350
S31.007	o	675	S240	92			Open Manhole	1350
S35.000	o	300	S241	95.800	94.300	1.200	Open Manhole	1200
S35.001	o	300	S242	96.409	94.193	1.916	Open Manhole	1200
S35.002	o	300	S243	96.409	92.528	3.581	Open Manhole	1200
S35.003	o	300	S244	93.089	91.409	1.380	Open Manhole	1200
S31.008	o	675	S245	91.498	88.328	2.495	Open Manhole	1350
S31.009	o	900	S246	90.058	88.013	1.145	Open Manhole	1800
S31.010	o	975	S247	90.500	87.861	1.664	Open Manhole	1875
S31.011	o	225	S248	90.000	87.764	2.011	Open Manhole	1875
S31.012	o	225	S249	89.500	87.583	1.692	Open Manhole	1200
S31.013	o	225	S250	88.212	86.975	1.012	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S31.004	18.486	250.0	S238	94.109	91.901	1.683	Open Manhole	1350
S34.000	12.762	30.0	S234	95.750	94.325	1.200	Open Manhole	1200
S34.001	40.419	71.5	S235	95.750	93.685	1.765	Open Manhole	1200
S34.002	49.581	53.5	S236	94.509	92.759	1.450	Open Manhole	1200
S34.003	18.288	42.3	S237	94.109	92.171	1.638	Open Manhole	1200
S34.004	12.954	43.9	S238	94.109	91.667	2.142	Open Manhole	1350
S31.005	29.229	250.0	S239	93.000	91.175	1.225	Open Manhole	1350
S31.006	13.335	100.3	S240	Future Phase		0	Open Manhole	1350
S31.007	30.397	100.0	S245			5	Open Manhole	1350
S35.000	31.552	294.9	S242	96.409	94.193	1.916	Open Manhole	1200
S35.001	61.516	294.4	S243	96.409	93.984	2.125	Open Manhole	1200
S35.002	28.159	30.0	S244	93.089	91.589	1.200	Open Manhole	1200
S35.003	42.340	30.0	S245	91.498	89.998	1.200	Open Manhole	1350
S31.008	26.949	109.4	S246	90.058	88.082	1.301	Open Manhole	1800
S31.009	9.264	120.0	S247	90.500	87.936	1.664	Open Manhole	1875
S31.010	11.301	141.3	S248	90.000	87.781	1.244	Open Manhole	1875
S31.011	10.961	55.1	S249	89.500	87.565	1.710	Open Manhole	1200
S31.012	48.002	74.9	S250	88.212	86.942	1.045	Open Manhole	1200
S31.013	40.112	78.9	S251	87.000	86.467	0.308	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S28.003	o	750	S251	87.000	85.699	0.551	Open Manhole	1500
S28.004	o	825	S252	87.000	85.410	0.765	Open Manhole	1500
S28.005	o	900	S253	86.500	85.253	0.347	Open Manhole	1800
S28.006	o	225	S254	86.500	85.150	1.050	Open Manhole	1800
S28.007	o	225	S255	85.900	84.951	0.724	Open Manhole	1200
S28.008	o	225	S256	86.943	84.659	2.059	Open Manhole	1200
S28.009	o	225	S257	86.200	82.660	3.315	Open Manhole	1200
S28.010	o	225	S258	83.800	81.273	2.302	Open Manhole	1200
S28.011	o	225	S259	82.500	80.929	1.346	Open Manhole	1200
S21.023	o	225	S260	84.000	75.791	7.984	Open Manhole	1200
S21.024	o	225	S261	76.933	66.712	9.996	Open Manhole	1200
S17.007	o	225	S262	67.500	60.040	7.235	Open Manhole	1200
S17.008	o	225	S263	61.000	58.189	2.586	Open Manhole	1200
S17.009	o	225	S264	59.500	57.645	1.630	Open Manhole	1200
S17.010	o	225	S265	59.000	55.166	3.609	Open Manhole	1200
S17.011	o	225	S266	57.500	49.635	7.640	Open Manhole	1200
S17.012	o	300	S267	51.000	49.412	1.288	Open Manhole	1200
S17.013	o	300	S268	52.000	48.615	3.085	Open Manhole	1200
S17.014	o	300	S269	51.000	48.400	2.300	Open Manhole	1200
S17.015	o	300	S270	49.700	47.901	1.499	Open Manhole	1200
S36.000	o	225	S272	101.000	99.007	1.768	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S28.003	34.911	162.5	S252	87.000	85.485	0.765	Open Manhole	1500
S28.004	67.357	231.5	S253	86.500	85.119	0.556	Open Manhole	1800
S28.005	18.722	302.0	S254	86.500	85.191	0.409	Open Manhole	1800
S28.006	18.454	94.6	S255	85.900	84.955	0.645	Open Manhole	1200
S28.007	27.140	89.0	S256	86.943	84.646	2.072	Open Manhole	1200
S28.008	11.596	84.3	S257	86.200	84.521	1.454	Open Manhole	1200
S28.009	40.752	149.8	S258	83.800	82.388	1.187	Open Manhole	1200
S28.010	27.682	134.9	S259	82.500	81.068	1.207	Open Manhole	1200
S28.011	41.630	106.7	S260	84.000	80.539	3.236	Open Manhole	1200
S21.023	60.240	160.2	S261	76.933	75.415	1.293	Open Manhole	1200
S21.024	86.415	100.0	S262	67.500	65.848	1.427	Open Manhole	1200
S17.007	56.992	91.7	S263	61.000	59.419	1.356	Open Manhole	1200
S17.008	16.171	99.8	S264	59.500	58.027	1.248	Open Manhole	1200
S17.009	7.151	64.6	S265	59.000	57.535	1.240	Open Manhole	1200
S17.010	13.912	100.1	S266	57.500	55.027	2.248	Open Manhole	1200
S17.011	16.923	108.4	S267	51.000	49.479	1.296	Open Manhole	1200
S17.012	90.000	112.9	S268	52.000	48.615	3.085	Open Manhole	1200
S17.013	25.007	116.3	S269	51.000	48.400	2.300	Open Manhole	1200
S17.014	24.634	100.1	S270	49.700	48.154	1.246	Open Manhole	1200
S17.015	16.041	100.3	S271	49.200	47.741	1.159	Open Manhole	0
S36.000	12.970	30.0	S273	100.000	98.575	1.200	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S36.001	o	225	S273	100.000	97.947	1.828	Open Manhole	1200
S36.002	o	225	S274	99.000	97.575	1.200	Open Manhole	1200
S36.003	o	225	S275	98.000	96.116	1.659	Open Manhole	1200
S36.004	o	225	S276	97.000	95.191	1.584	Open Manhole	1200
S36.005	o	300	S277	96.000	94.500	1.200	Open Manhole	1200
S37.000	o	225	S278	100.000	98.575	1.200	Open Manhole	1200
S37.001	o	225	S279	100.000	98.505	1.270	Open Manhole	1200
S37.002	o	225	S280	99.000	97.575	1.200	Open Manhole	1200
S37.003	o	300	S281	98.000	96.500	1.200	Open Manhole	1200
S37.004	o	375	S282	97.000	95.389	1.236	Open Manhole	1200
S37.005	o	375	S283	97.000	95.389	1.236	Open Manhole	1200
S36.006	o	375	S284	96.000	94.251	1.374	Open Manhole	1200
S38.000	o	225	S285	99.000	97.575	1.200	Open Manhole	1200
S38.001	o	225	S286	99.000	97.362	1.413	Open Manhole	1200
S38.002	o	225	S287	99.000	97.322	1.453	Open Manhole	1200
S38.003	o	300	S288	99.000	97.157	1.543	Open Manhole	1200
S38.004	o	300	S289	99.000	93.864	4.836	Open Manhole	1200
S36.007	o	600	S290	95.000	93.200	1.200	Open Manhole	1350
S36.008	o	225	S291	95.000	93.100	1.675	Open Manhole	1350

Future Phase

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S36.001	11.157	30.0	S274	99.000	97.575	1.200	Open Manhole	1200
S36.002	51.847	51.8	S275	98.000	96.575	1.200	Open Manhole	1200
S36.003	16.245	30.0	S276	97.000	95.574	1.201	Open Manhole	1200
S36.004	18.488	30.0	S277	96.000	94.575	1.200	Open Manhole	1200
S36.005	74.206	426.5	S284	96.000	94.326	1.374	Open Manhole	1200
S37.000	20.753	294.4	S279	100.000	98.505	1.270	Open Manhole	1200
S37.001	37.527	40.4	S280	99.000	97.575	1.200	Open Manhole	1200
S37.002	23.824	23.8	S281	98.000	96.575	1.200	Open Manhole	1200
S37.003	64.791	64.8	S282	97.000	95.500	1.200	Open Manhole	1200
S37.004	15.498	425.9	S283	97.000	95.389	1.236	Open Manhole	1200
S37.005	76.404	67.2	S284	96.000	94.251	1.374	Open Manhole	1200
S36.006	75.366	91.2	S290	95.000	93.425	1.200	Open Manhole	1350
S38.000	62.796	294.4	S286	99.000	97.362	1.413	Open Manhole	1200
S38.001	11.759	294.4	S287	99.000	97.322	1.453	Open Manhole	1200
S38.002	26.533	294.4	S288	99.000	97.232	1.543	Open Manhole	1200
S38.003	57.738	426.5	S289	99.000	97.021	1.679	Open Manhole	1200
S38.004	18.215	50.0	S290	95.000	93.500	1.200	Open Manhole	1350
S36.007	10.000	250.0	S291	95.000	93.160	1.240	Open Manhole	1350
S36.008	6.914	40.0	S292	95.000	92.927	1.848	Open Manhole	0

Future Phase

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S39.000	o	225	S293	98.000	96.575	1.200	Open Manhole	1200
S40.000	o	225	S294	99.000	97.550	1.225	Open Manhole	1200
S39.001	o	225	S295	[illegible]	[illegible]	[illegible]	Open Manhole	1200
S41.000	o	225	S296	[illegible]	[illegible]	[illegible]	Open Manhole	1200
S39.002	o	300	S297	97.500	95.179	2.021	Open Manhole	1200
S39.003	o	300	S298	97.300	95.102	1.898	Open Manhole	1200
S39.004	o	225	S299	97.200	94.800	2.175	Open Manhole	1200
S42.000	o	225	S301	105.798	104.373	1.200	Open Manhole	1200
S42.001	o	225	S302	102.514	101.076	1.212	Open Manhole	1200
S42.002	o	300	S303	100.078	98.413	1.365	Open Manhole	1200
S42.003	o	300	S304	99.703	98.006	1.397	Open Manhole	1200
S42.004	o	375	S305	99.920	97.870	1.675	Open Manhole	1200
S42.005	o	375	S306	99.836	97.793	1.667	Open Manhole	1200
S42.006	o	375	S307	98.751	97.076	1.301	Open Manhole	1200
S42.007	o	375	S308	98.065	96.389	1.301	Open Manhole	1200
S42.008	o	375	S309	96.972	95.210	1.387	Open Manhole	1200
S42.009	o	375	S310	96.080	94.321	1.384	Open Manhole	1200
S43.000	o	225	S311	98.900	97.453	1.222	Open Manhole	1200

Future Phase

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S39.000	74.295	200.0	S295	99.000	96.204	2.571	Open Manhole	1200
S40.000	45.817	200.0	S295	99.000	97.321	1.454	Open Manhole	1200
S39.001	68.558	200.0	S297	[illegible]	[illegible]	[illegible]	Open Manhole	1200
S41.000	55.527	200.0	S297	[illegible]	[illegible]	[illegible]	Open Manhole	1200
S39.002	15.379	200.0	S298	97.300	95.102	1.898	Open Manhole	1200
S39.003	46.805	200.0	S299	97.200	94.868	2.032	Open Manhole	1200
S39.004	16.083	201.0	S300	97.000	94.720	2.055	Open Manhole	0
S42.000	88.098	26.7	S302	102.514	101.076	1.212	Open Manhole	1200
S42.001	61.537	23.1	S303	100.078	98.413	1.439	Open Manhole	1200
S42.002	33.986	83.5	S304	99.703	98.006	1.397	Open Manhole	1200
S42.003	20.845	340.5	S305	99.920	97.945	1.675	Open Manhole	1200
S42.004	38.166	500.0	S306	99.836	97.793	1.667	Open Manhole	1200
S42.005	43.215	60.2	S307	98.751	97.076	1.301	Open Manhole	1200
S42.006	27.836	40.5	S308	98.065	96.389	1.301	Open Manhole	1200
S42.007	44.049	37.4	S309	96.972	95.210	1.387	Open Manhole	1200
S42.008	35.992	41.9	S310	96.080	94.350	1.355	Open Manhole	1200
S42.009	30.651	76.0	S335	95.677	93.918	1.384	Open Manhole	1350
S43.000	21.367	104.4	S312	98.800	97.248	1.327	Open Manhole	1200

Future Phase

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S43.001	o	225	S312	98.800	97.248	1.327	Open Manhole	1200
S43.002	o	225	S313	98.700	97.207	1.268	Open Manhole	1200
S43.003	o	225	S314	98.500	97.026	1.249	Open Manhole	1200
S43.004	o	225	S315	98.600	96.395	1.980	Open Manhole	1200
S43.005	o	225	S316	97.700	96.096	1.379	Open Manhole	1200
S43.006	o	225	S317	97.500	96.009	1.266	Open Manhole	1200
S44.000	o	225	S318	102	Future Phase		Open Manhole	1200
S44.001	o	225	S319	102			Open Manhole	1200
S44.002	o	225	S320	101.900	100.446	1.229	Open Manhole	1200
S44.003	o	225	S321	101.800	99.803	1.772	Open Manhole	1200
S44.004	o	300	S322	101.200	99.052	1.848	Open Manhole	1200
S44.005	o	300	S323	100.500	98.897	1.303	Open Manhole	1200
S45.000	o	225	S324	103.000	101.575	1.200	Open Manhole	1200
S45.001	o	300	S325	102.500	100.848	1.352	Open Manhole	1200
S45.002	o	375	S326	101.500	99.603	1.522	Open Manhole	1200
S45.003	o	375	S327	101.219	98.931	1.913	Open Manhole	1200
S44.006	o	375	S328	100.390	98.203	1.812	Open Manhole	1200
S44.007	o	375	S329	99.129	97.100	1.654	Open Manhole	1200
S44.008	o	375	S330	98.337	96.194	1.768	Open Manhole	1200
S43.007	o	450	S331	97.191	95.115	1.626	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S43.001	12.202	297.6	S313	98.700	97.207	1.268	Open Manhole	1200
S43.002	25.034	138.5	S314	98.500	97.026	1.249	Open Manhole	1200
S43.003	9.000	300.0	S315	98.600	96.996	1.379	Open Manhole	1200
S43.004	38.609	276.3	S316	97.700	96.256	1.219	Open Manhole	1200
S43.005	17.507	200.1	S317	97.500	96.009	1.266	Open Manhole	1200
S43.006	19.658	46.4	S331	97.191	95.585	1.380	Open Manhole	1200
S44.000	29.527	183.0	S319	10	Future Phase		Open Manhole	1200
S44.001	26.594	209.7	S320	10			Open Manhole	1200
S44.002	21.476	185.2	S321	101.800	100.330	1.245	Open Manhole	1200
S44.003	14.929	200.0	S322	101.200	99.728	1.247	Open Manhole	1200
S44.004	38.671	250.0	S323	100.500	98.897	1.303	Open Manhole	1200
S44.005	15.818	55.9	S328	100.390	98.614	1.476	Open Manhole	1200
S45.000	32.770	45.1	S325	102.500	100.848	1.427	Open Manhole	1200
S45.001	53.123	45.4	S326	101.500	99.678	1.522	Open Manhole	1200
S45.002	30.750	212.8	S327	101.219	99.458	1.386	Open Manhole	1200
S45.003	37.923	184.6	S328	100.390	98.726	1.290	Open Manhole	1200
S44.006	32.429	50.0	S329	99.129	97.554	1.200	Open Manhole	1200
S44.007	20.126	48.5	S330	98.337	96.685	1.277	Open Manhole	1200
S44.008	28.908	50.0	S331	97.191	95.616	1.200	Open Manhole	1200
S43.007	22.508	201.8	S332	96.667	95.003	1.214	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S43.008	o	450	S332	96.667	94.720	1.497	Open Manhole	1200
S43.009	o	525	S333	96.370	94.467	1.378	Open Manhole	1350
S43.010	o	450	S334	96.170	94.004	1.716	Open Manhole	1350
S42.010	o	525	S335	95.677	93.716	1.436	Open Manhole	1350
S46.000	o	225	S337	105.788	104.314	1.249	Open Manhole	1200
S46.001	o	225	S338	104.667	103.073	1.369	Open Manhole	1200
S46.002	o	300	S339	103.559	101.642	1.617	Open Manhole	1200
S46.003	o	300	S340	103.000	101.485	1.215	Open Manhole	1200
S46.004	o	300	S341	103.000	101.005	1.695	Open Manhole	1200
S46.005	o	300	S342	102.500	100.089	2.111	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S43.008	29.071	163.5	S333	96.370	94.542	1.378	Open Manhole	1350
S43.009	20.597	250.0	S334	96.170	94.385	1.261	Open Manhole	1350
S43.010	47.998	224.8	S335	95.677	93.791	1.436	Open Manhole	1350
S42.010	17.325	199.1	S336	96.407	93.629	2.253	Open Manhole	0
S46.000	70.901	57.1	S338	104.667	103.073	1.369	Open Manhole	1200
S46.001	69.921	61.3	S339	103.559	101.933	1.401	Open Manhole	1200
S46.002	42.151	268.8	S340	103.000	101.485	1.215	Open Manhole	1200
S46.003	62.302	131.2	S341	103.000	101.011	1.689	Open Manhole	1200
S46.004	25.619	49.0	S342	102.500	100.483	1.717	Open Manhole	1200
S46.005	16.722	40.0	S343	101.000	99.671	1.029	Open Manhole	0

