Clifton Scannell Emerson
Associates

Engineering Planning Report - Drainage & Water Services
EngineNode 220 kV Substation and Grid Connection

EngineNode
DATA CENTRE

Client: EngineNode

Date: 31th July 2020

Job Number: 18_086

Civil Engineering
Structural Engineering
Transport Engineering
Environmental Engineering
Project Management
Health and Safety

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Document Control Sheet

Project Name:	EngineNode 220 kV Substation and Grid Connection
Project Number:	18_086
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Issue No.	Issue Status	Date	Prepared by	Checked by
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1.2	APPROVAL	31/07/2020	ZS	CD

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1 Introduction

1.1 Overview

The following report is being submitted as part of the Strategic Infrastructure Development (SID) Application for the proposed development that comprises of a 220kV Gas Insulated Switchgear (GIS) Substation, 4 Transformers, an underground double circuit 220kV cable installation and an underground 49kVA cable installation.

The Proposed Development comprises a new Gas Insulated Substation 220kV GIS substation and two underground 220kV transmission lines from the proposed substation to the existing overhead 220 kV line Corduff to Woodlands.

The proposed 75kVA cable installation will provide a connection from an existing underground MV circuit which is located within the roadbed of the L1010 to the proposed 220kV GIS Substation.

1.2 Existing Land Use

The existing site is currently a greenfield site which was previously used as agricultural land.

1.3 Proposed Development on Landholding (subject to concurrent planning application)

The substation site is located on lands in Bracetown, Dunboyne, Co. Meath just off the M3 Motorway. The site is located c. 1.8km north-east of Dunboyne and traverses the townlands of Bracetown, Gunnocks, Normanstown, Pace and Portmanna, in the Barony of Dunboyne and the Civil Parish of Dunboyne.

The substation site is 1.7 hectares in area and is zoned as industrial/commercial (E2 - General Industry and Employment/E3 - Warehousing and Distribution as per the Meath County Development Plan 2013-2019 (MCDP)). The lands in question have been subject to planning application which is outlined below

- Proposed development (subject to concurrent planning application) under Meath County Council Reg. Ref. RA/191593 which consists of four number two-storey data storage buildings each containing eight number data halls within each building, a single storey energy centre building, an AGI substation, and ancillary services.

1.4 Proposed Infrastructure on Landholding (subject to concurrent planning application)

The proposed infrastructure subject to concurrent planning application under Meath County Council Reg Ref: RA/191593 includes connections to external Irish Water water supply main and foul sewer, existing watercourse bordering the site to the southeast which joins the Pinkeen Stream approximately 2 km east of the site, site entrance, gate house and site wide security fencing and gate in addition to infrastructure associated with the proposed data storage facility.

The services for the proposed development connect to the infrastructure described above which have been designed to facilitate the proposed development.

The Engineering and Water Services Report (Document No. RPT-18_086-004) submitted in support of this planning application is included in Appendix A to this report.

2 Surface Water Drainage

2.1 General

The proposed development will provide attenuation in compliance with the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) The following section outlines the surface water drainage proposals for the development. All SUDS elements have been designed as per the recommendation of the SuDS Manual 2015.

All surface water works including connections will be carried out in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

2.2 Existing Surface Water Network

There is no drainage system currently serving the site. The lands fall to the south east of the site and are bordered by a network of drainage ditches which form a single ditch / watercourse which in turn forms a tributary of the Pinkeen Stream. The watercourse in question joins the Pinkeen Stream approximately 2 km east of the site.

2.3 Proposed Surface Water Network

2.3.1 Overview

The proposed surface water network for the proposed development collects runoff from roofs, roads and other hard standing areas in a sealed system of pipes and gullies. Surface water drainage network of the proposed development connects into proposed surface water network subject to concurrent planning application that serves Catchment 1 of the proposed EngineNode development (Meath County Council Planning Reg. Ref. RA/191593).

The extent of Catchment Area 1 is marked in blue and the approximate proposed development site is marked in green in Figure 2.1 below.