Appendix F. Storage Structures

F.1. Model Outputs

Storage Structures for Storm

Tank or Pond Manhole: S10, DS/PN: S2.001

Invert Level (m) 76.850

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	1.000	100.0

Attenuation Tank B

Tank or Pond Manhole: S26, DS/PN: S2.007

Invert Level (m) 71.226

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	400.0	1.000	400.0

Attenuation Tank C

Tank or Pond Manhole: S39, DS/PN: S6.001

Invert Level (m) 73.883

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1833.3	1.200	1833.3

Future Phase

Tank or Pond Manhole: S87, DS/PN: S1.033

Invert Level (m) 31.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2200.0	1.000	2700.0

Attenuation Pond 4

Tank or Pond Manhole: S117, DS/PN: S11.004

Invert Level (m) 91.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1333.3	1.200	1333.3

Future Phase

Tank or Pond Manhole: S138, DS/PN: S17.005

Invert Level (m) 68.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	516.7	1.200	516.7

Attenuation Tank A

Tank or Pond Manhole: S189, DS/PN: S21.012

Invert Level (m) 86.623

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1210.0	0.100	1210.0	0.200	1210.0	0.300	1210.0

Forebay prior to Pond 2

Tank or Pond Manhole: S196, DS/PN: S21.019

Invert Level (m) 85.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1122.2	0.600	1122.0

Attenuation Pond 2

Tank or Pond Manhole: S199, DS/PN: S21.022

Invert Level (m) 83.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3125.0	0.600	3125.0

Attenuation Pond 1

Tank or Pond Manhole: S248, DS/PN: S31.011

Invert Level (m) 87.764

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2416.6	1.200	2416.6

Future Phase

Tank or Pond Manhole: S254, DS/PN: S28.006

Invert Level (m) 85.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1066.1	0.600	1362.0

Attenuation Pond 3

Tank or Pond Manhole: S291, DS/PN: S36.008

Invert Level (m) 93.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	366.6	1.200	366.6

Future Phase

Tank or Pond Manhole: S299, DS/PN: S39.004

Invert Level (m) 94.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	83.3	1.200	83.3

Future Phase

F.2. Underground Modular System Sizing Calculator

HydroChamber Calculator VR10

Issue Date: 11/11/08

Note: The Calculator can be updated at any time without prior notification. Please check with JFC for most recent publication

Input

Target Storage Capacity (m³)	620
Foundation Stone Under Chambers (mm)	200
Distribution Pipe Diameter (mm)	300
Number of Chambers Wide	14.00
Number of Chambers Long Indication	17.71
Number of Chambers Long rounded up	18.00
Estimated Porosity of Stone	0.4

Output

Actual Volume of Storage Provided (m³)	624.38
Total Width of Excavation (m)	22.06
Total Length of Excavation (m)	40.50
Estimated Stone Requirement (Tons)	1209
Actual No. of Chambers Required	252
Actaul No. of Endcaps Required	28

Instructions

- Enter target storage capacity
- Select proposed foundation depth
- Select distribution pipe diameter
- Enter number of chambers wide to provide the required excavation width
- Modify number of chambers long to achieve the required actual storage volume.
- The number of chambers wide and long may be modified along with the foundation depth to provide the storage volume required within width and length constraints

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CERTIFICATE No 08/4601

WRc APPROVED
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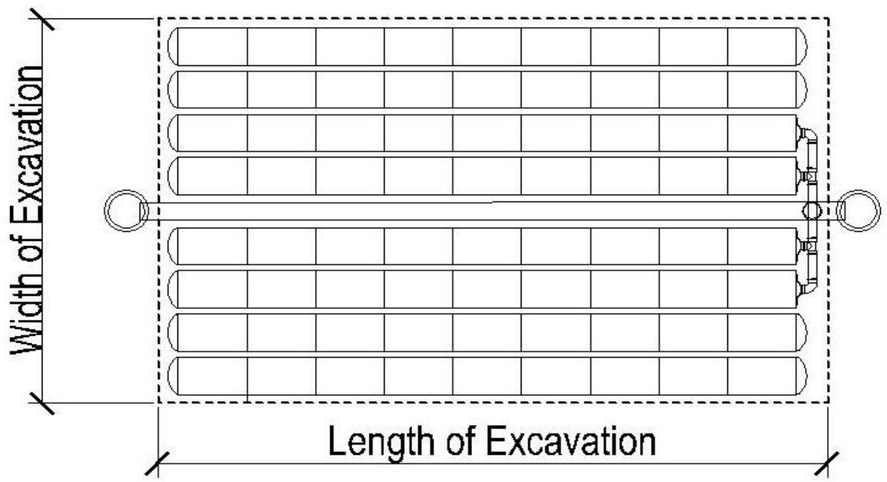
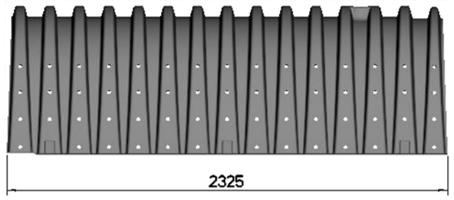
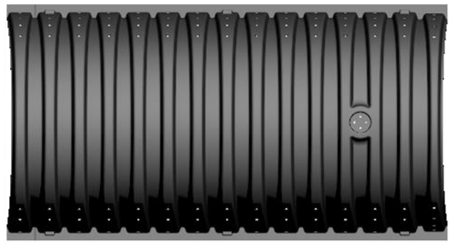
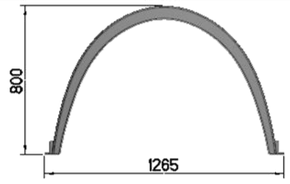
Sample Layout









HydroChamber 800 Specification

Overall Dimensions (mm): 2325 X 1265 X800

Installed Dimensions (mm): 2175 X 1265 X 800

Nominal Chamber Storage (m³): 1.40

System Storage* (m³): 2.1—2.8 m³ / Chamber

Lateral Flow : 114 Holes of Ø20mm

*** System storage is dependent upon foundation depth, distribution pipe diameter and porosity of stone aggregate. A minimum stone height above the crown of the chambers of 150mm is assumed. See HydroChamber design manual more details.**

HydroChamber Calculator VR10

Issue Date: 11/11/08

Note: The Calculator can be updated at any time without prior notification. Please check with JFC for most recent publication

Input

Target Storage Capacity (m³)	100
Foundation Stone Under Chambers (mm)	175
Distribution Pipe Diameter (mm)	300
Number of Chambers Wide	4.00
Number of Chambers Long Indication	10.25
Number of Chambers Long rounded up	9.00
Estimated Porosity of Stone	0.4

Output

Actual Volume of Storage Provided (m³)	100.90
Total Width of Excavation (m)	7.41
Total Length of Excavation (m)	20.93
Estimated Stone Requirement (Tons)	221
Actual No. of Chambers Required	36
Actaul No. of Endcaps Required	8

Instructions

- Enter target storage capacity
- Select proposed foundation depth
- Select distribution pipe diameter
- Enter number of chambers wide to provide the required excavation width
- Modify number of chambers long to achieve the required actual storage volume.
- The number of chambers wide and long may be modified along with the foundation depth to provide the storage volume required within width and length constraints

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CERTIFICATE No 08/4601

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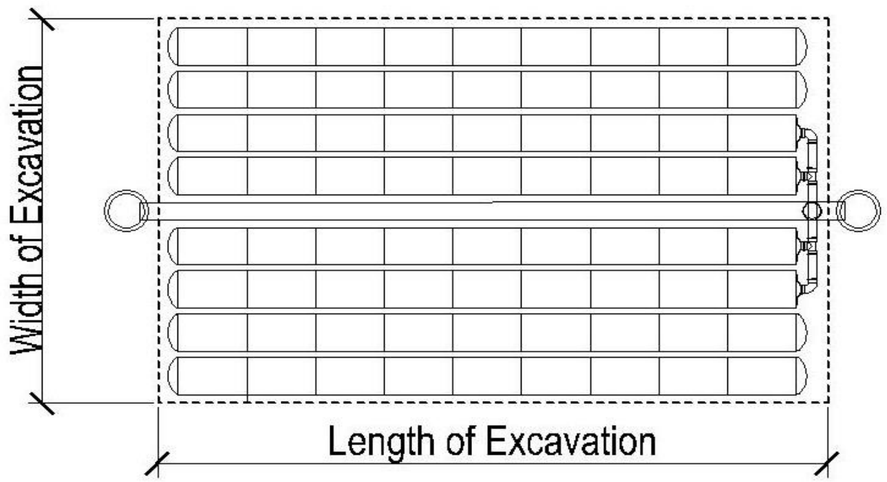
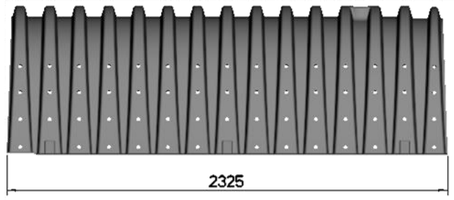
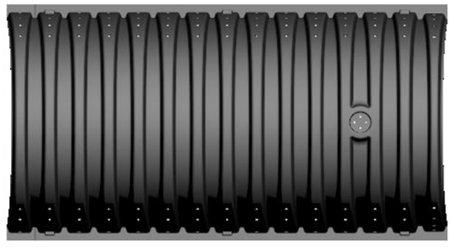
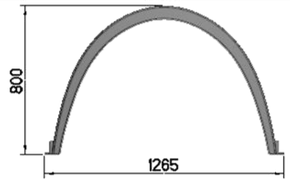
Certificate No. PT/273/0608

Sample Layout









HydroChamber 800 Specification

Overall Dimensions (mm): 2325 X 1265 X800

Installed Dimensions (mm): 2175 X 1265 X 800

Nominal Chamber Storage (m³): 1.40

System Storage* (m³): 2.1—2.8 m³ / Chamber

Lateral Flow : 114 Holes of Ø20mm

*** System storage is dependent upon foundation depth, distribution pipe diameter and porosity of stone aggregate. A minimum stone height above the crown of the chambers of 150mm is assumed. See HydroChamber design manual more details.**

HydroChamber Calculator VR10

Issue Date: 11/11/08

Note: The Calculator can be updated at any time without prior notification. Please check with JFC for most recent publication

Input

Target Storage Capacity (m³)	400
Foundation Stone Under Chambers (mm)	375
Distribution Pipe Diameter (mm)	300
Number of Chambers Wide	9.00
Number of Chambers Long Indication	16.67
Number of Chambers Long rounded up	16.00
Estimated Porosity of Stone	0.4

Output

Actual Volume of Storage Provided (m³)	404.81
Total Width of Excavation (m)	14.74
Total Length of Excavation (m)	36.15
Estimated Stone Requirement (Tons)	903
Actual No. of Chambers Required	144
Actaul No. of Endcaps Required	18

Instructions

- Enter target storage capacity
- Select proposed foundation depth
- Select distribution pipe diameter
- Enter number of chambers wide to provide the required excavation width
- Modify number of chambers long to achieve the required actual storage volume.
- The number of chambers wide and long may be modified along with the foundation depth to provide the storage volume required within width and length constraints

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CERTIFICATE No 08/4601

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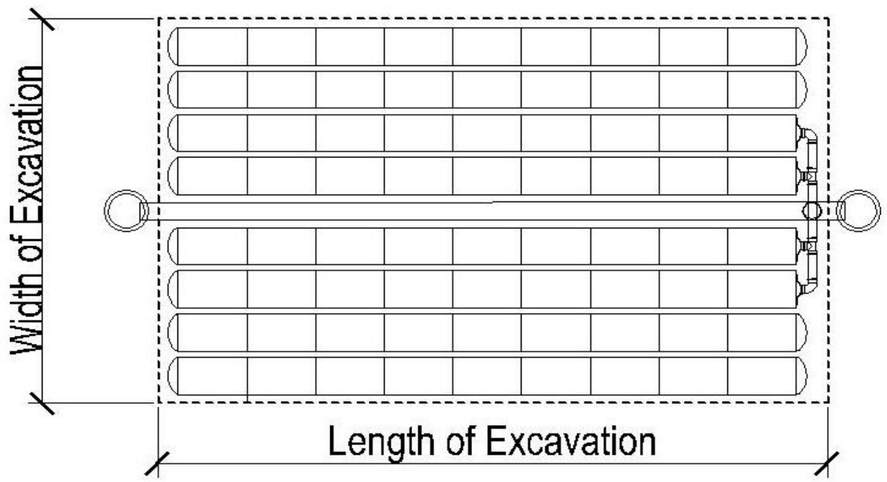
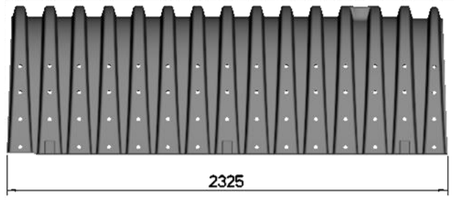
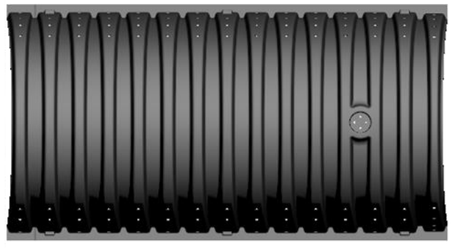
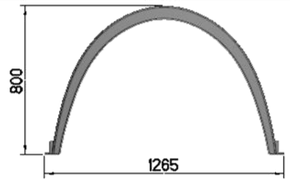
Sample Layout









HydroChamber 800 Specification

Overall Dimensions (mm): 2325 X 1265 X800

Installed Dimensions (mm): 2175 X 1265 X 800

Nominal Chamber Storage (m³): 1.40

System Storage* (m³): 2.1—2.8 m³ / Chamber

Lateral Flow : 114 Holes of Ø20mm

*** System storage is dependent upon foundation depth, distribution pipe diameter and porosity of stone aggregate. A minimum stone height above the crown of the chambers of 150mm is assumed. See HydroChamber design manual more details.**

Appendix G. Online Controls

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S10, DS/PN: S2.001, Volume (m³): 7.5

Unit Reference	MD-SHE-0199-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	199
Invert Level (m)	76.850
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	20.0	Kick-Flo®	0.721	17.1
Flush-Flo™	0.340	20.0	Mean Flow over Head Range	-	16.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	0.800	18.0	2.000	27.8	4.000	38.9	7.000	51.0
0.200	18.7	1.000	20.0	2.200	29.1	4.500	41.1	7.500	52.7
0.300	19.9	1.200	21.8	2.400	30.4	5.000	43.3	8.000	54.4
0.400	19.9	1.400	23.5	2.600	31.6	5.500	45.3	8.500	56.0
0.500	19.5	1.600	25.0	3.000	33.8	6.000	47.3	9.000	57.6
0.600	19.0	1.800	26.5	3.500	36.4	6.500	49.2	9.500	59.1

Hydro-Brake® Optimum Manhole: S26, DS/PN: S2.007, Volume (m³): 5.6

Unit Reference	MD-SHE-0359-8000-1000-8000
Design Head (m)	1.000
Design Flow (l/s)	80.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	359
Invert Level (m)	71.200
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	80.0	Kick-Flo®	0.827	73.0
Flush-Flo™	0.516	80.0	Mean Flow over Head Range	-	62.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.3	0.300	67.2	0.500	80.0	0.800	74.3	1.200	87.4
0.200	36.1	0.400	78.8	0.600	79.5	1.000	80.0	1.400	94.2

Hydro-Brake® Optimum Manhole: S26, DS/PN: S2.007, Volume (m³): 5.6

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.600	100.5	2.400	122.4	4.000	157.1	6.000	191.6	8.000	220.6
1.800	106.4	2.600	127.3	4.500	166.4	6.500	199.2	8.500	227.3
2.000	112.0	3.000	136.5	5.000	175.2	7.000	206.6	9.000	233.7
2.200	117.3	3.500	147.2	5.500	183.6	7.500	213.7	9.500	240.0

Hydro-Brake® Optimum Manhole: S39, DS/PN: S6.001, Volume (m³): 7.9

Unit Reference	MD-SHE-0071-2000-0700-2000
Design Head (m)	0.700
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	71
Invert Level (m)	73.883
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	2.0	Kick-Flo®	0.450	1.6
Flush-Flo™	0.207	2.0	Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.1	2.000	3.2	4.000	4.5	7.000	5.8
0.200	2.0	1.000	2.4	2.200	3.4	4.500	4.7	7.500	6.0
0.300	2.0	1.200	2.6	2.400	3.5	5.000	5.0	8.000	6.2
0.400	1.8	1.400	2.7	2.600	3.7	5.500	5.2	8.500	6.4
0.500	1.7	1.600	2.9	3.000	3.9	6.000	5.4	9.000	6.6
0.600	1.9	1.800	3.1	3.500	4.2	6.500	5.6	9.500	6.8

Hydro-Brake® Optimum Manhole: S87, DS/PN: S1.033, Volume (m³): 14.4

Unit Reference	MD-SHE-0315-6000-1200-6000
Design Head (m)	1.200
Design Flow (l/s)	63.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	315
Invert Level (m)	31.400
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.20	63.5	Kick-Flo®	0.912	52.6
Flush-Flo™	0.490	63.5	Mean Flow over Head Range	-	49.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Hydro-Brake® Optimum Manhole: S87, DS/PN: S1.033, Volume (m³): 14.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.5	0.800	56.5	2.000	76.8	4.000	107.6	7.000	141.4
0.200	32.3	1.000	54.9	2.200	80.4	4.500	113.9	7.500	146.2
0.300	56.4	1.200	63.5	2.400	83.9	5.000	120.0	8.000	150.9
0.400	59.5	1.400	64.6	2.600	87.2	5.500	125.7	8.500	155.5
0.500	60.0	1.600	68.9	3.000	93.5	6.000	131.1	9.000	159.9
0.600	59.5	1.800	73.0	3.500	100.8	6.500	136.4	9.500	164.2

Hydro-Brake® Optimum Manhole: S117, DS/PN: S11.004, Volume (m³): 5.9

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	91.900
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

Hydro-Brake® Optimum Manhole: S138, DS/PN: S17.005, Volume (m³): 3.5

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	68.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.3	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

Hydro-Brake® Optimum Manhole: S138, DS/PN: S17.005, Volume (m³): 3.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.7	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.8	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.3	2.400	2.9	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.4	2.600	3.0	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.5	3.000	3.1	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.6	3.500	3.3	6.500	4.4	9.500	5.2

Hydro-Brake® Optimum Manhole: S196, DS/PN: S21.019, Volume (m³): 8.7

Unit Reference	MD-SHE-0432-1200-0700-1200
Design Head (m)	0.700
Design Flow (l/s)	120.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	432
Invert Level (m)	85.650
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	119.6	Kick-Flo®	0.673	117.4
Flush-Flo™	0.547	119.6	Mean Flow over Head Range	-	78.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.5	0.800	127.6	2.000	199.5	4.000	280.3	7.000	369.1
0.200	41.7	1.000	142.2	2.200	209.1	4.500	297.0	7.500	376.6
0.300	82.1	1.200	155.5	2.400	218.2	5.000	312.8	8.000	389.3
0.400	116.0	1.400	167.6	2.600	226.9	5.500	327.8	8.500	401.6
0.500	119.2	1.600	178.9	3.000	243.4	6.000	342.1	9.000	413.6
0.600	119.2	1.800	189.5	3.500	262.5	6.500	355.9	9.500	425.2

Hydro-Brake® Optimum Manhole: S199, DS/PN: S21.022, Volume (m³): 5.4

Unit Reference	MD-SHE-0393-9600-0700-9600
Design Head (m)	0.700
Design Flow (l/s)	96.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	393
Invert Level (m)	83.300
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	2100

Hydro-Brake® Optimum Manhole: S199, DS/PN: S21.022, Volume (m³): 5.4

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	95.9	Kick-Flo®	0.656	92.9
Flush-Flo™	0.505	95.8	Mean Flow over Head Range	-	65.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.9	0.800	102.3	2.000	159.9	4.000	224.5	7.000	295.6
0.200	38.9	1.000	114.1	2.200	167.5	4.500	237.9	7.500	302.0
0.300	74.7	1.200	124.6	2.400	174.8	5.000	250.5	8.000	312.1
0.400	94.2	1.400	134.4	2.600	181.8	5.500	262.5	8.500	322.0
0.500	95.8	1.600	143.4	3.000	195.0	6.000	274.0	9.000	331.5
0.600	94.6	1.800	151.9	3.500	210.3	6.500	285.0	9.500	340.8

Hydro-Brake® Optimum Manhole: S248, DS/PN: S31.011, Volume (m³): 13.2

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	87.764
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

Hydro-Brake® Optimum Manhole: S254, DS/PN: S28.006, Volume (m³): 14.2

Unit Reference	MD-SHE-0073-2000-0600-2000
Design Head (m)	0.600
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	73

Hydro-Brake® Optimum Manhole: S254, DS/PN: S28.006, Volume (m³): 14.2

Invert Level (m)	85.150
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	2.0	Kick-Flo®	0.397	1.7
Flush-Flo™	0.177	2.0	Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	0.800	2.3	2.000	3.5	4.000	4.8	7.000	6.3
0.200	2.0	1.000	2.5	2.200	3.6	4.500	5.1	7.500	6.5
0.300	1.9	1.200	2.7	2.400	3.8	5.000	5.3	8.000	6.7
0.400	1.7	1.400	2.9	2.600	3.9	5.500	5.6	8.500	6.9
0.500	1.8	1.600	3.1	3.000	4.2	6.000	5.8	9.000	7.1
0.600	2.0	1.800	3.3	3.500	4.5	6.500	6.0	9.500	7.3

Hydro-Brake® Optimum Manhole: S291, DS/PN: S36.008, Volume (m³): 5.2

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	93.100
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

Hydro-Brake® Optimum Manhole: S299, DS/PN: S39.004, Volume (m³): 5.9

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated

Hydro-Brake® Optimum Manhole: S299, DS/PN: S39.004, Volume (m³): 5.9

Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	94.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

Appendix H. Summary of Results

H.1. Results Status Description

OK when the maximum water level is lower than the pipe's soffit.

SURCHARGED when the maximum water level is above the pipe's soffit and to within 300mm of the manhole cover level. (Allowable for 1 in 30 year storm events and greater in accordance with the GDSDS, refer to table 2-1)

FLOOD RISK when the maximum water level is above the pipe's soffit but below the manhole cover by the depth specified in the Preferences.

FLOOD when the maximum water level is above the manhole cover (No Flooding has been indicated within Summary of Results for up to the 1 in 100 year storm event)

H.2. 1 in 100-year Outputs

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	3.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 12 Number of Storage Structures 13 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.269
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

As per Met Eireann Information

up to 6 hour event as per GDSDS

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	100
Climate Change (%)	20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	100	+20%					84.311	-0.124
S1.001	S2	15 Winter	100	+20%					83.041	-0.074
S1.002	S3	15 Winter	100	+20%	100/15 Summer				81.233	1.367
S1.003	S4	15 Winter	100	+20%	100/15 Summer				75.776	0.522
S1.004	S5	15 Winter	100	+20%	100/15 Summer				73.469	0.705
S2.000	S6	15 Winter	100	+20%					79.351	-0.115
S3.000	S7	15 Winter	100	+20%	100/15 Summer				79.933	0.406
S3.001	S8	15 Winter	100	+20%	100/15 Summer				79.409	0.251
S3.002	S9	15 Winter	100	+20%	100/15 Summer				79.133	0.182
S2.001	S10	120 Winter	100	+20%	100/15 Summer				79.067	1.992
S2.002	S11	15 Winter	100	+20%	100/15 Summer				74.759	0.096
S2.003	S12	15 Winter	100	+20%	100/15 Summer				74.268	0.350
S4.000	S13	15 Winter	100	+20%	100/15 Summer				76.724	1.224
S2.004	S14	15 Winter	100	+20%	100/15 Summer				74.005	0.403
S2.005	S15	15 Winter	100	+20%	100/15 Summer				73.611	0.124
S5.000	S16	15 Winter	100	+20%	100/15 Summer				78.144	1.024
S5.001	S17	15 Winter	100	+20%	100/15 Summer				77.115	0.483
S5.002	S18	15 Winter	100	+20%	100/15 Summer				76.500	0.075
S5.003	S19	15 Winter	100	+20%					75.887	-0.076
S5.004	S20	15 Winter	100	+20%	100/15 Summer				75.402	0.267
S5.005	S21	15 Winter	100	+20%	100/15 Summer				74.708	0.524
S5.006	S22	15 Winter	100	+20%	100/15 Summer				73.825	0.721
S5.007	S23	15 Winter	100	+20%	100/15 Summer				73.337	1.286
S5.008	S24	30 Winter	100	+20%	100/15 Summer				72.888	1.113
S2.006	S25	30 Winter	100	+20%	100/15 Summer				72.505	0.807
S2.007	S26	120 Winter	100	+20%	100/15 Summer				72.391	0.816
S2.008	S27	30 Winter	100	+20%	100/15 Summer				71.692	0.567
S2.009	S28	30 Winter	100	+20%	100/15 Summer				71.667	0.582
S2.010	S29	30 Winter	100	+20%	100/15 Summer				71.632	0.732
S2.011	S30	30 Winter	100	+20%	100/15 Summer				71.569	1.094

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.42		38.4	OK	
S1.001	S2	0.000	0.82		169.0	OK	
S1.002	S3	0.000	1.19		243.7	FLOOD RISK	
S1.003	S4	0.000	1.01		305.0	SURCHARGED	
S1.004	S5	0.000	1.23		362.9	SURCHARGED	
S2.000	S6	0.000	0.70		108.0	OK	
S3.000	S7	0.000	1.22		67.7	SURCHARGED	
S3.001	S8	0.000	1.16		72.9	SURCHARGED	
S3.002	S9	0.000	1.13		84.2	SURCHARGED	
S2.001	S10	0.000	0.36		29.2	SURCHARGED	
S2.002	S11	0.000	0.82		131.2	SURCHARGED	
S2.003	S12	0.000	1.22		130.5	SURCHARGED	
S4.000	S13	0.000	1.26		99.4	FLOOD RISK	
S2.004	S14	0.000	1.83		243.1	SURCHARGED	
S2.005	S15	0.000	1.25		243.9	SURCHARGED	
S5.000	S16	0.000	1.57		85.3	FLOOD RISK	
S5.001	S17	0.000	1.72		105.0	SURCHARGED	
S5.002	S18	0.000	1.08		130.4	SURCHARGED	
S5.003	S19	0.000	0.83		149.0	OK	
S5.004	S20	0.000	0.88		162.5	SURCHARGED	
S5.005	S21	0.000	0.91		173.8	SURCHARGED	
S5.006	S22	0.000	0.71		210.5	SURCHARGED	
S5.007	S23	0.000	1.28		222.6	FLOOD RISK	
S5.008	S24	0.000	1.61		208.6	SURCHARGED	
S2.006	S25	0.000	3.05		465.4	SURCHARGED	
S2.007	S26	0.000	0.57		84.5	SURCHARGED	
S2.008	S27	0.000	1.72		97.8	SURCHARGED	
S2.009	S28	0.000	1.00		104.6	SURCHARGED	
S2.010	S29	0.000	1.05		110.8	SURCHARGED	
S2.011	S30	0.000	1.04		142.6	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S2.012	S31	30 Winter	100	+20%	100/15 Summer				71.510
S1.005	S32	30 Winter	100	+20%	100/15 Summer				71.480
S1.006	S33	30 Winter	100	+20%	100/15 Summer				71.202
S1.007	S34	30 Winter	100	+20%	100/15 Summer				70.912
S1.008	S35	30 Winter	100	+20%	100/15 Summer				70.613
S1.009	S36	30 Winter	100	+20%	100/15 Summer				69.724
S1.010	S37	30 Winter	100	+20%	100/15 Summer				68.889
S6.000	S38	15 Winter	100	+20%	100/15 Summer				77.644
S6.001	S39	360 Winter	100	+	Future Phase				75.094
S6.002	S40	360 Winter	100	+					72.250
S6.003	S41	360 Winter	100	+20%					69.114
S1.011	S42	30 Winter	100	+20%					68.508
S1.012	S43	30 Winter	100	+20%					67.064
S1.013	S44	30 Winter	100	+20%					65.024
S1.014	S45	30 Winter	100	+20%					63.105
S1.015	S46	30 Winter	100	+20%					61.128
S1.016	S47	30 Winter	100	+20%					57.914
S1.017	S48	30 Winter	100	+20%					54.971
S1.018	S49	30 Winter	100	+20%					54.122
S1.019	S50	30 Winter	100	+20%					49.732
S1.020	S51	30 Winter	100	+20%	100/15 Summer				49.522
S1.021	S52	30 Winter	100	+20%	100/15 Summer				48.992
S1.022	S53	30 Winter	100	+20%	100/15 Summer				44.310
S1.023	S54	30 Winter	100	+20%	100/15 Summer				41.364
S1.024	S55	30 Winter	100	+20%	100/15 Summer				38.662
S7.000	S56	15 Winter	100	+20%					68.684
S7.001	S57	15 Summer	100	+20%					67.997
S7.002	S58	15 Summer	100	+20%					67.666
S7.003	S59	15 Summer	100	+20%					66.868
S7.004	S60	15 Winter	100	+20%					65.457
S7.005	S61	15 Winter	100	+20%					64.258
S8.000	S62	15 Winter	100	+20%	100/15 Summer				65.226
S8.001	S63	15 Winter	100	+20%	100/15 Summer				65.229
S8.002	S64	15 Winter	100	+20%	100/15 Summer				64.587
S7.006	S65	15 Winter	100	+20%	100/15 Summer				62.046
S7.007	S66	15 Winter	100	+20%	100/15 Summer				60.824
S7.008	S67	15 Winter	100	+20%	100/15 Summer				59.281
S7.009	S68	15 Winter	100	+20%	100/15 Summer				57.945
S7.010	S69	15 Winter	100	+20%	100/15 Summer				52.003
S7.011	S70	15 Winter	100	+20%	100/15 Summer				49.846
S7.012	S71	15 Winter	100	+20%	100/15 Summer				48.531
S7.013	S72	15 Winter	100	+20%	100/15 Summer				47.194
S7.014	S73	15 Winter	100	+20%	100/15 Summer				46.507
S9.000	S74	15 Winter	100	+20%					49.472
S7.015	S75	15 Winter	100	+20%	100/15 Summer				44.362
S10.000	S76	15 Winter	100	+20%					45.412
S7.016	S77	15 Winter	100	+20%	100/15 Summer				40.782
S7.017	S78	30 Winter	100	+20%	100/15 Summer				38.922
S1.025	S79	30 Winter	100	+20%	100/15 Summer				37.892
S1.026	S80	30 Winter	100	+20%	100/15 Summer				36.948
S1.027	S81	30 Winter	100	+20%	100/15 Summer				36.008
S1.028	S82	30 Winter	100	+20%	100/15 Summer				35.377
S1.029	S83	30 Winter	100	+20%	100/15 Summer				34.746
S1.030	S84	30 Winter	100	+20%	100/15 Summer				34.115
S1.031	S85	30 Winter	100	+20%	100/15 Summer				33.484
S1.032	S86	360 Winter	100	+20%	100/15 Summer				33.087

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S2.012	S31	1.235	0.000	1.25		154.3	SURCHARGED	
S1.005	S32	1.362	0.000	3.02		413.5	SURCHARGED	
S1.006	S33	1.449	0.000	1.67		414.3	SURCHARGED	
S1.007	S34	1.419	0.000	1.69		419.8	SURCHARGED	
S1.008	S35	1.246	0.000	1.64		443.9	SURCHARGED	
S1.009	S36	0.682	0.000	1.37		470.1	SURCHARGED	
S1.010	S37	0.296	0.000	1.91		474.1	SURCHARGED	
S6.000	S38	1.159	0.000	2.97		1451.8	SURCHARGED	
S6.001	S39	0.911				2.6	SURCHARGED	
S6.002	S40	-0.278	Future Phase			2.6	OK	
S6.003	S41	-0.274	0.000	0.02		2.6	OK	
S1.011	S42	0.000	0.000	1.02		473.4	OK	
S1.012	S43	-0.254	0.000	0.70		483.1	OK	
S1.013	S44	-0.256	0.000	0.70		496.3	OK	
S1.014	S45	-0.267	0.000	0.67		510.2	OK	
S1.015	S46	-0.231	0.000	0.76		524.0	OK	
S1.016	S47	-0.273	0.000	0.66		554.1	OK	
S1.017	S48	-0.194	0.000	0.84		565.5	OK	
S1.018	S49	-0.152	0.000	0.95		575.4	OK	
S1.019	S50	-0.304	0.000	0.55		602.7	OK	
S1.020	S51	0.297	0.000	1.03		1081.9	SURCHARGED	
S1.021	S52	0.267	0.000	1.65		1083.0	SURCHARGED	
S1.022	S53	0.210	0.000	1.41		1101.5	SURCHARGED	
S1.023	S54	0.158	0.000	1.28		1101.2	SURCHARGED	
S1.024	S55	0.222	0.000	1.45		1099.8	SURCHARGED	
S7.000	S56	-0.188	0.000	0.07		5.5	OK	
S7.001	S57	-0.168	0.000	0.14		8.3	OK	
S7.002	S58	-0.155	0.000	0.21		10.3	OK	
S7.003	S59	-0.153	0.000	0.22		19.4	OK	
S7.004	S60	-0.132	0.000	0.36		31.2	OK	
S7.005	S61	-0.054	0.000	0.93		80.7	OK	
S8.000	S62	1.137	0.000	0.17		8.2	FLOOD RISK	
S8.001	S63	1.260	0.000	1.14		117.1	FLOOD RISK	
S8.002	S64	1.176	0.000	2.07		215.0	FLOOD RISK	
S7.006	S65	0.348	0.000	1.23		300.6	SURCHARGED	
S7.007	S66	1.261	0.000	1.67		399.2	SURCHARGED	
S7.008	S67	1.425	0.000	1.73		404.8	SURCHARGED	
S7.009	S68	1.121	0.000	2.24		460.7	SURCHARGED	
S7.010	S69	1.011	0.000	1.96		460.8	SURCHARGED	
S7.011	S70	1.909	0.000	2.80		455.8	SURCHARGED	
S7.012	S71	2.653	0.000	3.07		454.8	SURCHARGED	
S7.013	S72	1.534	0.000	3.14		452.0	FLOOD RISK	
S7.014	S73	0.916	0.000	3.52		451.5	SURCHARGED	
S9.000	S74	-0.128	0.000	0.39		43.6	OK	
S7.015	S75	0.575	0.000	1.43		464.9	SURCHARGED	
S10.000	S76	-0.122	0.000	0.43		43.6	OK	
S7.016	S77	0.547	0.000	1.41		477.3	SURCHARGED	
S7.017	S78	0.507	0.000	1.23		458.6	SURCHARGED	
S1.025	S79	1.815	0.000	2.02		1516.8	SURCHARGED	
S1.026	S80	2.998	0.000	2.03		1519.0	FLOOD RISK	
S1.027	S81	2.424	8.099	1.96		1511.1	FLOOD	1
S1.028	S82	2.283	0.000	1.96		1508.9	FLOOD RISK	
S1.029	S83	1.744	0.000	1.96		1504.9	FLOOD RISK	
S1.030	S84	1.277	0.000	1.58		1505.0	SURCHARGED	
S1.031	S85	0.899	0.000	1.81		1504.9	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.032	S86	0.695	0.000	0.72		551.5	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.033	S87	360 Winter	100	+20%	100/15 Summer				33.081	1.306
S1.034	S88	360 Winter	100	+20%					25.046	-0.171
S1.035	S89	360 Winter	100	+20%					24.108	-0.170
S1.036	S90	360 Winter	100	+20%					22.938	-0.170
S11.000	S92	15 Winter	100	+20%	100/15 Summer				95.753	0.953
S12.000	S93	15 Winter	100	+20%					98.772	-0.028
S12.001	S94	15 Winter	100	+20%	100/15 Summer				98.541	0.741
S13.000	S95	15 Winter	100	+20%					101.484	-0.106
S13.001	S96	15 Winter	100	+20%	100/15 Summer				100.154	1.707
S13.002	S97	15 Winter	100	+20%	100/15 Summer				98.311	0.969
S12.002	S98	15 Winter	100	+20%	100/15 Summer				98.071	1.323
S14.000	S99	15 Winter	100	+20%	100/15 Summer				97.338	0.645
S12.003	S100	15 Winter	100	+20%	100/15 Summer				97.021	0.751
S12.004	S101	15 Winter	100	+20%	100/15 Summer				96.080	1.478
S11.001	S102	15 Winter	100	+20%					95.547	1.169
S15.000	S103	15 Winter	100	+20%					97.945	0.369
S15.001	S104	15 Winter	100	+20%	100/15 Summer				96.983	0.583
S15.002	S105	15 Winter	100	+20%	100/15 Summer				96.658	0.358
S15.003	S106	15 Winter	100	+20%					95.765	-0.035
S15.004	S107	15 Winter	100	+20%	100/15 Summer				95.505	0.144
S15.005	S108	15 Winter	100	+20%	100/15 Summer				95.142	0.273
S15.006	S109	15 Winter	100	+20%	100/15 Summer				94.523	0.392
S11.002	S110	15 Winter	100	+20%	100/15 Summer				93.852	0.601
S16.000	S111	15 Winter	100	+20%	100/15 Summer				96.987	0.313
S16.001	S112	15 Winter	100	+20%	100/15 Summer				96.383	0.277
S16.002	S113	15 Winter	100	+20%	100/15 Summer				95.186	0.401
S16.003	S114	15 Winter	100	+20%	100/15 Summer				94.446	0.672
S16.004	S115	15 Winter	100	+20%	100/15 Summer				93.373	0.394
S11.003	S116	360 Winter	100	+20%	100/15 Summer				93.247	0.605
S11.004	S117	360 Winter	100	+20%	100/15 Summer				93.247	1.122
S11.005	S118	360 Winter	100	+20%					91.180	-0.195
S17.000	S120	15 Winter	100	+20%	100/15 Summer				77.984	0.105
S18.000	S121	15 Winter	100	+20%					84.214	-0.091
S18.001	S122	15 Winter	100	+20%	100/15 Summer				83.273	0.167
S18.002	S123	15 Winter	100	+20%	100/15 Summer				82.619	1.644
S18.003	S124	15 Winter	100	+20%	100/15 Summer				80.106	0.715
S18.004	S125	15 Winter	100	+20%	100/15 Summer				78.503	0.165
S17.001	S126	15 Winter	100	+20%	100/15 Summer				77.597	0.438
S17.002	S127	15 Winter	100	+20%	100/15 Summer				71.128	0.349
S19.000	S128	15 Winter	100	+20%					75.829	-0.130
S19.001	S129	15 Summer	100	+20%					75.643	-0.084
S19.002	S130	15 Winter	100	+20%	100/15 Winter				75.586	0.014
S20.000	S131	15 Winter	100	+20%					76.544	0.744
S20.001	S132	15 Winter	100	+20%					76.502	0.835
S20.002	S133	15 Winter	100	+20%	100/15 Summer				75.997	0.463
S19.003	S134	15 Winter	100	+20%	100/15 Summer				75.570	0.258
S19.004	S135	15 Winter	100	+20%	100/15 Summer				70.685	0.064
S17.003	S136	15 Winter	100	+20%	100/15 Summer				70.173	0.386
S17.004	S137	360 Winter	100	+20%	100/15 Summer				69.799	0.750
S17.005	S138	360 Winter	100	+20%	100/15 Summer				69.798	1.373
S17.006	S139	360 Winter	100	+20%					67.506	-0.201
S21.000	S140	15 Winter	100	+20%	100/15 Summer				94.346	0.302
S21.001	S141	15 Winter	100	+20%	100/15 Summer				94.194	0.552
S21.002	S142	15 Winter	100	+20%	100/15 Summer				94.101	0.663
S21.003	S143	15 Winter	100	+20%	100/15 Summer				94.008	0.745
S21.004	S144	15 Winter	100	+20%	100/15 Summer				93.692	0.940