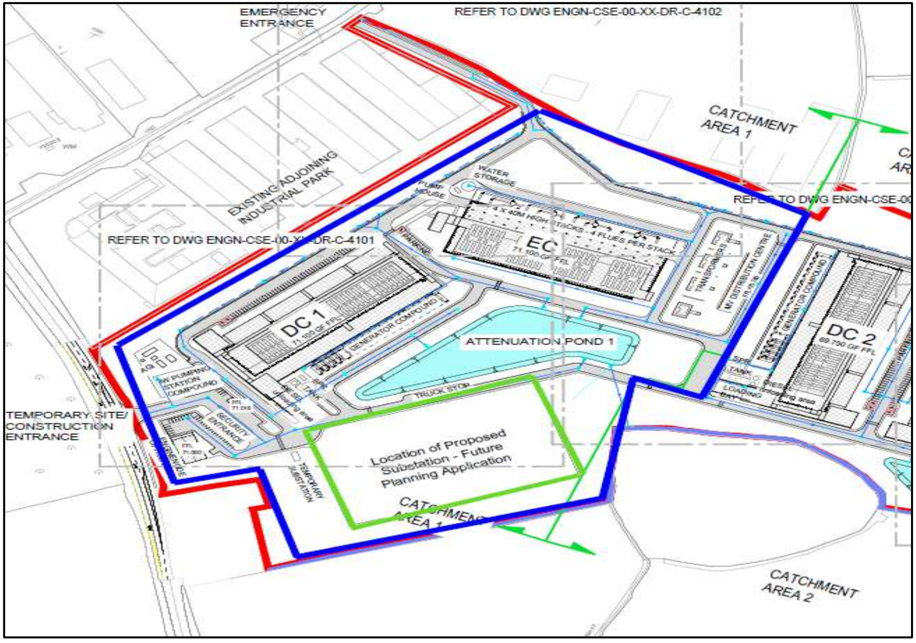


Fig 2.1 – Extract from Drawing No. ENGN-CSE-00-XX-DR-C-4100 indicting Catchment 1

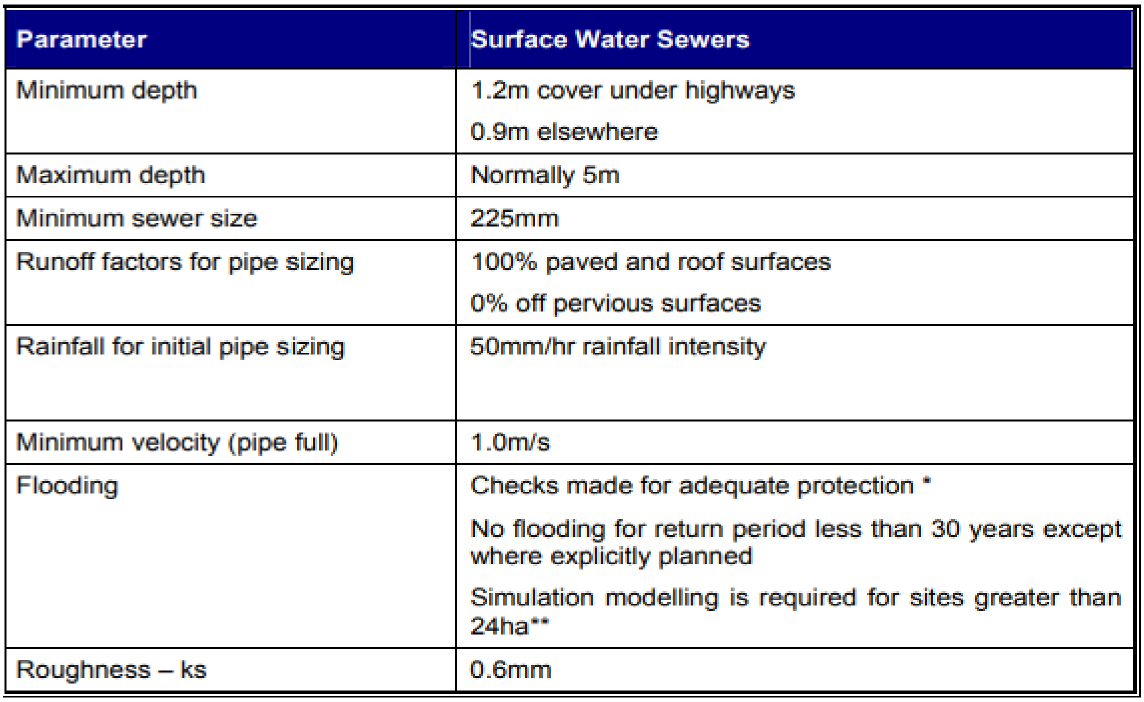
Catchment 1 of the proposed data centre development is served by an Attenuation Pond (noted as Attenuation Pond 1 in Fig 2.1 above) which has capacity to store the 1:100 year storm event. The allowable discharge flow rate from Catchment 1 is 24.39 litres/sec.

The calculation of allowable discharge rate and required storage volumes associated with the proposed EngineNode Data Centre Development are addressed in detail in Section 2.4.5 of Document No. RPT-18_086-004 'Engineering Planning Report – Drainage and Water Services' included in Appendix A.