Future Phase

Future Phase

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.033	S87	0.000	0.30		63.5	SURCHARGED	
S1.034	S88	0.000	0.38		63.5	OK	
S1.035	S89	0.000	0.39		63.5	OK	
S1.036	S90	0.000	0.39		63.5	OK	
S11.000	S92	0.000	1.37		91.7	FLOOD RISK	
S12.000	S93	0.000	0.59		52.9	OK	
S12.001	S94	0.000	1.52		122.0	SURCHARGED	
S13.000	S95	0.000	0.55		53.6	OK	
S13.001	S96	0.000	1.48		143.8	SURCHARGED	
S13.002	S97	0.000	1.57		129.4	FLOOD RISK	
S12.002	S98	0.000	1.66		229.7	SURCHARGED	
S14.000	S99	0.000	1.59		147.2	SURCHARGED	
S12.003	S100	0.000	2.47		364.6	SURCHARGED	
S12.004	S101	0.000	1.89		411.9	SURCHARGED	
S11.001	S102	0.000			6	SURCHARGED	
S15.000	S103	0.000			7	SURCHARGED	
S15.001	S104	0.000	1.83		80.1	SURCHARGED	
S15.002	S105	0.000	1.30		99.6	SURCHARGED	
S15.003	S106	0.000	0.79		120.2	OK	
S15.004	S107	0.000	0.89		135.8	SURCHARGED	
S15.005	S108	0.000	0.97		153.6	SURCHARGED	
S15.006	S109	0.000	1.03		153.5	SURCHARGED	
S11.002	S110	0.000	2.50		620.8	SURCHARGED	
S16.000	S111	0.000	1.04		65.1	SURCHARGED	
S16.001	S112	0.000	0.96		181.2	SURCHARGED	
S16.002	S113	0.000	1.09		192.7	SURCHARGED	
S16.003	S114	0.000	1.20		251.5	SURCHARGED	
S16.004	S115	0.000	3.07		242.1	SURCHARGED	
S11.003	S116	0.000	0.57		214.6	SURCHARGED	
S11.004	S117	0.000	0.05		2.1	FLOOD RISK	
S11.005	S118	0.000	0.04		2.1	OK	
S17.000	S120	0.000	0.83		50.6	SURCHARGED	
S18.000	S121	0.000	0.66		54.9	OK	
S18.001	S122	0.000	0.93		76.1	SURCHARGED	
S18.002	S123	0.000	1.27		115.7	SURCHARGED	
S18.003	S124	0.000	1.26		212.8	SURCHARGED	
S18.004	S125	0.000	0.88		285.0	SURCHARGED	
S17.001	S126	0.000	1.38		365.5	SURCHARGED	
S17.002	S127	0.000	1.18		365.9	SURCHARGED	
S19.000	S128	0.000	0.38		21.0	OK	
S19.001	S129	0.000	0.71		21.1	OK	
S19.002	S130	0.000	0.36		19.6	SURCHARGED	
S20.000	S131	0.000			9	SURCHARGED	
S20.001	S132	0.000			3	SURCHARGED	
S20.002	S133	0.000	2.29		63.3	SURCHARGED	
S19.003	S134	0.000	1.79		113.6	SURCHARGED	
S19.004	S135	0.000	1.10		112.8	SURCHARGED	
S17.003	S136	0.000	1.45		473.5	SURCHARGED	
S17.004	S137	0.000	0.34		100.9	SURCHARGED	
S17.005	S138	0.000	0.03		2.3	FLOOD RISK	
S17.006	S139	0.000	0.03		2.3	OK	
S21.000	S140	0.000	0.96		85.7	SURCHARGED	
S21.001	S141	0.000	0.87		85.4	SURCHARGED	
S21.002	S142	0.000	1.05		94.9	SURCHARGED	
S21.003	S143	0.000	0.96		154.5	SURCHARGED	

Maximum Flow Downstream of Pond 4 - Catchment A

Future Phase

Future Phase

Maximum Flow Downstream of Tank A

Maximum Flow Downstream of Pond 1

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S21.004	S144	0.000	0.88		195.5	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S21.005	S145	15 Winter	100	+20%	100/15 Summer				93.439	1.050
S21.006	S146	15 Winter	100	+20%	100/15 Summer				91.548	0.924
S22.000	S147	15 Winter	100	+20%					99.906	-0.113
S22.001	S148	15 Winter	100	+20%					99.834	-0.024
S22.002	S149	15 Winter	100	+20%	100/15 Summer				99.726	0.171
S22.003	S150	15 Winter	100	+20%	100/15 Summer				99.262	0.331
S22.004	S151	15 Winter	100	+20%	100/15 Summer				98.853	0.822
S22.005	S152	15 Winter	100	+20%	100/15 Summer				98.243	1.112
S22.006	S153	15 Winter	100	+20%	100/15 Summer				97.527	1.296
S22.007	S154	15 Winter	100	+20%	100/15 Summer				97.197	1.408
S22.008	S155	30 Winter	100	+20%	100/15 Summer				96.949	1.266
S22.009	S156	30 Winter	100	+20%	100/15 Summer				96.705	1.116
S22.010	S157	30 Winter	100	+20%	100/15 Summer				96.463	1.103
S22.011	S158	30 Winter	100	+20%	100/15 Summer				96.224	1.027
S22.012	S159	30 Winter	100	+20%	100/15 Summer				95.974	0.944
S22.013	S160	30 Winter	100	+20%	100/15 Summer				95.848	0.951
S22.014	S161	30 Winter	100	+20%	100/15 Summer				95.714	1.015
S22.015	S162	30 Winter	100	+20%	100/15 Summer				95.573	1.079
S22.016	S163	30 Winter	100	+20%	100/15 Summer				95.423	1.125
S22.017	S164	30 Winter	100	+20%	100/15 Summer				94.500	1.102
S22.018	S165	15 Winter	100	+20%	100/15 Summer				94.190	0.989
S23.000	S166	15 Winter	100	+20%	100/15 Summer				95.618	0.388
S24.000	S167	15 Winter	100	+20%	Future Phase				96.875	0.744
S24.001	S168	15 Winter	100	+20%					96.508	0.727
S24.002	S169	15 Winter	100	+20%	100/15 Summer				96.181	0.818
S23.001	S170	15 Winter	100	+20%	100/15 Summer				95.211	0.948
S23.002	S171	15 Winter	100	+20%	100/15 Summer				94.577	0.751
S22.019	S172	15 Winter	100	+20%	100/15 Summer				93.884	0.778
S22.020	S173	15 Winter	100	+20%	100/15 Summer				93.075	0.625
S25.000	S174	15 Winter	100	+20%					95.186	-0.131
S26.000	S175	15 Winter	100	+20%					96.142	-0.107
S26.001	S176	15 Winter	100	+20%	100/15 Winter				95.500	0.004
S26.002	S177	15 Winter	100	+20%	100/15 Summer				95.421	0.222
S26.003	S178	15 Winter	100	+20%	100/15 Summer				95.341	0.345
S26.004	S179	15 Winter	100	+20%	100/15 Summer				95.264	0.353
S25.001	S180	15 Winter	100	+20%	100/15 Summer				94.474	0.866
S25.002	S181	15 Winter	100	+20%	100/15 Summer				93.108	0.718
S22.021	S182	15 Winter	100	+20%	100/15 Summer				92.214	1.189
S21.007	S183	15 Winter	100	+20%	100/15 Summer				90.839	0.579
S27.000	S184	15 Winter	100	+20%	100/15 Summer				91.993	0.455
S21.008	S185	15 Winter	100	+20%	100/15 Summer				89.937	1.362
S21.009	S186	15 Winter	100	+20%	100/15 Summer				88.924	1.074
S21.010	S187	15 Winter	100	+20%	100/15 Summer				88.392	0.801
S21.011	S188	15 Winter	100	+20%	100/15 Summer				87.863	0.370
S21.012	S189	60 Winter	100	+20%					87.236	-0.137
S21.013	S190	60 Winter	100	+20%					87.157	-0.119
S21.014	S191	60 Winter	100	+20%					87.087	-0.117
S21.015	S192	60 Winter	100	+20%	100/60 Winter				86.992	0.051
S21.016	S193	60 Winter	100	+20%	100/60 Winter				86.865	0.025
S21.017	S194	240 Winter	100	+20%	100/120 Winter				86.804	0.054
S21.018	S195	240 Winter	100	+20%	100/120 Summer				86.785	0.195
S21.019	S196	240 Winter	100	+20%	100/30 Summer				86.769	0.669
S21.020	S197	240 Winter	100	+20%					85.196	-0.097
S21.021	S198	240 Winter	100	+20%					84.735	-0.140
S21.022	S199	360 Winter	100	+20%					83.717	-0.033
S28.000	S200	15 Winter	100	+20%					87.616	-0.048

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S21.005	S145	0.000	1.03		286.8	SURCHARGED	
S21.006	S146	0.000	1.45		319.9	FLOOD RISK	
S22.000	S147	0.000	0.71		55.7	OK	
S22.001	S148	0.000	0.72		73.0	OK	
S22.002	S149	0.000	1.00		108.1	SURCHARGED	
S22.003	S150	0.000	0.80		141.2	SURCHARGED	
S22.004	S151	0.000	0.92		161.8	SURCHARGED	
S22.005	S152	0.000	0.94		165.5	FLOOD RISK	
S22.006	S153	0.000	0.92		191.0	FLOOD RISK	
S22.007	S154	0.000	1.69		215.8	FLOOD RISK	
S22.008	S155	0.000	1.68		201.3	SURCHARGED	
S22.009	S156	0.000	1.05		196.8	SURCHARGED	
S22.010	S157	0.000	1.24		196.0	SURCHARGED	
S22.011	S158	0.000	1.26		202.0	SURCHARGED	
S22.012	S159	0.000	1.01		208.0	SURCHARGED	
S22.013	S160	0.000	0.86		215.3	SURCHARGED	
S22.014	S161	0.000	0.87		222.2	SURCHARGED	
S22.015	S162	0.000	0.92		229.4	SURCHARGED	
S22.016	S163	0.000	1.01		309.1	SURCHARGED	
S22.017	S164	0.000	1.26		315.4	SURCHARGED	
S22.018	S165	0.000	1.80		314.8	SURCHARGED	
S23.000	S166	0.000	0.86		67.2	SURCHARGED	
S24.000	S167	0.000	Future Phase		5	SURCHARGED	
S24.001	S168	0.000			4	SURCHARGED	
S24.002	S169	0.000	1.10		143.3	SURCHARGED	
S23.001	S170	0.000	1.23		190.8	SURCHARGED	
S23.002	S171	0.000	0.98		188.7	SURCHARGED	
S22.019	S172	0.000	2.10		506.1	SURCHARGED	
S22.020	S173	0.000	2.12		510.4	SURCHARGED	
S25.000	S174	0.000	0.60		92.1	OK	
S26.000	S175	0.000	0.54		47.4	OK	
S26.001	S176	0.000	0.85		48.4	SURCHARGED	
S26.002	S177	0.000	0.72		45.6	SURCHARGED	
S26.003	S178	0.000	1.02		41.9	SURCHARGED	
S26.004	S179	0.000	0.93		78.5	SURCHARGED	
S25.001	S180	0.000	1.36		212.1	SURCHARGED	
S25.002	S181	0.000	1.70		208.1	SURCHARGED	
S22.021	S182	0.000	1.34		718.5	SURCHARGED	
S21.007	S183	0.000	2.23		1041.0	SURCHARGED	
S27.000	S184	0.000	1.13		93.9	SURCHARGED	
S21.008	S185	0.000	1.38		1120.2	SURCHARGED	
S21.009	S186	0.000	1.43		1137.5	SURCHARGED	
S21.010	S187	0.000	1.88		1138.0	SURCHARGED	
S21.011	S188	0.000	1.88		1137.4	SURCHARGED	
S21.012	S189	0.000	1.00		606.4	OK	
S21.013	S190	0.000	1.00		605.3	OK	
S21.014	S191	0.000	0.76		606.4	OK	
S21.015	S192	0.000	1.00		606.4	SURCHARGED	
S21.016	S193	0.000	1.05		609.8	FLOOD RISK	
S21.017	S194	0.000	0.61		407.5	FLOOD RISK	
S21.018	S195	0.000	0.62		404.2	FLOOD RISK	
S21.019	S196	0.000	0.60		120.2	SURCHARGED	
S21.020	S197	0.000	0.90		120.2	OK	
S21.021	S198	0.000	0.71		120.2	OK	
S21.022	S199	0.000	0.36		94.7	OK	