As a result of the proposed development there will be additional hard-standing areas draining to Attenuation Pond 1 however there is sufficient capacity in Attenuation Pond 1 to accommodate the required storage volume for the proposed development. Detailed calculations of the required attenuation storage volume are provided in Section 2.4.5 and Appendix D of this report.

2.3.2 Surface Water Network Design

The pipe network is designed in accordance with the requirement of Table 6.4 of the Greater Dublin Strategic Drainage Study (GDSDS) – See Fig 2.2 below.



Parameter	Surface Water Sewers
Minimum depth	1.2m cover under highways 0.9m elsewhere
Maximum depth	Normally 5m
Minimum sewer size	225mm
Runoff factors for pipe sizing	100% paved and roof surfaces 0% off pervious surfaces
Rainfall for initial pipe sizing	50mm/hr rainfall intensity
Minimum velocity (pipe full)	1.0m/s
Flooding	Checks made for adequate protection * No flooding for return period less than 30 years except where explicitly planned Simulation modelling is required for sites greater than 24ha**
Roughness – ks	0.6mm

Fig 2.2 – GDSDS Pipe Design Criteria

Manholes shall be provided at junctions in the network, at changes of direction and gradient and at no more than 90m centres.

The surface water pipe network has been modelled using WinDesTM software.

2.3.3 SuDS Implementation

The main elements of the SuDS design are "Quantity", "Quality" and "Amenity". "Quantity" refers to the quantity of surface water generated by the development of the discharge to local watercourses and must be restricted to the pre-development greenfield run-off rate. This can be achieved by storage of surface water. The main types of storage used in a SuDS design are Interception Storage and Treatment Storage.

Interception storage includes filter drains where appropriate however site investigation carried out on site indicate that the soil on site has poor permeability (See in Appendix A BRE 365 test results Appendix E to Document No. RPT-18_086-004 'Engineering Planning Report – Drainage and Water Services' included in Appendix A to this report). Treatment storage includes the provision of a permanent wet pool in the attenuation ponds.

2.3.4 Water Quality

In accordance with Appendix E to Volume 2 of the GDSDS of Appendix A and Table 16.4 of the Greater Dublin Regional Drainage Code of Practice it is proposed to provide treatment storage as a wet pool in the attenuation ponds. The wet pool is sized based on an 80% runoff from paved areas during a 15mm rainfall event. The treatment storage volume for the Catchment 1 of the proposed data centre development is outlined in Section 2.4.4 of Document No. RPT-18_086-004 'Engineering Planning Report – Drainage and Water Services' included in Appendix A.

Further surface water treatment techniques incorporated into the design in terms of water quality include redesigning of the proposed (subject to concurrent planning application) SurfSepTM screening unit and petrol interceptor which is to be provided upstream of retention pond.

The SurfSepTM screening units protect downstream receiving systems from fine solids and debris that would otherwise accumulate over time.

It is proposed to provide a Class 1 bypass interceptor upstream of the surface water attenuation system upstream to capture the additional proposed area. The bypass separator is designed to fully treat all flows generated by rainfall rates up to 5mm/hour. This covers 99% of all rainfall events. Petrol interceptor is to be sized in accordance with the EN 858 and PPG3.

Details of the petrol interceptors are provided in Appendix B and details of the proposed SurfSepTM screening units are provided in Appendix C.

2.3.5 Water Quantity

The surface water network has been designed to provide sufficient capacity to contain and convey all surface water runoff associated with the 1 in 100 year event to the proposed (subject to concurrent planning application) Attenuation Pond 1 without any overland flooding. As discussed in Section 2.3.1 the attenuation pond, which serves Catchment 1 of the proposed data centre development has been designed to provide sufficient capacity to accommodate the proposed development. The proposed data centre development allowable discharge rate of 24.36 litres/sec will not be increase as a result of the proposed substation and grid connection development (Refer to Section 2.4.5 of Document No. RPT-18_086-004 'Engineering Planning Report – Drainage and Water Services' included in Appendix A).

The attenuation storage volume required during the 1 in 100 year return period has been simulated using WindesTM software. The result of the analysis is summarised in Table 2.3 below. See Appendix D for details of the WindesTM calculations.

Table 2.3 overleaf summarises the storage volumes associated with the proposed data centre development (Scenario 1) and the proposed data centre and proposed substation and grid connection development combined (Scenario 2).

Scenario	Wet Pond Invert Level (m OD)	Outlet Invert Level (m OD)	Ground Level (m OD)	Critical Storm Duration (mins)	High Water Level in 100 year event (m OD)	Attenuation Storage Volume (m^3)
Scenario 1 – Proposed data centre Development	68.275	68.450	70.000	1440	68.922	3,833
Scenario 2 – Proposed data centre and proposed substation and grid connection development combined	68.275	68.450	70.000	1440	69.076	4,937

Table 2.3 –Attenuation Volume Summary

As can be seen in Table 2.3 above Scenario 2 results in an increase in the volume of attenuation storage in Attenuation Pond 1 of 1,104m^3 and in a increase in the high water level in a 1 in 100 year storm event of 0.154m. Attenuation Pond 1 has adequate capacity to accommodate the proposed development as the pond will have 0.924m freeboard during the 1 in 100 year storm event during Scenario 2.

In summary the proposed (subject to concurrent planning application) Attenuation Pond 1 has adequate storage capacity to accommodate flows from the proposed substation and grid connection development with no increase in discharge to the adjacent watercourse.

The proposed Surface Water Drainage Network is indicated on Drawing No. A1045-CSE-HEL-XX-DR-C-4700 Combined Services Layout.

3 Foul Water Drainage

3.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 12st August 2019 in relation to water and wastewater demand for the proposed EngineNode development. A Confirmation of Feasibility (CoF) was subsequently obtained from Irish Water on 29th May 2020. The reference number for the CoF is CDS 19006045 which is provided in Appendix C to this report.

3.2 Existing Infrastructure

There is an existing 140mm⌀ OD foul water rising main located in the R147 to the east of the site. This rising main is pumped from the Takeda Biologics facility c. 2.5 km to the north of the site to the 9C Trunk Sewer in Mulhuddart (adjacent to the Kepak Facility). The proposed EngineNode data centre development under Meath County Council Reg. Ref. RA/191593 would connect to this 140mm⌀ OD foul water rising main by diverting the main into a new strategic pumping station (Referred to as IW Strategic Pumping Station) on site.

3.3 Proposed Foul Water Drainage Network

The proposed substation development will connect to a foul water manhole FMH-6.3 3 proposed under Meath County Council Reg. Ref. RA/191593. From this manhole wastewater flows by 150mm⌀ gravity pipe network proposed in data centre development to Site Pumping Station from where it is pumped to IW Strategic Pumping Station. As noted in Section 3.3 the IW Strategic Pumping Station will pump foul water to the 9C Sewer at Mulhuddart.

The locations of the proposed Site Pumping Station, IW Strategic Pumping Station and approximate proposed substation development site (in green) are indicated in Fig 3.1 below.

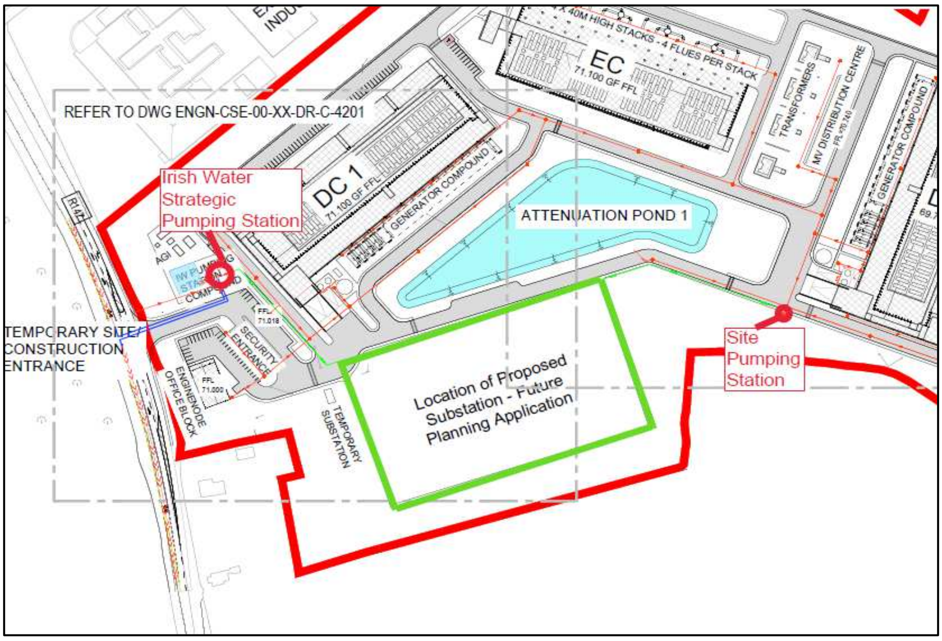


Fig 3.1 – Extract from Drawing No. ENGN-CSE-00-XX-DR-C-4200 indicting Pumping Station Locations