Future Phase

Maximum Flow Downstream of Pond 2

Maximum Flow Downstream of Pond 1

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S28.000	S200	0.000	0.02		1.5	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S29.000	S201	60 Winter	100	+20%					93.308	-0.225
S29.001	S202	15 Winter	100	+20%					91.882	0.488
S29.002	S203	15 Winter	100	+20%					89.977	1.162
S28.001	S204	15 Winter	100	+20%	100/15 Summer				87.619	0.512
S30.000	S205	15 Winter	100	+20%	100/15 Summer				94.263	1.163
S30.001	S206	15 Winter	100	+20%	100/15 Summer				94.089	1.117
S30.002	S207	15 Winter	100	+20%	100/15 Summer				93.583	1.403
S30.003	S208	15 Winter	100	+20%	100/15 Summer				92.117	1.219
S30.004	S209	15 Winter	100	+20%	100/15 Summer				90.866	0.841
S30.005	S210	15 Winter	100	+20%	100/15 Summer				90.053	0.600
S30.006	S211	15 Winter	100	+20%	100/15 Summer				88.098	1.064
S28.002	S212	15 Winter	100	+20%	100/15 Summer				87.258	0.458
S31.000	S213	15 Winter	100	+20%	100/15 Summer				94.675	0.875
S31.001	S214	15 Winter	100	+20%	100/15 Summer				93.910	0.424
S31.002	S215	15 Winter	100	+20%	100/15 Summer				93.301	0.063
S32.000	S216	15 Winter	100	+20%	100/15 Summer				97.652	0.252
S32.001	S217	15 Winter	100	+20%	100/15 Summer				97.495	0.195
S32.002	S218	15 Winter	100	+20%	100/15 Summer				96.801	0.101
S32.003	S219	15 Winter	100	+20%	100/15 Summer				96.569	0.181
S32.004	S220	15 Winter	100	+20%	100/15 Summer				96.113	0.022
S32.005	S221	15 Winter	100	+20%	100/15 Summer				95.337	0.515
S33.000	S222	15 Winter	100	+20%	100/15 Summer				95.384	0.754
S33.001	S223	15 Winter	100	+20%	100/15 Summer				95.263	1.063
S33.002	S224	15 Winter	100	+20%	100/15 Summer				95.217	1.144
S33.003	S225	15 Winter	100	+20%	100/15 Summer				95.170	1.201
S33.004	S226	15 Winter	100	+20%	100/15 Summer				95.122	1.262
S32.006	S227	15 Winter	100	+20%	100/15 Summer				94.885	1.117
S32.007	S228	15 Winter	100	+20%	100/15 Summer				94.509	0.937
S32.008	S229	15 Winter	100	+20%	100/15 Summer				94.292	1.370
S32.009	S230	15 Winter	100	+20%	100/15 Summer				93.513	0.904
S31.003	S231	15 Winter	100	+20%	100/15 Summer				93.143	0.576
S31.004	S232	15 Winter	100	+20%	100/15 Summer				92.769	0.269
S34.000	S233	15 Winter	100	+20%					94.817	-0.158
S34.001	S234	15 Winter	100	+20%					94.470	-0.080
S34.002	S235	15 Winter	100	+20%	100/15 Summer				94.453	0.468
S34.003	S236	15 Winter	100	+20%	100/15 Summer				93.192	0.289
S34.004	S237	15 Winter	100	+20%	100/15 Summer				92.648	0.386
S31.005	S238	15 Winter	100	+20%	100/15 Summer				92.223	0.331
S31.006	S239	15 Winter	100	+20%	100/15 Summer				91.838	0.305
S31.007	S240	15 Winter	100	+20%					90.531	-0.146
S35.000	S241	15 Winter	100	+20%					94.459	-0.141
S35.001	S242	15 Winter	100	+20%					94.345	-0.148
S35.002	S243	15 Winter	100	+20%					92.720	-0.108
S35.003	S244	15 Winter	100	+20%					91.601	-0.108
S31.008	S245	15 Winter	100	+20%	100/15 Summer				89.515	0.512
S31.009	S246	15 Winter	100	+20%	100/15 Summer				89.077	0.164
S31.010	S247	360 Winter	100	+20%	100/15 Summer				89.033	0.197
S31.011	S248	360 Winter	100	+20%	100/15 Summer				89.033	1.045
S31.012	S249	360 Winter	100	+20%					87.611	-0.198
S31.013	S250	360 Winter	100	+20%					87.003	-0.197
S28.003	S251	15 Winter	100	+20%					86.153	-0.297
S28.004	S252	360 Winter	100	+20%					85.969	-0.266
S28.005	S253	360 Winter	100	+20%					85.969	-0.184
S28.006	S254	360 Winter	100	+20%	100/15 Summer				85.969	0.594
S28.007	S255	360 Winter	100	+20%					84.981	-0.195
S28.008	S256	360 Winter	100	+20%					84.690	-0.194

Future Phase

Future Phase

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S29.000	S201	0.000	0.00		0.0	OK	
S29.001	S202	0.000	Future Phase		6	SURCHARGED	
S29.002	S203	0.000			2	SURCHARGED	
S28.001	S204	0.000	1.08		263.5	SURCHARGED	
S30.000	S205	0.000	1.34		81.0	FLOOD RISK	
S30.001	S206	0.000	1.91		132.9	SURCHARGED	
S30.002	S207	0.000	1.26		205.5	SURCHARGED	
S30.003	S208	0.000	1.43		224.6	FLOOD RISK	
S30.004	S209	0.000	2.11		225.6	SURCHARGED	
S30.005	S210	0.000	1.48		228.3	SURCHARGED	
S30.006	S211	0.000	1.89		229.0	SURCHARGED	
S28.002	S212	0.000	1.66		490.0	SURCHARGED	
S31.000	S213	0.000	1.69		113.5	SURCHARGED	
S31.001	S214	0.000	1.52		101.2	SURCHARGED	
S31.002	S215	0.000	1.34		100.2	SURCHARGED	
S32.000	S216	0.000	1.34		41.5	SURCHARGED	
S32.001	S217	0.000	1.07		55.4	SURCHARGED	
S32.002	S218	0.000	0.87		68.4	SURCHARGED	
S32.003	S219	0.000	1.24		68.0	SURCHARGED	
S32.004	S220	0.000	1.08		68.0	SURCHARGED	
S32.005	S221	0.000	Future Phase		.2	SURCHARGED	
S33.000	S222	0.000			.1	SURCHARGED	
S33.001	S223	0.000	1.30		36.9	FLOOD RISK	
S33.002	S224	0.000	0.96		56.0	FLOOD RISK	
S33.003	S225	0.000	0.74		82.1	FLOOD RISK	
S33.004	S226	0.000	1.71		184.3	FLOOD RISK	
S32.006	S227	0.000	1.39		256.3	SURCHARGED	
S32.007	S228	0.000	1.82		273.0	SURCHARGED	
S32.008	S229	0.000	1.56		335.9	SURCHARGED	
S32.009	S230	0.000	2.39		342.4	SURCHARGED	
S31.003	S231	0.000	2.02		465.1	SURCHARGED	
S31.004	S232	0.000	1.98		464.8	SURCHARGED	
S34.000	S233	0.000	0.19		15.9	OK	
S34.001	S234	0.000	0.12		14.4	OK	
S34.002	S235	0.000	1.20		172.4	SURCHARGED	
S34.003	S236	0.000	1.16		170.5	SURCHARGED	
S34.004	S237	0.000	1.21		164.2	SURCHARGED	
S31.005	S238	0.000	1.81		629.6	SURCHARGED	
S31.006	S239	0.000	1.86		678.0	SURCHARGED	
S31.007	S240	0.000	0.97		677.6	OK	
S35.000	S241	0.000	0.54		31.6	OK	
S35.001	S242	0.000	0.51		31.3	OK	
S35.002	S243	0.000	0.71		130.5	OK	
S35.003	S244	0.000	0.71		134.6	OK	
S31.008	S245	0.000	1.31		825.9	SURCHARGED	
S31.009	S246	0.000	0.90		847.6	SURCHARGED	
S31.010	S247	0.000	0.32		359.8	SURCHARGED	
S31.011	S248	0.000	0.03		2.0	SURCHARGED	
S31.012	S249	0.000	0.04		2.0	OK	
S31.013	S250	0.000	0.04		2.0	OK	
S28.003	S251	0.000	0.67		489.7	OK	
S28.004	S252	0.000	0.14		126.7	OK	
S28.005	S253	0.000	0.16		122.4	OK	
S28.006	S254	0.000	0.05		2.0	SURCHARGE	
S28.007	S255	0.000	0.05		2.0	OK	

Maximum Flow Downstream of Pond 3

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S28.008	S256	0.000	0.05		2.3	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S28.009	S257	360 Winter	100	+20%					82.695	-0.190
S28.010	S258	360 Winter	100	+20%					81.307	-0.191
S28.011	S259	360 Winter	100	+20%					80.960	-0.193
S21.023	S260	360 Winter	100	+20%	100/120 Summer				77.888	1.872
S21.024	S261	360 Winter	100	+20%	100/120 Summer				69.221	2.284
S17.007	S262	360 Winter	100	+20%	100/120 Summer				61.867	1.602
S17.008	S263	360 Winter	100	+20%	100/120 Summer				58.998	0.584
S17.009	S264	360 Winter	100	+20%	100/120 Summer				58.244	0.374
S17.010	S265	360 Winter	100	+20%	100/120 Summer				55.908	0.517
S17.011	S266	360 Winter	100	+20%	100/120 Summer				50.481	0.621
S17.012	S267	360 Winter	100	+20%					49.705	-0.007
S17.013	S268	360 Winter	100	+20%	100/180 Winter				48.939	0.024
S17.014	S269	360 Winter	100	+20%					48.679	-0.021
S17.015	S270	360 Winter	100	+20%	100/360 Winter				48.204	0.003
S36.000	S272	60 Winter	100	+20%					99.007	-0.225
S36.001	S273	60 Winter	100	+20%					97.947	-0.225
S36.002	S274	15 Winter	100	+20%					97.755	-0.045
S36.003	S275	15 Winter	100	+20%	100/15 Summer				96.446	0.105
S36.004	S276	15 Winter	100	+20%	100/15 Summer				96.180	0.764
S36.005	S277	15 Winter	100	+20%	100/15 Summer				95.866	1.066
S37.000	S278	15 Winter	100	+20%	100/15 Summer				98.883	0.083
S37.001	S279	15 Winter	100	+20%	100/15 Summer				98.886	0.156
S37.002	S280	15 Winter	100	+20%	Future Phase				98.069	0.269
S37.003	S281	15 Winter	100	+20%					97.352	0.552
S37.004	S282	15 Winter	100	+20%	100/15 Summer				95.906	0.106
S37.005	S283	15 Winter	100	+20%					95.641	-0.122
S36.006	S284	15 Winter	100	+20%	100/15 Summer				95.179	0.553
S38.000	S285	15 Winter	100	+20%	100/15 Summer				98.979	1.179
S38.001	S286	15 Winter	100	+20%	100/15 Summer				98.279	0.693
S38.002	S287	15 Winter	100	+20%	100/15 Summer				98.124	0.578
S38.003	S288	15 Winter	100	+20%	100/15 Summer				97.885	0.429
S38.004	S289	360 Winter	100	+20%	100/120 Summer				94.902	0.738
S36.007	S290	360 Winter	100	+20%	100/15 Winter				94.901	1.101
S36.008	S291	360 Winter	100	+20%	100/15 Summer				94.901	1.576
S39.000	S293	15 Winter	100	+20%	100/15 Summer				97.700	0.900
S40.000	S294	15 Winter	100	+20%					97.696	-0.079
S39.001	S295	15 Winter	100	+20%	100/15 Summer				97.342	0.914
S41.000	S296	360 Winter	100	+20%	100/15 Winter				96.630	0.873
S39.002	S297	360 Winter	100	+20%	100/15 Summer				96.630	1.151
S39.003	S298	360 Winter	100	+20%	100/15 Summer				96.627	1.225
S39.004	S299	360 Winter	100	+20%	100/15 Summer				96.623	1.598
S42.000	S301	15 Winter	100	+20%					104.512	-0.086
S42.001	S302	15 Winter	100	+20%	100/15 Summer				101.588	0.287
S42.002	S303	15 Winter	100	+20%	100/15 Summer				99.244	0.531
S42.003	S304	15 Winter	100	+20%	100/15 Summer				98.795	0.489
S42.004	S305	15 Winter	100	+20%	100/15 Summer				98.422	0.177
S42.005	S306	15 Winter	100	+20%					98.027	-0.141
S42.006	S307	15 Winter	100	+20%					97.297	-0.153
S42.007	S308	15 Winter	100	+20%					96.618	-0.146
S42.008	S309	15 Winter	100	+20%	100/15 Winter				95.652	0.067
S42.009	S310	15 Winter	100	+20%	100/15 Summer				95.180	0.484
S43.000	S311	15 Winter	100	+20%	100/15 Summer				98.050	0.372
S43.001	S312	15 Winter	100	+20%	100/15 Summer				98.010	0.537
S43.002	S313	15 Winter	100	+20%	100/15 Summer				97.980	0.548
S43.003	S314	15 Winter	100	+20%	100/15 Summer				97.789	0.538
S43.004	S315	15 Winter	100	+20%	100/15 Summer				97.714	1.094

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S28.009	S257	0.000	0.06		2.3	OK	
S28.010	S258	0.000	0.06		2.3	OK	
S28.011	S259	0.000	0.05		2.3	OK	
S21.023	S260	0.000	2.45		97.0	SURCHARGED	
S21.024	S261	0.000	1.91		97.0	SURCHARGED	
S17.007	S262	0.000	1.90		99.2	SURCHARGED	
S17.008	S263	0.000	2.15		99.2	SURCHARGED	
S17.009	S264	0.000	2.12		99.2	SURCHARGED	
S17.010	S265	0.000	2.19		99.2	SURCHARGED	
S17.011	S266	0.000	2.23		99.2	SURCHARGED	
S17.012	S267	0.000	0.98		99.2	OK	
S17.013	S268	0.000	1.08		99.2	SURCHARGED	
S17.014	S269	0.000	1.00		99.0	OK	
S17.015	S270	0.000	1.05		99.0	SURCHARGED	
S36.000	S272	0.000	0.00		0.0	OK	
S36.001	S273	0.000	0.00		0.0	OK	
S36.002	S274	0.000	1.00		69.4	OK	
S36.003	S275	0.000	0.80		67.3	SURCHARGED	
S36.004	S276	0.000	0.71		61.1	SURCHARGED	
S36.005	S277	0.000	2.32		119.1	FLOOD RISK	
S37.000	S278	0.000	0.09		2.6	SURCHARGED	
S37.001	S279	0.000			.2	SURCHARGED	
S37.002	S280	0.000			.0	SURCHARGED	
S37.003	S281	0.000	1.19		156.9	SURCHARGED	
S37.004	S282	0.000	2.37		157.0	SURCHARGED	
S37.005	S283	0.000	0.67		154.7	OK	
S36.006	S284	0.000	1.28		253.6	SURCHARGED	
S38.000	S285	0.000	1.75		51.0	FLOOD RISK	
S38.001	S286	0.000	2.02		52.0	SURCHARGED	
S38.002	S287	0.000	1.91		53.3	SURCHARGED	
S38.003	S288	0.000	2.01		102.0	SURCHARGED	
S38.004	S289	0.000	0.19		25.9	SURCHARGED	
S36.007	S290	0.000	0.30		81.8	FLOOD RISK	
S36.008	S291	0.000	0.04		2.4	FLOOD RISK	
S39.000	S293	0.000	1.01		36.1	SURCHARGED	
S40.000	S294	0.000	0.75		26.1	OK	
S39.001	S295	0.000	1.90		67.6	SURCHARGED	
S41.000	S296	0.000	0.06		2.0	SURCHARGED	
S39.002	S297	0.000	0.36		23.6	SURCHARGED	
S39.003	S298	0.000	0.32		23.3	SURCHARGED	
S39.004	S299	0.000	0.07		2.4	SURCHARGED	
S42.000	S301	0.000	0.69		67.8	OK	
S42.001	S302	0.000	0.94		98.4	SURCHARGED	
S42.002	S303	0.000	1.05		117.0	SURCHARGED	
S42.003	S304	0.000	2.45		128.2	SURCHARGED	
S42.004	S305	0.000	1.81		145.1	SURCHARGED	
S42.005	S306	0.000	0.70		165.2	OK	
S42.006	S307	0.000	0.65		178.4	OK	
S42.007	S308	0.000	0.67		200.3	OK	
S42.008	S309	0.000	0.74		207.7	SURCHARGED	
S42.009	S310	0.000	1.06		214.9	SURCHARGED	
S43.000	S311	0.000	0.59		27.4	SURCHARGED	
S43.001	S312	0.000			.7	SURCHARGED	
S43.002	S313	0.000			.2	SURCHARGED	
S43.003	S314	0.000			.8	SURCHARGED	

Maximum Flow Outfall to County Brook Stream. Catchment A and Part Catchment B

Future Phase

Future Phase

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S43.004	S315	0.000	1.50		44.3	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S43.005	S316	30 Winter	100	+20%	100/15 Summer				97.464	1.143
S43.006	S317	30 Winter	100	+20%	100/15 Summer				97.161	0.928
S44.000	S318	15 Winter	100	+20%	100/15 Summer				101.349	0.391
S44.001	S319	15 Winter	100	+20%	100/15 Summer				101.127	0.329
S44.002	S320	15 Winter	100	+20%					100.804	0.133
S44.003	S321	15 Winter	100	+20%					100.138	0.110
S44.004	S322	15 Winter	100	+20%					99.678	0.326
S44.005	S323	15 Winter	100	+20%	100/15 Summer				99.424	0.227
S45.000	S324	15 Winter	100	+20%					101.723	-0.077
S45.001	S325	15 Winter	100	+20%	100/15 Summer				101.538	0.390
S45.002	S326	15 Winter	100	+20%	100/15 Summer				100.298	0.320
S45.003	S327	15 Winter	100	+20%	100/15 Summer				99.739	0.433
S44.006	S328	15 Winter	100	+20%	100/15 Summer				99.289	0.711
S44.007	S329	15 Winter	100	+20%	100/15 Summer				98.370	0.895
S44.008	S330	15 Winter	100	+20%	100/15 Summer				97.724	1.155
S43.007	S331	15 Winter	100	+20%	100/15 Summer				96.843	1.278
S43.008	S332	30 Winter	100	+20%	100/15 Summer				96.414	1.244
S43.009	S333	30 Winter	100	+20%	100/15 Summer				95.877	0.885
S43.010	S334	30 Winter	100	+20%	100/15 Summer				95.630	1.175
S42.010	S335	15 Winter	100	+20%	100/15 Summer				94.740	0.499
S46.000	S337	15 Winter	100	+20%	100/15 Summer				104.649	0.110
S46.001	S338	15 Winter	100	+20%	100/15 Summer				104.082	0.783
S46.002	S339	15 Winter	100	+20%	100/15 Summer				102.213	0.271
S46.003	S340	15 Winter	100	+20%	100/15 Summer				101.834	0.048
S46.004	S341	15 Winter	100	+20%					101.188	-0.117
S46.005	S342	15 Winter	100	+20%					100.266	-0.123