The substation building will be unmanned and will not occupied on a regular basis. A two man crew visiting site for two days per months is estimated to be the anticipated level of occupancy (Average of 1 persons on site per week). As a result this development is not covered by the types of activities listed in Appendix D of the Irish Water Code of Practice for Wastewater Infrastructure. Accordingly, proposed wastewater flows have been based on the assumed usage rates of the appliances in the building. The proposed foul water flows from the development are calculated in Table 3.1 below:-

Appliance	**Flow per use (litres)**	**Average use per week**	**Weekly Flow (litres)**	**Average Daily Flow (litres)**
WC and WHB*	10	1	10	1.42
Sink**	7	1	7	1.0
Total			**16**	**2.42**

*Based on Appendix D of the Irish Water Code of Practice for Wastewater Infrastructure for WC on an amenity site

** Based on water demand for 1 no. meal as per Section 3.28 of Irish Water Code of Practice for Water Infrastructure.

Table 3.1 – Average Foul Water Daily Demand

As can be seen in Table 3.1 the average daily foul water demand of 2.42 litre per day. The total average daily foul water demand for the proposed EngineNode data centre development is 12,250 litres per day (Refer to Section 3.4.2 of Document No. RPT-18_086-004 ‘Engineering Planning Report – Drainage and Water Services’ included in Appendix A) thus the foul water demand for proposed substation development is equivalent to 0.02% of the overall foul water demand for the proposed EngineNode data centre site.

Based on the Colebrook-White Equation a 150mmø pipe at a gradient of between 1:82 and 1 :150 provide adequate capacity and maintain velocities of at least 0.75 m/s in accordance with the requirements of Irish Water Code of Practice for Wastewater Infrastructure (Document No. IW-CDS-5030-03).

Due to the severe consequences of a spillage entering the surface water system it is proposed to connect the discharge from the electrical substation transformer bunds to the foul system. This drainage is to pass through a Class 1 Full Retention Oil Separator before entering the foul water network. Details of the proposed full retention separator are provided in Appendix E of this report.

Refer to Drawing No. ENGN-CSE-00-XX-DR-C-4200– Overall Proposed Foul Water Layout included in Appendix B which indicates proposed (subject to concurrent planning application) foul water network.

The proposed Foul Water Drainage Network is indicated on Drawing No. A1045-CSE-HEL-XX-DR-C-2050 Proposed Sub-station Site layout & Services in Appendix B.

4 Water Supply

4.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 12st August 2019 in relation to water and wastewater demand for the proposed EngineNode development. A Confirmation of Feasibility (CoF) was subsequently obtained from Irish Water on 29th May 2020. The reference number for the CoF is CDS 19006045 which is provided in Appendix C to this report.

4.2 Existing Infrastructure

There is an existing 450mmø water main located in the R147 which is deemed to be suitable to provide a connection to serve the proposed EngineNode development subject to Meath County Council Planning Reg. Ref. RA/191593.

4.3 Potable Water Supply

The proposed development will connect to the internal EngineNode site water supply network proposed under Meath County Council Reg. Ref. RA/191593. The EngineNode site water supply network will be connected to the existing 450mmø Irish Water watermain located in the R147 to the west of the site.

Refer to Drawing No. ENGN-CSE-00-XX-DR-C-4300 – Overall Proposed Watermain Layout included in Appendix B which indicates proposed watermain water network subject to concurrent planning application. An extract from this drawing is provided in Fig 4.1 below which indicated the approximate location of the proposed data centre site connection to the Irish Water Network in blue and the approximate location of the proposed substation development site in green.