Future Phase

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S43.005	S316	0.000	2.09		68.5	FLOOD RISK	
S43.006	S317	0.000	1.06		73.5	SURCHARGED	
S44.000	S318	0.000	1.19		42.5	SURCHARGED	
S44.001	S319	0.000	1.56		51.7	SURCHARGED	
S44.002	S320	0.000			9	SURCHARGED	
S44.003	S321	0.000			7	SURCHARGED	
S44.004	S322	0.000	1.71		111.2	SURCHARGED	
S44.005	S323	0.000	0.78		98.5	SURCHARGED	
S45.000	S324	0.000	0.57		41.5	OK	
S45.001	S325	0.000	1.02		160.2	SURCHARGED	
S45.002	S326	0.000	1.81		219.1	SURCHARGED	
S45.003	S327	0.000	1.73		230.0	SURCHARGED	
S44.006	S328	0.000	1.27		320.6	SURCHARGED	
S44.007	S329	0.000	1.29		312.6	SURCHARGED	
S44.008	S330	0.000	1.24		308.3	SURCHARGED	
S43.007	S331	0.000	1.99		372.3	SURCHARGED	
S43.008	S332	0.000	1.74		375.3	FLOOD RISK	
S43.009	S333	0.000	1.59		381.7	SURCHARGED	
S43.010	S334	0.000	2.03		395.4	SURCHARGED	
S42.010	S335	0.000	2.41		599.2	SURCHARGED	
S46.000	S337	0.000	0.78		52.0	SURCHARGED	
S46.001	S338	0.000	1.27		81.6	SURCHARGED	
S46.002	S339	0.000	1.63		102.5	SURCHARGED	
S46.003	S340	0.000	1.06		97.5	SURCHARGED	

Free maximum discharge into proposed Soakaway

Outfall to existing storm drainage network constructed under WCC grant permission ref;1715

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S46.004	S341	0.000	0.68		97.4	OK	
S46.005	S342	0.000	0.65		97.2	OK	

H.3. 1 in 30-year Outputs

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	3.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 12 Number of Storage Structures 13 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.269
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

As per Met Eireann Information

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 30
Climate Change (%) 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	30	+20%					84.297	-0.138
S1.001	S2	15 Summer	30	+20%					82.991	-0.124
S1.002	S3	15 Winter	30	+20%	30/15 Summer				80.109	0.243
S1.003	S4	15 Winter	30	+20%					75.162	-0.092
S1.004	S5	15 Winter	30	+20%	30/15 Summer				73.054	0.290
S2.000	S6	15 Winter	30	+20%					79.323	-0.143
S3.000	S7	15 Winter	30	+20%	30/15 Summer				79.578	0.051
S3.001	S8	15 Winter	30	+20%					79.157	-0.002
S3.002	S9	15 Winter	30	+20%					78.918	-0.033
S2.001	S10	120 Winter	30	+20%	30/15 Summer				78.495	1.420
S2.002	S11	15 Summer	30	+20%					74.552	-0.111
S2.003	S12	15 Winter	30	+20%	30/15 Summer				74.024	0.106
S4.000	S13	15 Winter	30	+20%	30/15 Summer				75.979	0.479
S2.004	S14	15 Winter	30	+20%	30/15 Summer				73.815	0.213
S2.005	S15	15 Winter	30	+20%	30/15 Summer				73.515	0.028
S5.000	S16	15 Winter	30	+20%	30/15 Summer				77.600	0.480
S5.001	S17	15 Winter	30	+20%	30/15 Summer				76.856	0.224
S5.002	S18	15 Winter	30	+20%					76.353	-0.072
S5.003	S19	15 Winter	30	+20%					75.852	-0.111
S5.004	S20	15 Winter	30	+20%					75.038	-0.097
S5.005	S21	15 Winter	30	+20%					74.100	-0.084
S5.006	S22	15 Winter	30	+20%	30/15 Summer				73.373	0.269
S5.007	S23	15 Winter	30	+20%	30/15 Summer				72.967	0.916
S5.008	S24	15 Winter	30	+20%	30/15 Summer				72.603	0.828
S2.006	S25	15 Winter	30	+20%	30/15 Summer				72.253	0.555
S2.007	S26	120 Winter	30	+20%	30/15 Summer				72.068	0.493
S2.008	S27	30 Winter	30	+20%	30/15 Summer				71.234	0.109
S2.009	S28	30 Winter	30	+20%	30/15 Winter				71.136	0.051
S2.010	S29	30 Winter	30	+20%	30/15 Winter				71.028	0.128

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.32		29.6	OK	
S1.001	S2	0.000	0.64		130.3	OK	
S1.002	S3	0.000	1.04		212.0	SURCHARGED	
S1.003	S4	0.000	0.91		274.5	OK	
S1.004	S5	0.000	1.10		325.0	SURCHARGED	
S2.000	S6	0.000	0.54		83.3	OK	
S3.000	S7	0.000	1.05		57.9	SURCHARGED	
S3.001	S8	0.000	1.02		63.9	OK	
S3.002	S9	0.000	1.00		74.4	OK	
S2.001	S10	0.000	0.31		25.3	SURCHARGED	
S2.002	S11	0.000	0.72		115.0	OK	
S2.003	S12	0.000	1.06		113.4	SURCHARGED	
S4.000	S13	0.000	1.12		88.8	SURCHARGED	
S2.004	S14	0.000	1.61		214.0	SURCHARGED	
S2.005	S15	0.000	1.09		213.7	SURCHARGED	
S5.000	S16	0.000	1.32		72.0	SURCHARGED	
S5.001	S17	0.000	1.44		88.1	SURCHARGED	
S5.002	S18	0.000	0.92		110.9	OK	
S5.003	S19	0.000	0.70		127.0	OK	
S5.004	S20	0.000	0.78		143.8	OK	
S5.005	S21	0.000	0.85		162.3	OK	
S5.006	S22	0.000	0.64		190.8	SURCHARGED	
S5.007	S23	0.000	1.15		200.2	SURCHARGED	
S5.008	S24	0.000	1.55		200.8	SURCHARGED	
S2.006	S25	0.000	2.87		438.6	SURCHARGED	
S2.007	S26	0.000	0.53		79.7	SURCHARGED	
S2.008	S27	0.000	1.54		87.4	SURCHARGED	
S2.009	S28	0.000	0.90		94.1	SURCHARGED	
S2.010	S29	0.000	0.98		103.2	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S2.011	S30	15 Winter	30	+20%	30/15 Summer				70.812	0.337
S2.012	S31	15 Winter	30	+20%	30/15 Summer				70.744	0.469
S1.005	S32	15 Winter	30	+20%	30/15 Summer				70.714	0.596
S1.006	S33	15 Winter	30	+20%	30/15 Summer				70.468	0.715
S1.007	S34	30 Winter	30	+20%	30/15 Summer				70.226	0.733
S1.008	S35	30 Winter	30	+20%	30/15 Summer				70.010	0.643
S1.009	S36	30 Winter	30	+20%	30/15 Summer				69.374	0.332
S1.010	S37	30 Winter	30	+20%	30/15 Summer				68.757	0.164
S6.000	S38	15 Winter	30	+20%	30/15 Summer				77.153	0.668
S6.001	S39	1440 Winter	30		Future Phase				75.305	1.122
S6.002	S40	1440 Winter	30						72.252	-0.277
S6.003	S41	1440 Winter	30	+20%					69.116	-0.272
S1.011	S42	30 Winter	30	+20%					68.320	-0.188
S1.012	S43	30 Winter	30	+20%					67.021	-0.297
S1.013	S44	30 Winter	30	+20%					64.979	-0.301
S1.014	S45	30 Winter	30	+20%					63.060	-0.312
S1.015	S46	30 Winter	30	+20%					61.073	-0.286
S1.016	S47	30 Winter	30	+20%					57.863	-0.324
S1.017	S48	30 Winter	30	+20%					54.899	-0.266
S1.018	S49	30 Winter	30	+20%					54.040	-0.234
S1.019	S50	30 Winter	30	+20%					49.629	-0.407
S1.020	S51	30 Winter	30	+20%					49.154	-0.071
S1.021	S52	30 Winter	30	+20%	30/15 Summer				48.816	0.091
S1.022	S53	30 Winter	30	+20%	30/15 Winter				44.129	0.029
S1.023	S54	30 Winter	30	+20%					41.206	0.000
S1.024	S55	30 Winter	30	+20%	30/15 Winter				38.483	0.043
S7.000	S56	15 Winter	30	+20%					68.679	-0.193
S7.001	S57	15 Summer	30	+20%					67.990	-0.175
S7.002	S58	15 Summer	30	+20%					67.657	-0.164
S7.003	S59	15 Summer	30	+20%					66.858	-0.163
S7.004	S60	15 Winter	30	+20%					65.444	-0.145
S7.005	S61	15 Winter	30	+20%					64.229	-0.083
S8.000	S62	15 Winter	30	+20%	30/15 Summer				64.546	0.456
S8.001	S63	15 Winter	30	+20%	30/15 Summer				64.546	0.578
S8.002	S64	15 Winter	30	+20%	30/15 Summer				64.098	0.687
S7.006	S65	15 Winter	30	+20%					61.631	-0.067
S7.007	S66	15 Winter	30	+20%	30/15 Summer				60.090	0.527
S7.008	S67	15 Winter	30	+20%	30/15 Summer				58.545	0.689
S7.009	S68	15 Winter	30	+20%	30/15 Summer				57.550	0.726
S7.010	S69	15 Winter	30	+20%	30/15 Summer				51.621	0.629
S7.011	S70	15 Winter	30	+20%	30/15 Summer				48.741	0.804
S7.012	S71	15 Winter	30	+20%	30/15 Summer				47.686	1.808
S7.013	S72	15 Winter	30	+20%	30/15 Summer				46.719	1.059
S7.014	S73	15 Winter	30	+20%	30/15 Summer				46.229	0.638
S9.000	S74	15 Winter	30	+20%					49.459	-0.141
S7.015	S75	15 Winter	30	+20%	30/15 Summer				44.036	0.249
S10.000	S76	15 Winter	30	+20%					45.398	-0.136
S7.016	S77	15 Winter	30	+20%	30/15 Summer				40.468	0.233
S7.017	S78	15 Winter	30	+20%	30/15 Summer				38.523	0.108
S1.025	S79	15 Winter	30	+20%	30/15 Summer				36.466	0.389
S1.026	S80	30 Winter	30	+20%	30/15 Summer				35.483	1.533
S1.027	S81	30 Winter	30	+20%	30/15 Summer				34.868	1.284
S1.028	S82	30 Winter	30	+20%	30/15 Summer				34.429	1.335
S1.029	S83	30 Winter	30	+20%	30/15 Summer				33.989	0.987
S1.030	S84	30 Winter	30	+20%	30/15 Summer				33.547	0.709
S1.031	S85	30 Winter	30	+20%	30/15 Summer				33.105	0.520

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S2.011	S30	0.000	0.93		127.4	SURCHARGED	
S2.012	S31	0.000	1.15		142.0	SURCHARGED	
S1.005	S32	0.000	2.88		393.8	SURCHARGED	
S1.006	S33	0.000	1.60		396.9	SURCHARGED	
S1.007	S34	0.000	1.54		381.6	SURCHARGED	
S1.008	S35	0.000	1.45		393.1	SURCHARGED	
S1.009	S36	0.000	1.16		399.0	SURCHARGED	
S1.010	S37	0.000	1.61		401.1	SURCHARGED	
S6.000	S38	0.000	2.34		1147.8	SURCHARGED	
S6.001	S39	0.000	Future Phase		.8	SURCHARGED	
S6.002	S40	0.000			.8	OK	
S6.003	S41	0.000	0.02		2.8	OK	
S1.011	S42	0.000	0.87		403.4	OK	
S1.012	S43	0.000	0.60		410.9	OK	
S1.013	S44	0.000	0.59		419.2	OK	
S1.014	S45	0.000	0.56		426.2	OK	
S1.015	S46	0.000	0.63		432.8	OK	
S1.016	S47	0.000	0.53		447.7	OK	
S1.017	S48	0.000	0.67		452.4	OK	
S1.018	S49	0.000	0.75		457.2	OK	
S1.019	S50	0.000	0.43		470.1	OK	
S1.020	S51	0.000	0.82		862.4	OK	
S1.021	S52	0.000	1.32		861.9	SURCHARGED	
S1.022	S53	0.000	1.12		877.8	SURCHARGED	
S1.023	S54	0.000	1.02		877.8	OK	
S1.024	S55	0.000	1.16		878.6	SURCHARGED	
S7.000	S56	0.000	0.05		4.2	OK	
S7.001	S57	0.000	0.11		6.4	OK	
S7.002	S58	0.000	0.16		7.9	OK	
S7.003	S59	0.000	0.17		14.9	OK	
S7.004	S60	0.000	0.27		24.1	OK	
S7.005	S61	0.000	0.72		62.2	OK	
S8.000	S62	0.000	0.12		6.0	SURCHARGED	
S8.001	S63	0.000	0.94		96.1	SURCHARGED	
S8.002	S64	0.000	1.71		177.2	SURCHARGED	
S7.006	S65	0.000	1.00		244.1	OK	
S7.007	S66	0.000	1.39		333.7	SURCHARGED	
S7.008	S67	0.000	1.47		342.8	SURCHARGED	
S7.009	S68	0.000	1.91		391.5	SURCHARGED	
S7.010	S69	0.000	1.67		392.2	SURCHARGED	
S7.011	S70	0.000	2.40		391.2	SURCHARGED	
S7.012	S71	0.000	2.62		387.1	SURCHARGED	
S7.013	S72	0.000	2.67		384.7	SURCHARGED	
S7.014	S73	0.000	3.00		385.1	SURCHARGED	
S9.000	S74	0.000	0.30		33.6	OK	
S7.015	S75	0.000	1.21		394.9	SURCHARGED	
S10.000	S76	0.000	0.33		33.6	OK	
S7.016	S77	0.000	1.20		405.6	SURCHARGED	
S7.017	S78	0.000	1.09		406.7	SURCHARGED	
S1.025	S79	0.000	1.68		1266.6	SURCHARGED	
S1.026	S80	0.000	1.64		1227.6	SURCHARGED	
S1.027	S81	0.000	1.64		1260.0	SURCHARGED	
S1.028	S82	0.000	1.64		1260.0	SURCHARGED	
S1.029	S83	0.000	1.64		1259.4	SURCHARGED	
S1.030	S84	0.000	1.32		1258.3	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.031	S85	0.000	1.51		1258.2	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.032	S86	960 Winter	30	+20%	30/15 Summer				32.867
S1.033	S87	960 Winter	30	+20%	30/15 Summer				32.861
S1.034	S88	960 Winter	30	+20%					25.041
S1.035	S89	960 Winter	30	+20%					24.104
S1.036	S90	960 Winter	30	+20%					22.933
S11.000	S92	15 Winter	30	+20%	30/15 Summer				95.017
S12.000	S93	15 Winter	30	+20%					98.683
S12.001	S94	15 Winter	30	+20%	30/15 Summer				98.109
S13.000	S95	15 Winter	30	+20%					101.467
S13.001	S96	15 Winter	30	+20%	30/15 Summer				99.211
S13.002	S97	15 Winter	30	+20%	30/15 Summer				97.543
S12.002	S98	15 Winter	30	+20%	30/15 Summer				97.399
S14.000	S99	15 Winter	30	+20%	30/15 Summer				96.944
S12.003	S100	15 Winter	30	+20%	30/15 Summer				96.676
S12.004	S101	15 Winter	30	+20%	30/15 Summer				95.193
S11.001	S102	15 Winter	30	+2					94.821
S15.000	S103	15 Winter	30	+2					97.527
S15.001	S104	15 Winter	30	+20%	30/15 Summer				96.736
S15.002	S105	15 Winter	30	+20%	30/15 Summer				96.473
S15.003	S106	15 Winter	30	+20%					95.687
S15.004	S107	15 Winter	30	+20%					95.271
S15.005	S108	15 Winter	30	+20%					94.807
S15.006	S109	15 Winter	30	+20%	30/15 Summer				94.227
S11.002	S110	15 Winter	30	+20%	30/15 Summer				93.601
S16.000	S111	15 Winter	30	+20%					96.624
S16.001	S112	15 Winter	30	+20%					96.030
S16.002	S113	15 Winter	30	+20%	30/15 Summer				94.828
S16.003	S114	15 Winter	30	+20%	30/15 Summer				94.096
S16.004	S115	1440 Winter	30	+20%	30/15 Summer				93.475
S11.003	S116	1440 Winter	30	+20%	30/15 Summer				93.475
S11.004	S117	1440 Winter	30	+20%	30/15 Summer				93.474
S11.005	S118	1440 Winter	30	+20%					91.181
S17.000	S120	15 Winter	30	+20%					77.796
S18.000	S121	15 Winter	30	+20%					84.194
S18.001	S122	15 Winter	30	+20%					83.027
S18.002	S123	15 Winter	30	+20%	30/15 Summer				81.538
S18.003	S124	15 Winter	30	+20%	30/15 Summer				79.588
S18.004	S125	15 Winter	30	+20%					78.213
S17.001	S126	15 Winter	30	+20%	30/15 Summer				77.365
S17.002	S127	15 Winter	30	+20%	30/15 Winter				70.797
S19.000	S128	15 Winter	30	+20%					75.816
S19.001	S129	15 Summer	30	+20%					75.621
S19.002	S130	15 Winter	30	+20%					75.436
S20.000	S131	15 Winter	30	+20%	30/15 Summer				76.123
S20.001	S132	15 Winter	30	+2					76.088
S20.002	S133	15 Winter	30	+2					75.738
S19.003	S134	15 Winter	30	+20%	30/15 Summer				75.423
S19.004	S135	15 Winter	30	+20%					70.536
S17.003	S136	1440 Winter	30	+20%	30/15 Summer				69.961
S17.004	S137	1440 Winter	30	+20%	30/15 Summer				69.960
S17.005	S138	1440 Winter	30	+20%	30/15 Summer				69.959
S17.006	S139	1440 Winter	30	+20%					67.507
S21.000	S140	15 Winter	30	+20%					93.948
S21.001	S141	15 Winter	30	+20%					93.553
S21.002	S142	15 Winter	30	+20%					93.377
S21.003	S143	15 Winter	30	+20%					93.263

Future Phase

Future Phase

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.032	S86	0.475	0.000	0.34		258.0	SURCHARGED	
S1.033	S87	1.086	0.000	0.28		66.0	SURCHARGED	
S1.034	S88	-0.176	0.000	0.36		66.0	OK	
S1.035	S89	-0.174	0.000	0.37		66.0	OK	
S1.036	S90	-0.175	0.000	0.37		66.0	OK	
S11.000	S92	0.217	0.000	1.24		83.1	SURCHARGED	
S12.000	S93	-0.117	0.000	0.47		42.3	OK	
S12.001	S94	0.309	0.000	1.27		102.3	SURCHARGED	
S13.000	S95	-0.123	0.000	0.42		41.3	OK	
S13.001	S96	0.764	0.000	1.26		122.2	SURCHARGED	
S13.002	S97	0.201	0.000	1.43		117.8	SURCHARGED	
S12.002	S98	0.651	0.000	1.41		194.5	SURCHARGED	
S14.000	S99	0.251	0.000	1.32		122.2	SURCHARGED	
S12.003	S100	0.406	0.000	2.00		295.1	SURCHARGED	
S12.004	S101	0.591	0.000	1.55		337.3	SURCHARGED	
S11.001	S102	0.443	Future Phase			399.6	SURCHARGED	
S15.000	S103	-0.049				72.8	OK	
S15.001	S104	0.336	0.000	1.63		71.3	SURCHARGED	
S15.002	S105	0.173	0.000	1.17		89.2	SURCHARGED	
S15.003	S106	-0.113	0.000	0.70		106.2	OK	
S15.004	S107	-0.090	0.000	0.81		124.1	OK	
S15.005	S108	-0.062	0.000	0.90		143.1	OK	
S15.006	S109	0.096	0.000	0.97		144.5	SURCHARGED	
S11.002	S110	0.350	0.000	2.13		530.6	SURCHARGED	
S16.000	S111	-0.049	0.000	0.96		60.2	OK	
S16.001	S112	-0.077	0.000	0.90		170.2	OK	
S16.002	S113	0.044	0.000	1.02		180.7	SURCHARGED	
S16.003	S114	0.322	0.000	1.09		228.3	SURCHARGED	
S16.004	S115	0.496	0.000	0.20		16.2	SURCHARGED	
S11.003	S116	0.833	0.000	0.17		65.6	SURCHARGED	
S11.004	S117	1.349	0.000	0.05		2.3	FLOOD RISK	
S11.005	S118	-0.194	0.000	0.05		2.3	OK	
S17.000	S120	-0.083	0.000	0.71		43.8	OK	
S18.000	S121	-0.111	0.000	0.51		42.3	OK	
S18.001	S122	-0.079	0.000	0.75		61.4	OK	
S18.002	S123	0.563	0.000	1.11		100.9	SURCHARGED	
S18.003	S124	0.197	0.000	1.10		184.5	SURCHARGED	
S18.004	S125	-0.125	0.000	0.76		246.7	OK	
S17.001	S126	0.206	0.000	1.20		318.3	SURCHARGED	
S17.002	S127	0.018	0.000	1.03		318.0	SURCHARGED	
S19.000	S128	-0.143	0.000	0.29		16.2	OK	
S19.001	S129	-0.106	0.000	0.54		16.3	OK	
S19.002	S130	-0.137	0.000	0.30		16.2	OK	
S20.000	S131	0.323	0.000	0.44		12.6	SURCHARGED	
S20.001	S132	0.421	Future Phase			44.9	SURCHARGED	
S20.002	S133	0.204				51.6	SURCHARGED	
S19.003	S134	0.111	0.000	1.42		90.1	SURCHARGED	
S19.004	S135	-0.085	0.000	0.87		89.3	OK	
S17.003	S136	0.174	0.000	0.09		31.1	SURCHARGED	
S17.004	S137	0.911	0.000	0.10		31.0	SURCHARGED	
S17.005	S138	1.534	0.000	0.03		2.4	SURCHARGED	
S17.006	S139	-0.200	0.000	0.03		2.4	OK	
S21.000	S140	-0.096	0.000	0.77		69.2	OK	
S21.001	S141	-0.089	0.000	0.82		80.4	OK	
S21.002	S142	-0.061	0.000	0.88		79.6	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S21.003	S143	0.000	0.000	0.92		149.2	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S21.004	S144	15 Winter	30	+20%	30/15 Summer				92.933	0.182
S21.005	S145	15 Winter	30	+20%	30/15 Summer				92.721	0.332
S21.006	S146	15 Winter	30	+20%	30/15 Summer				91.252	0.628
S22.000	S147	15 Winter	30	+20%					99.877	-0.142
S22.001	S148	15 Winter	30	+20%					99.724	-0.134
S22.002	S149	15 Winter	30	+20%					99.484	-0.071
S22.003	S150	15 Winter	30	+20%					98.832	-0.099
S22.004	S151	15 Winter	30	+20%	30/15 Summer				98.230	0.199
S22.005	S152	15 Winter	30	+20%	30/15 Summer				97.574	0.443
S22.006	S153	15 Winter	30	+20%	30/15 Summer				96.815	0.584
S22.007	S154	15 Winter	30	+20%	30/15 Summer				96.475	0.686
S22.008	S155	15 Winter	30	+20%	30/15 Summer				96.233	0.550
S22.009	S156	15 Winter	30	+20%	30/15 Summer				95.991	0.402
S22.010	S157	15 Winter	30	+20%	30/15 Summer				95.747	0.387
S22.011	S158	15 Winter	30	+20%	30/15 Summer				95.504	0.306
S22.012	S159	15 Winter	30	+20%	30/15 Summer				95.251	0.221
S22.013	S160	15 Winter	30	+20%	30/15 Summer				95.125	0.228
S22.014	S161	15 Winter	30	+20%	30/15 Summer				94.993	0.294
S22.015	S162	15 Winter	30	+20%	30/15 Summer				94.856	0.362
S22.016	S163	15 Winter	30	+20%	30/15 Summer				94.713	0.415
S22.017	S164	15 Winter	30	+20%	30/15 Summer				94.011	0.613
S22.018	S165	15 Winter	30	+20%	30/15 Summer				93.778	0.576
S23.000	S166	15 Winter	30	+20%					95.176	-0.054
S24.000	S167	15 Winter	30	+20%	30				96.335	0.204
S24.001	S168	15 Winter	30	+20%	30				95.866	0.085
S24.002	S169	15 Winter	30	+20%	30/15 Summer				95.528	0.165
S23.001	S170	15 Winter	30	+20%	30/15 Summer				94.712	0.449
S23.002	S171	15 Winter	30	+20%	30/15 Summer				94.142	0.316
S22.019	S172	15 Winter	30	+20%	30/15 Summer				93.542	0.436
S22.020	S173	15 Winter	30	+20%	30/15 Summer				92.889	0.439
S25.000	S174	15 Winter	30	+20%					95.161	-0.156
S26.000	S175	15 Winter	30	+20%					96.125	-0.124
S26.001	S176	15 Summer	30	+20%					95.404	-0.092
S26.002	S177	15 Summer	30	+20%					95.103	-0.096
S26.003	S178	15 Summer	30	+20%					94.944	-0.052
S26.004	S179	15 Summer	30	+20%					94.850	-0.061
S25.001	S180	15 Winter	30	+20%	30/15 Summer				93.958	0.350
S25.002	S181	15 Winter	30	+20%	30/15 Summer				92.856	0.466
S22.021	S182	15 Winter	30	+20%	30/15 Summer				91.799	0.774
S21.007	S183	15 Winter	30	+20%	30/15 Summer				90.705	0.445
S27.000	S184	15 Winter	30	+20%	30/15 Summer				91.556	0.018
S21.008	S185	15 Winter	30	+20%	30/15 Summer				89.297	0.722
S21.009	S186	15 Winter	30	+20%	30/15 Summer				88.552	0.702
S21.010	S187	15 Winter	30	+20%	30/15 Summer				88.149	0.558
S21.011	S188	15 Winter	30	+20%	30/15 Summer				87.743	0.250
S21.012	S189	60 Winter	30	+20%					87.130	-0.243
S21.013	S190	60 Winter	30	+20%					87.033	-0.243
S21.014	S191	60 Winter	30	+20%					86.876	-0.328
S21.015	S192	60 Winter	30	+20%					86.703	-0.238
S21.016	S193	60 Winter	30	+20%					86.618	-0.222
S21.017	S194	240 Winter	30	+20%					86.504	-0.246
S21.018	S195	240 Winter	30	+20%					86.489	-0.101
S21.019	S196	240 Winter	30	+20%	30/30 Winter				86.474	0.374
S21.020	S197	240 Winter	30	+20%					85.168	-0.125
S21.021	S198	240 Winter	30	+20%					84.713	-0.162
S21.022	S199	720 Winter	30	+20%					83.663	-0.087

Future Phase

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S21.004	S144	0.000	0.83		184.3	SURCHARGED	
S21.005	S145	0.000	0.91		253.1	SURCHARGED	
S21.006	S146	0.000	1.28		282.3	SURCHARGED	
S22.000	S147	0.000	0.54		42.9	OK	
S22.001	S148	0.000	0.58		58.6	OK	
S22.002	S149	0.000	0.90		97.2	OK	
S22.003	S150	0.000	0.76		134.0	OK	
S22.004	S151	0.000	0.90		158.3	SURCHARGED	
S22.005	S152	0.000	0.93		164.1	SURCHARGED	
S22.006	S153	0.000	0.89		186.0	SURCHARGED	
S22.007	S154	0.000	1.61		204.8	SURCHARGED	
S22.008	S155	0.000	1.68		202.1	SURCHARGED	
S22.009	S156	0.000	1.07		200.6	SURCHARGED	
S22.010	S157	0.000	1.26		198.4	SURCHARGED	
S22.011	S158	0.000	1.25		200.0	SURCHARGED	
S22.012	S159	0.000	0.98		201.2	SURCHARGED	
S22.013	S160	0.000	0.82		206.5	SURCHARGED	
S22.014	S161	0.000	0.83		211.7	SURCHARGED	
S22.015	S162	0.000	0.88		219.1	SURCHARGED	
S22.016	S163	0.000	0.89		272.5	SURCHARGED	
S22.017	S164	0.000	1.13		282.4	SURCHARGED	
S22.018	S165	0.000	1.63		284.2	SURCHARGED	
S23.000	S166	0.000	0.80		62.8	OK	
S24.000	S167	0.000			7	SURCHARGED	
S24.001	S168	0.000			9	SURCHARGED	
S24.002	S169	0.000	1.01		131.3	SURCHARGED	
S23.001	S170	0.000	1.18		183.1	SURCHARGED	
S23.002	S171	0.000	0.93		180.4	SURCHARGED	
S22.019	S172	0.000	1.87		448.5	SURCHARGED	
S22.020	S173	0.000	1.87		452.0	SURCHARGED	
S25.000	S174	0.000	0.46		71.1	OK	
S26.000	S175	0.000	0.42		36.6	OK	
S26.001	S176	0.000	0.66		37.4	OK	
S26.002	S177	0.000	0.61		38.8	OK	
S26.003	S178	0.000	0.94		38.6	OK	
S26.004	S179	0.000	0.87		73.3	OK	
S25.001	S180	0.000	1.21		188.9	SURCHARGED	
S25.002	S181	0.000	1.53		187.0	SURCHARGED	
S22.021	S182	0.000	1.18		635.2	SURCHARGED	
S21.007	S183	0.000	2.00		933.1	SURCHARGED	
S27.000	S184	0.000	1.00		83.5	SURCHARGED	
S21.008	S185	0.000	1.21		985.0	SURCHARGED	
S21.009	S186	0.000	1.25		992.1	SURCHARGED	
S21.010	S187	0.000	1.63		987.9	SURCHARGED	
S21.011	S188	0.000	1.64		991.5	SURCHARGED	
S21.012	S189	0.000	0.79		480.3	OK	
S21.013	S190	0.000	0.79		478.9	OK	
S21.014	S191	0.000	0.60		483.6	OK	
S21.015	S192	0.000	0.80		486.2	OK	
S21.016	S193	0.000	0.84		489.6	OK	
S21.017	S194	0.000	0.47		317.8	OK	
S21.018	S195	0.000	0.49		317.2	OK	
S21.019	S196	0.000	0.51		129.5	SURCHARGED	
S21.020	S197	0.000	0.78		129.5	OK	
S21.021	S198	0.000	0.62		129.5	OK	

Future Phase

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S21.022	S199	0.000	0.35		92.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S28.000	S200	120 Winter	30	+20%					87.439	-0.225
S29.000	S201	120 Winter	30	+20%					93.308	-0.225
S29.001	S202	15 Winter	30	+20%					91.348	-0.046
S29.002	S203	15 Winter	30	+20%					89.049	0.234
S28.001	S204	15 Winter	30	+20%	30/15 Summer				87.346	0.239
S30.000	S205	15 Winter	30	+20%	30/15 Summer				93.535	0.435
S30.001	S206	15 Winter	30	+20%	30/15 Summer				93.330	0.358
S30.002	S207	15 Winter	30	+20%	30/15 Summer				92.740	0.560
S30.003	S208	15 Winter	30	+20%	30/15 Summer				91.523	0.625
S30.004	S209	15 Winter	30	+20%	30/15 Summer				90.511	0.486
S30.005	S210	15 Winter	30	+20%	30/15 Summer				89.849	0.396
S30.006	S211	15 Winter	30	+20%	30/15 Summer				87.771	0.737
S28.002	S212	15 Winter	30	+20%	30/15 Summer				87.084	0.284
S31.000	S213	15 Winter	30	+20%	30/15 Summer				94.208	0.408
S31.001	S214	15 Winter	30	+20%	30/15 Summer				93.601	0.115
S31.002	S215	15 Winter	30	+20%					93.223	-0.015
S32.000	S216	15 Winter	30	+20%	30/15 Summer				97.427	0.027
S32.001	S217	15 Winter	30	+20%					97.254	-0.046
S32.002	S218	15 Winter	30	+20%					96.653	-0.047
S32.003	S219	15 Winter	30	+20%	30/15 Summer				96.457	0.070
S32.004	S220	15 Winter	30	+20%					96.043	-0.048
S32.005	S221	15 Winter	30	+20%					94.737	-0.085
S33.000	S222	15 Winter	30	+20%					94.610	-0.020
S33.001	S223	15 Winter	30	+20%	30/15 Summer				94.528	0.328
S33.002	S224	15 Winter	30	+20%	30/15 Summer				94.475	0.402
S33.003	S225	15 Winter	30	+20%	30/15 Summer				94.436	0.467
S33.004	S226	15 Winter	30	+20%	30/15 Summer				94.398	0.537
S32.006	S227	15 Winter	30	+20%	30/15 Summer				94.240	0.473
S32.007	S228	15 Winter	30	+20%	30/15 Summer				93.965	0.393
S32.008	S229	15 Winter	30	+20%	30/15 Summer				93.787	0.865
S32.009	S230	15 Winter	30	+20%	30/15 Summer				93.215	0.607
S31.003	S231	15 Winter	30	+20%	30/15 Summer				92.941	0.374
S31.004	S232	15 Winter	30	+20%	30/15 Summer				92.667	0.167
S34.000	S233	15 Winter	30	+20%					94.808	-0.167
S34.001	S234	15 Summer	30	+20%					94.313	-0.237
S34.002	S235	15 Winter	30	+20%	30/15 Summer				94.042	0.057
S34.003	S236	15 Winter	30	+20%	30/15 Summer				92.916	0.013
S34.004	S237	15 Winter	30	+20%	30/15 Summer				92.371	0.109
S31.005	S238	15 Winter	30	+20%	30/15 Summer				92.032	0.140
S31.006	S239	15 Winter	30	+20%	30/15 Summer				91.702	0.169
S31.007	S240	15 Winter	30	+20%					90.469	-0.208
S35.000	S241	15 Winter	30	+20%					94.436	-0.164
S35.001	S242	15 Winter	30	+20%					94.324	-0.169
S35.002	S243	15 Winter	30	+20%					92.690	-0.138
S35.003	S244	15 Winter	30	+20%					91.570	-0.139
S31.008	S245	1440 Winter	30	+20%	30/15 Winter				89.283	0.280
S31.009	S246	1440 Winter	30	+20%	30/600 Winter				89.283	0.370
S31.010	S247	1440 Winter	30	+20%	30/480 Winter				89.283	0.447
S31.011	S248	1440 Winter	30	+20%	30/15 Summer				89.283	1.294
S31.012	S249	1440 Winter	30	+20%					87.612	-0.197
S31.013	S250	1440 Winter	30	+20%					87.004	-0.196
S28.003	S251	1440 Winter	30	+20%					86.133	-0.317
S28.004	S252	1440 Winter	30	+20%					86.133	-0.102
S28.005	S253	1440 Winter	30	+20%					86.133	-0.020
S28.006	S254	1440 Winter	30	+20%	30/15 Winter				86.133	0.758
S28.007	S255	1440 Winter	30	+20%					84.982	-0.193