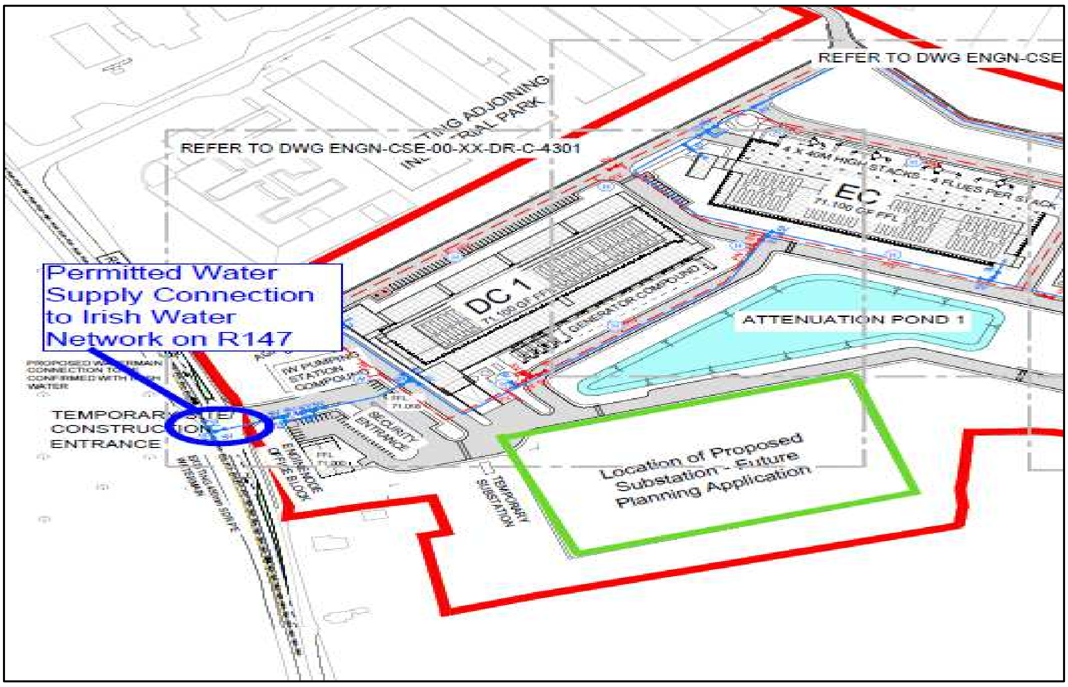


Fig 4.1 – Extract from Drawing No. ENGN-CSE-00-XX-DR-C-4300 indicting proposed connection to Irish Water Network

The substation building will be unmanned and will not occupied on a regular basis. A two man crew visiting site for two days per months is estimated to be the anticipated level of occupancy (Average of 1 persons on site per week). As a result this development is not covered by the types of activities listed in Section 3.28 of the Irish Water Code of Practice for Water Infrastructure. Accordingly, proposed wastewater flows have been based on the assumed usage rates of the appliances in the building. The proposed foul water flows from the development are calculated in Table 4.1 below:-

Appliance	Flow per use (litres)	Average use per week	Weekly Flow (litres)	Average Daily Flow (litres)
WC and WHB*	10	1	10	1.42
Sink**	7	1	7	1.0
Total			**16**	**2.42**
*Based on Appendix D of the Irish Water Code of Practice for Wastewater Infrastructure for WC on an amenity site ** Based on water demand for 1 no. meal as per Section 3.28 of Irish Water Code of Practice for Water Infrastructure.				

Table 4.1 – Average Water Daily Demand

As can be seen in Table 3.1 the average daily foul water demand of 2.42 litre per day. The total average daily foul water demand for the proposed EngineNode data centre site is 11,250 litres per day (Refer to Section 4.4.1 of Document No. RPT-18_086-004 ‘Engineering Planning Report – Drainage and Water Services’ included in Appendix A) thus the foul water demand for proposed substation development is equivalent to 0.022% of the overall foul water demand for the proposed EngineNode data centre site.

The proposed Water Supply Network is indicated on Drawing No. A1045-CSE-HEL-XX-DR-C-2050 Proposed Sub-station Site layout & Services in Appendix B.

4.4 Fire Flow Requirements

The proposed substation development will be served by a 250mmø proposed (subject to concurrent planning application) fire hydrant main which is connected to sprinkler tanks which serve each proposed building. The fire hydrants will be provided at appropriate locations in accordance with the specialist fire protection contractors design and Meath County Council requirements.

5 Flood Risk Assessment

A Strategic Flood Risk Assessment (SFRA) was developed as part of the Meath County Development Plan 2013-2019. In this it shows the site as being outside any identified flood zones and does not indicate the site is at risk from any fluvial, pluvial or coastal flooding event.

A review of available information has identified no flood hazards for the proposed development therefore, in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities, the site is deemed to be located within Flood Zone C, where the probability of flooding is low (i.e. less than 0.1% AEP or 1 in 1,000 years). Refer to Figure 5.1 below.

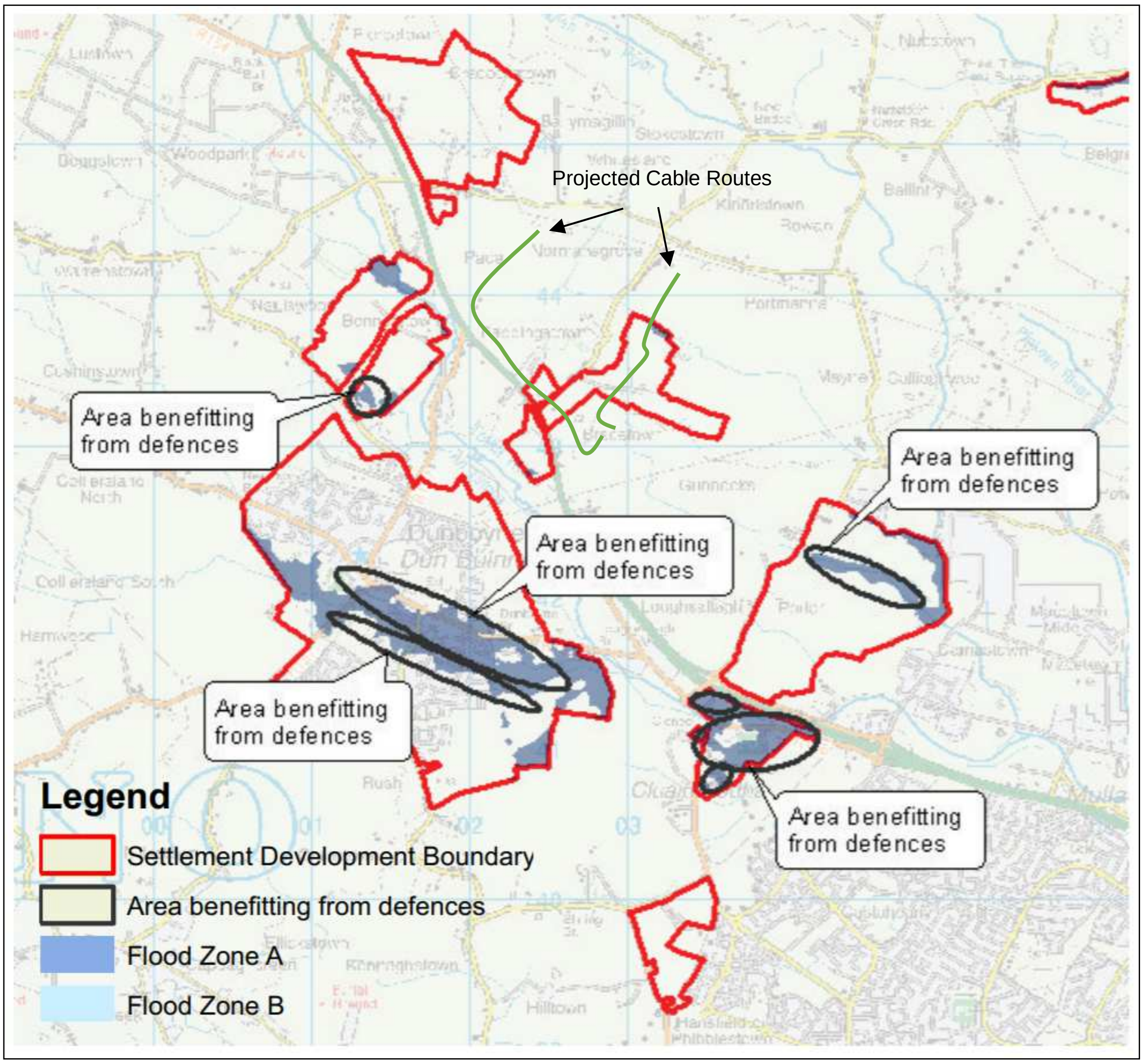


Figure 5.1 Flood Zone Map (source: SFRA Meath County Development Plan).

There are also no historic flood events recorded in the vicinity of the site, as can be seen in Figure 5.2 below.

Figure 5.2 Flood Risk Map (source: OPW Flood Hazard Mapping).

In addition as part of the planning submission for the EngineNode development (proposed under Meath County Council Reg. Ref. RA/191593) a Site-Specific Flood Risk Assessment (SSFRA) was carried out by CSEA. The SSFRA concluded that development on the subject site is appropriate for the site's flood zone category and a justification test as outlined in the Guidelines (OPW Guidelines, 2009, "Planning System and Flood Risk Management Guidelines for Planning Authorities) is not required. The SSFRA is included in Appendix G of this report.