Future Phase

Future Phase

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S28.000	S200	0.000	0.00		0.0	OK	
S29.000	S201	0.000	0.00		0.0	OK	
S29.001	S202	0.000			5	OK	
S29.002	S203	0.000			7	SURCHARGED	
S28.001	S204	0.000	0.92		225.6	SURCHARGED	
S30.000	S205	0.000	1.25		75.8	SURCHARGED	
S30.001	S206	0.000	1.74		121.6	SURCHARGED	
S30.002	S207	0.000	1.12		182.4	SURCHARGED	
S30.003	S208	0.000	1.30		203.2	SURCHARGED	
S30.004	S209	0.000	1.91		203.9	SURCHARGED	
S30.005	S210	0.000	1.34		206.4	SURCHARGED	
S30.006	S211	0.000	1.72		207.9	SURCHARGED	
S28.002	S212	0.000	1.45		428.0	SURCHARGED	
S31.000	S213	0.000	1.37		92.3	SURCHARGED	
S31.001	S214	0.000	1.21		80.3	SURCHARGED	
S31.002	S215	0.000	1.00		74.5	OK	
S32.000	S216	0.000	1.12		34.7	SURCHARGED	
S32.001	S217	0.000	0.95		49.3	OK	
S32.002	S218	0.000	0.78		61.6	OK	
S32.003	S219	0.000	1.12		61.6	SURCHARGED	
S32.004	S220	0.000	0.98		61.7	OK	
S32.005	S221	0.000			7	OK	
S33.000	S222	0.000			2	OK	
S33.001	S223	0.000	1.10		31.2	SURCHARGED	
S33.002	S224	0.000	0.91		53.4	SURCHARGED	
S33.003	S225	0.000	0.71		77.9	SURCHARGED	
S33.004	S226	0.000	1.55		167.9	SURCHARGED	
S32.006	S227	0.000	1.27		234.8	SURCHARGED	
S32.007	S228	0.000	1.63		243.9	SURCHARGED	
S32.008	S229	0.000	1.33		286.8	SURCHARGED	
S32.009	S230	0.000	2.04		292.6	SURCHARGED	
S31.003	S231	0.000	1.72		395.5	SURCHARGED	
S31.004	S232	0.000	1.68		395.0	SURCHARGED	
S34.000	S233	0.000	0.15		12.2	OK	
S34.001	S234	0.000	0.10		12.1	OK	
S34.002	S235	0.000	1.03		147.5	SURCHARGED	
S34.003	S236	0.000	1.03		151.4	SURCHARGED	
S34.004	S237	0.000	1.10		149.6	SURCHARGED	
S31.005	S238	0.000	1.53		531.0	SURCHARGED	
S31.006	S239	0.000	1.57		574.2	SURCHARGED	
S31.007	S240	0.000	0.82		572.8	OK	
S35.000	S241	0.000	0.41		24.3	OK	
S35.001	S242	0.000	0.39		24.1	OK	
S35.002	S243	0.000	0.55		101.1	OK	
S35.003	S244	0.000	0.55		104.3	OK	
S31.008	S245	0.000	0.11		70.2	SURCHARGED	
S31.009	S246	0.000	0.08		70.9	SURCHARGED	
S31.010	S247	0.000	0.10		110.7	SURCHARGED	
S31.011	S248	0.000	0.04		2.2	SURCHARGED	
S31.012	S249	0.000	0.04		2.2	OK	
S31.013	S250	0.000	0.04		2.2	OK	
S28.003	S251	0.000	0.06		40.3	OK	
S28.004	S252	0.000	0.04		39.9	OK	
S28.005	S253	0.000	0.05		38.4	OK	
S28.006	S254	0.000	0.05		2.5	SURCHARGED	

Future Phase

Future Phase

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S28.007	S255	0.000	0.05		2.5	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S28.008	S256	1440 Winter	30	+20%					84.691
S28.009	S257	1440 Winter	30	+20%					82.696
S28.010	S258	1440 Winter	30	+20%					81.309
S28.011	S259	1440 Winter	30	+20%					80.962
S21.023	S260	720 Winter	30	+20%	30/120 Summer				77.795
S21.024	S261	720 Winter	30	+20%	30/120 Summer				69.091
S17.007	S262	720 Winter	30	+20%	30/120 Summer				61.773
S17.008	S263	720 Winter	30	+20%	30/120 Summer				58.959
S17.009	S264	720 Winter	30	+20%	30/120 Summer				58.223
S17.010	S265	720 Winter	30	+20%	30/120 Summer				55.880
S17.011	S266	720 Winter	30	+20%	30/120 Summer				50.437
S17.012	S267	720 Winter	30	+20%					49.661
S17.013	S268	720 Winter	30	+20%	30/480 Winter				48.925
S17.014	S269	720 Winter	30	+20%					48.637
S17.015	S270	720 Winter	30	+20%					48.201
S36.000	S272	120 Winter	30	+20%					99.007
S36.001	S273	120 Winter	30	+20%					97.947
S36.002	S274	15 Winter	30	+20%					97.724
S36.003	S275	15 Summer	30	+20%					96.247
S36.004	S276	15 Winter	30	+20%	30/15 Summer				95.619
S36.005	S277	15 Winter	30	+20%	30/15 Summer				95.422
S37.000	S278	15 Winter	30	+20%					98.669
S37.001	S279	15 Winter	30		Future Phase				98.670
S37.002	S280	15 Winter	30						97.729
S37.003	S281	15 Winter	30	+20%	30/15 Summer				96.961
S37.004	S282	15 Winter	30	+20%	30/15 Summer				95.868
S37.005	S283	15 Winter	30	+20%					95.595
S36.006	S284	1440 Winter	30	+20%	30/15 Summer				95.010
S38.000	S285	15 Winter	30	+20%	30/15 Summer				98.417
S38.001	S286	15 Winter	30	+20%	30/15 Summer				97.952
S38.002	S287	15 Winter	30	+20%	30/15 Summer				97.841
S38.003	S288	15 Winter	30	+20%	30/15 Summer				97.654
S38.004	S289	1440 Winter	30	+20%	30/180 Winter				95.008
S36.007	S290	1440 Winter	30	+20%	30/60 Summer				95.007
S36.008	S291	1440 Winter	30	+20%	30/15 Summer				95.007
S39.000	S293	15 Winter	30	+20%	30/15 Summer				97.108
S40.000	S294	15 Winter	30	+20%					97.673
S39.001	S295	15 Winter	30	+20%	30/15 Summer				96.921
S41.000	S296	960 Winter	30	+20%	30/120 Summer				96.289
S39.002	S297	960 Winter	30	+20%	30/15 Summer				96.289
S39.003	S298	960 Winter	30	+20%	30/15 Winter				96.287
S39.004	S299	960 Winter	30	+20%	30/15 Summer				96.283
S42.000	S301	15 Winter	30	+20%					104.490
S42.001	S302	15 Winter	30	+20%					101.234
S42.002	S303	15 Winter	30	+20%	30/15 Summer				98.890
S42.003	S304	15 Winter	30	+20%	30/15 Summer				98.586
S42.004	S305	15 Winter	30	+20%	30/15 Summer				98.331
S42.005	S306	15 Winter	30	+20%					97.996
S42.006	S307	15 Winter	30	+20%					97.267
S42.007	S308	15 Winter	30	+20%					96.586
S42.008	S309	15 Winter	30	+20%					95.427
S42.009	S310	15 Winter	30	+20%	30/15 Summer				94.858
S43.000	S311	15 Winter	30	+20%	30/15 Winter				97.684
S43.001	S312	15 Winter	30	+20%	30/15 Summer				97.636
S43.002	S313	15 Winter	30	+20%	30/15 Summer				97.600
S43.003	S314	15 Winter	30	+20%	30/15 Summer				97.332

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S28.008	S256	-0.192	0.000	0.05		2.5	OK	
S28.009	S257	-0.189	0.000	0.06		2.5	OK	
S28.010	S258	-0.189	0.000	0.06		2.5	OK	
S28.011	S259	-0.192	0.000	0.05		2.5	OK	
S21.023	S260	1.779	0.000	2.40		94.9	SURCHARGED	
S21.024	S261	2.154	0.000	1.87		94.9	SURCHARGED	
S17.007	S262	1.508	0.000	1.86		97.1	SURCHARGED	
S17.008	S263	0.545	0.000	2.10		97.1	SURCHARGED	
S17.009	S264	0.353	0.000	2.07		97.1	SURCHARGED	
S17.010	S265	0.489	0.000	2.14		97.1	SURCHARGED	
S17.011	S266	0.578	0.000	2.18		97.1	SURCHARGED	
S17.012	S267	-0.051	0.000	0.96		97.1	OK	
S17.013	S268	0.010	0.000	1.06		97.1	SURCHARGED	
S17.014	S269	-0.063	0.000	0.98		97.1	OK	
S17.015	S270	0.000	0.000	1.03		97.1	OK	
S36.000	S272	-0.225	0.000	0.00		0.0	OK	
S36.001	S273	-0.225	0.000	0.00		0.0	OK	
S36.002	S274	-0.076	0.000	0.77		53.5	OK	
S36.003	S275	-0.094	0.000	0.63		53.3	OK	
S36.004	S276	0.203	0.000	0.61		51.8	SURCHARGED	
S36.005	S277	0.622	0.000	1.95		100.0	SURCHARGED	
S37.000	S278	-0.131	0.000	0.02		0.5	OK	
S37.001	S279	-0.060	Future Phase			68.2	OK	
S37.002	S280	-0.071				78.4	OK	
S37.003	S281	0.161	0.000	1.04		136.8	SURCHARGED	
S37.004	S282	0.068	0.000	2.07		136.8	SURCHARGED	
S37.005	S283	-0.168	0.000	0.58		134.9	OK	
S36.006	S284	0.384	0.000	0.09		18.1	SURCHARGED	
S38.000	S285	0.617	0.000	1.48		43.2	SURCHARGED	
S38.001	S286	0.365	0.000	1.68		43.1	SURCHARGED	
S38.002	S287	0.295	0.000	1.56		43.4	SURCHARGED	
S38.003	S288	0.198	0.000	1.56		79.2	SURCHARGED	
S38.004	S289	0.844	0.000	0.06		8.0	SURCHARGED	
S36.007	S290	1.207	7.499	0.09		25.3		
S36.008	S291	1.682	2.630	0.04		2.5		
S39.000	S293	0.308	0.000	0.89		31.6	SURCHARGED	
S40.000	S294	-0.102	0.000	0.58		20.1	OK	
S39.001	S295	0.492	0.000	1.55		55.2	SURCHARGED	
S41.000	S296	0.532	0.000	0.03		0.9	SURCHARGED	
S39.002	S297	0.810	0.000	0.14		9.3	SURCHARGED	
S39.003	S298	0.885	0.000	0.13		9.2	SURCHARGED	
S39.004	S299	1.258	0.000	0.07		2.2	SURCHARGED	
S42.000	S301	-0.107	0.000	0.53		52.3	OK	
S42.001	S302	-0.067	0.000	0.81		85.1	OK	
S42.002	S303	0.177	0.000	0.88		98.7	SURCHARGED	
S42.003	S304	0.280	0.000	2.02		105.9	SURCHARGED	
S42.004	S305	0.086	0.000	1.46		117.6	SURCHARGED	
S42.005	S306	-0.173	0.000	0.56		132.0	OK	
S42.006	S307	-0.183	0.000	0.51		141.7	OK	
S42.007	S308	-0.178	0.000	0.53		158.1	OK	
S42.008	S309	-0.158	0.000	0.61		171.3	OK	
S42.009	S310	0.162	0.000	0.85		172.2	SURCHARGED	
S43.000	S311	0.006	0.000	0.53		24.4	SURCHARGED	
S43.001	S312	0.163	Future Phase			23.4	SURCHARGED	
S43.002	S313	0.168				49.0	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S43.003	S314	0.081	Future Phase			48.9	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S43.004	S315	15 Winter	30	+20%	30/15 Summer				97.188	0.567
S43.005	S316	15 Winter	30	+20%	30/15 Summer				96.899	0.578
S43.006	S317	15 Winter	30	+20%	30/15 Summer				96.649	0.416
S44.000	S318	15 Winter	30	+20%	30/15 Summer				101.054	0.095
S44.001	S319	15 Winter	30	+20%	30/15 Summer				100.914	0.117
S44.002	S320	15 Winter	30	+20%	30/15 Summer				100.707	0.037
S44.003	S321	15 Winter	30	+20%	30/15 Summer				100.067	0.039
S44.004	S322	15 Winter	30	+20%	30/15 Summer				99.501	0.149
S44.005	S323	15 Winter	30	+20%					99.085	-0.112
S45.000	S324	15 Winter	30	+20%					101.680	-0.120
S45.001	S325	15 Winter	30	+20%					101.110	-0.038
S45.002	S326	15 Winter	30	+20%	30/15 Summer				100.175	0.197
S45.003	S327	15 Winter	30	+20%	30/15 Summer				99.555	0.249
S44.006	S328	15 Winter	30	+20%	30/15 Summer				98.836	0.258
S44.007	S329	15 Winter	30	+20%	30/15 Summer				97.752	0.277
S44.008	S330	15 Winter	30	+20%	30/15 Summer				97.182	0.613
S43.007	S331	15 Winter	30	+20%	30/15 Summer				96.390	0.825
S43.008	S332	15 Winter	30	+20%	30/15 Summer				96.007	0.838
S43.009	S333	15 Winter	30	+20%	30/15 Summer				95.540	0.548
S43.010	S334	15 Winter	30	+20%	30/15 Summer				95.325	0.870
S42.010	S335	15 Winter	30	+20%	30/15 Summer				94.586	0.345
S46.000	S337	15 Winter	30	+20%					104.449	-0.090
S46.001	S338	15 Winter	30	+20%	30/15 Summer				103.577	0.278
S46.002	S339	15 Winter	30	+20%	30/15 Summer				102.097	0.155
S46.003	S340	15 Winter	30	+20%					101.719	-0.067
S46.004	S341	15 Winter	30	+20%					101.176	-0.130
S46.005	S342	15 Winter	30	+20%					100.254	-0.135

Future Phase

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S43.004	S315	0.000	1.50		44.2	SURCHARGED	
S43.005	S316	0.000	2.03		66.6	SURCHARGED	
S43.006	S317	0.000	0.98		67.7	SURCHARGED	
S44.000	S318	0.000	0.99		35.4	SURCHARGED	
S44.001	S319	0.000			.0	SURCHARGED	
S44.002	S320	0.000			.1	SURCHARGED	
S44.003	S321	0.000	1.29		41.4	SURCHARGED	
S44.004	S322	0.000	1.38		89.3	SURCHARGED	
S44.005	S323	0.000	0.70		88.5	OK	
S45.000	S324	0.000	0.45		32.5	OK	
S45.001	S325	0.000	0.89		138.9	OK	
S45.002	S326	0.000	1.56		188.6	SURCHARGED	
S45.003	S327	0.000	1.51		200.5	SURCHARGED	
S44.006	S328	0.000	1.19		301.5	SURCHARGED	
S44.007	S329	0.000	1.27		307.7	SURCHARGED	
S44.008	S330	0.000	1.20		299.2	SURCHARGED	
S43.007	S331	0.000	1.86		348.0	SURCHARGED	
S43.008	S332	0.000	1.63		352.6	SURCHARGED	
S43.009	S333	0.000	1.48		354.2	SURCHARGED	
S43.010	S334	0.000	1.86		361.2	SURCHARGED	
S42.010	S335	0.000	2.09		518.4	SURCHARGED	
S46.000	S337	0.000	0.65		43.4	OK	
S46.001	S338	0.000	1.11		71.4	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S46.002	S339	0.000	1.42		89.1	SURCHARGED	
S46.003	S340	0.000	0.95		87.7	OK	
S46.004	S341	0.000	0.62		87.6	OK	
S46.005	S342	0.000	0.58		87.3	OK	

Appendix I. Soakaway Design

Denotes where input values are required

BRE 365 Soakaway Design Fassaroe Development - Road Soakaway

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1 Input r = 0.255 (From Figure 1)

2 **Calculate M5-Dmin and M10-Dmin**
From Table 1 (Rainfall Data Sheet) select Z1 values and input below:
Then from Table 2 select Z2 vaules based on the calculated M5-Dmin depths and input below:

Storm Duration, D min	Z1	M5-Dmin =20mm x Z1	Z2	M10-Dmin (R) =Z2xM5-Dmin
5	0.33	6.6	1.19	7.9
10	0.48	9.6	1.19	11.4
15	0.58	11.6	1.20	13.9
30	0.76	15.2	1.20	18.2
60	1.00	20.0	1.19	23.8
120	1.27	25.4	1.18	30.0
240	1.64	32.8	1.18	38.7
360	1.88	37.6	1.17	44.0
600	2.24	44.8	1.16	52.0
1140	3.10	62.0	1.15	71.3

3 **S = I - O** *S = the required storage in the soakaway*
I = the inflow from the impermeable area
O = the outflow infiltrating into the soil

I = A x R *A = the impermeable area drained to the soakaway*
R = the total rainfall in a design storm (10 yr return period)

O = a50 x f x d *a50 = the internal surface area of the soakaway to 50% effective depth - excludes base area as this is assumed to become clogged*
f = the soil infiltration rate
D = the storm duration

Input Values

A (sq m) =	7820
f (m/s) =	0.0000285
L (m) =	75
W (m) =	20
eff D (m) =	1
a50 =	95

Catchment E
Change soakaway dimensions until it states it is 'Suitable' in the yellow box
for rectangular soakaway

For a 5 year return Period:

Duration (min)	5	10	15	30	60	120	240	360	600	1440
Inflow, I =	51.612	75.072	90.712	118.864	156.4	198.628	256.496	294.032	350.336	484.84
Outflow, O =	0.81225	1.6245	2.43675	4.8735	9.747	19.494	38.988	58.482	97.47	233.928
S =	50.79975	73.4475	88.27525	113.9905	146.653	179.134	217.508	235.55	252.866	250.912

Effective Storage, eff S (75% assumed) =	1125	Soakaway dimensions suitable

For a 10 year return Period:

Duration (min)	5	10	15	30	60	120	240	360	600	1440
Inflow, I =	61.41828	89.33568	108.8544	142.6368	186.116	234.381	302.6653	344.0174	406.3898	557.566
Outflow, O =	0.81225	1.6245	2.43675	4.8735	9.747	19.494	38.988	58.482	97.47	233.928
S =	60.60603	87.71118	106.4177	137.7633	176.369	214.887	263.6773	285.5354	308.9198	323.638

Effective Storage, eff S (75% assumed) =	1125	Soakaway dimensions suitable

For a 30 year return Period (growth factor of 1.64 applied)

Duration (min)	5	10	15	30	60	120	240	360	600	1440
Inflow, I =	70.5364	102.5984	123.973	162.447	213.747	271.458	350.545	401.844	478.793	662.615
Outflow, O =	0.81225	1.6245	2.43675	4.8735	9.747	19.494	38.988	58.482	97.47	233.928
S =	69.72415	100.9739	121.5363	157.573967	203.9997	251.9643	311.5565	343.3617	381.3225	428.6867

Effective Storage, eff S (75% assumed) =	1125	Soakaway dimensions suitable

For a 100 year return Period (growth factor of 1.96 applied)

Duration (min)	5	10	15	30	60	120	240	360	600	1440
Inflow, I =	84.2996	122.6176	148.163	194.145	255.453	324.426	418.943	480.252	572.215	791.905
Outflow, O =	0.81225	1.6245	2.43675	4.8735	9.747	19.494	38.988	58.482	97.47	233.928
S =	83.48735	120.9931	145.7262	189.271033	245.7063	304.9317	379.9555	421.7703	474.7455	557.9773

Effective Storage, eff S (75% assumed) =	1125	Soakaway dimensions suitable

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