Appendix A – EngineNode Data Storage Engineering Planning Report Drainage and Water Services

Clifton Scannell Emerson
Associates

Engineering Planning Report - Drainage & Water Services

EngineNode Data Storage

Client: EngineNode

Date: 14th October 2019

Job Number: 18_086

Civil Engineering
Structural Engineering
Transport Engineering
Environmental Engineering
Project Management
Health and Safety

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Document Control Sheet

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Project Number:	18_086
Report Title:	Engineering Planning Report - Drainage & Water Services
Filename:	RPT-18_086-004

Issue No.	Issue Status	Date	Prepared by	Checked by
1.0	DRAFT	03/09/19	CD	PF
1.1	Planning Draft	01/10/19	CD	PF
1.2	Planning Issue	14/10/19	CD	PF

Table of Contents

1 Introduction

This report is being submitted as part of the planning application for EngineNode Limited for the proposed data storage facility and energy centre development on site at Gunnocks, Clonee, Co. Meath. The report outlines the proposals for drainage services, water supply and flood risk assessment for the development. The proposed development site is approximately 25 Hectares in size.

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1.1 Development Description

The proposed development consists of four number two-storey data storage buildings, each containing data halls within each building, a single storey energy centre building, an AGI, HV electrical substation, and ancillary services.

The campus will have an internal road network comprised of impermeable asphalt roads and concrete yard areas depending on their location and access usage. The site perimeter shall consist of extensive berming and landscaping (natural species), with 3-metre-high security fencing and associated security infrastructure. The main site access shall be comprised of 3 metre railing and gates, a security entrance building and associated infrastructure.

The four-number data storage buildings shall all have the same building footprint and elevation. The data storage facilities shall be comprised of two storey cladded buildings, each 25.0 metres high. Each data storage facility shall have ancillary storage tanks adjacent to the building. These will include a sprinkler tank, humidifier water tanks and diesel tanks/delivery yard.

The proposed energy centre is comprised of a single storey cladded building which shall be 20.50 metres high with a set-back plant screen at 25.0 metres. The energy centre shall be comprised of gas fired engines. These engines shall be served by 4 no. 40 metre high flue stacks. The energy centre shall have associated transformers in bunded areas along with a single storey over basement MV distribution building. The energy centre shall have an ancillary building with offices and welfare facilities and associated parking.

To facilitate the energy centre an Above Ground (Gas) Installation (AGI) shall be provided along the north west site boundary.

A separate planning application will be made to An Bord Pleanála under Section 182A of the Planning and Development Act 2000 (as amended), to construct a new HV substation compound and associated underground HV cables.

1.2 Existing Land Use

The existing site is a greenfield site which is currently used as agricultural land.

2 Surface Water Drainage

2.1 General

The proposed development will provide attenuation in compliance with the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) The following section outlines the surface water drainage proposals for the development. All SUDS elements have been designed as per the recommendation of the SuDS Manual 2015.

All surface water works including connections will be carried out in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

A pre-planning meeting has taken place with Mr. Paul Aspell, Executive Engineer, of Meath County Council, on 18th July 2019 and with follow up correspondence with Mr. Philip Traynor, Area Engineer, on 20th August 2019. Minutes of meetings and correspondence with Meath County Council is included in Appendix A of this report.

2.2 Drawings

The following drawings provided in support of this planning application are applicable to surface water drainage:-

- ENGN-CSE-00-XX-DR-C-1010 – Surface Water Outfall to Pinkeen Stream
- ENGN-CSE-00-XX-DR-C-4100 – Proposed & Existing Surface Water Drainage Overall Layout Plan
- ENGN-CSE-00-XX-DR-C-4101 – Proposed Surface Water Drainage Layout Plan Sheet 1 of 4
- ENGN-CSE-00-XX-DR-C-4102 – Proposed Surface Water Drainage Layout Plan Sheet 2 of 4
- ENGN-CSE-00-XX-DR-C-4103 – Proposed Surface Water Drainage Layout Plan Sheet 3 of 4
- ENGN-CSE-00-XX-DR-C-4104 – Proposed Surface Water Drainage Layout Plan Sheet 4 of 4
- ENGN-CSE-00-XX-DR-C-4903 – Proposed Standard Trench Details
- ENGN-CSE-00-XX-DR-C-4908 – Proposed Road and Drainage Details
- ENGN-CSE-00-XX-DR-C-4910 – Proposed Surface Water Hydrobrake Manhole, Surfsep & Petrol Interceptor Details
- ENGN-CSE-00-XX-DR-C 4801- Attenuation Pond Cross-Sections Sheet 1 of 2
- ENGN-CSE-00-XX-DR-C 4802- Attenuation Pond Cross-Sections Sheet 2 of 2

2.3 Existing Surface Water Network

There is no drainage system currently serving the site. The lands fall to the south east of the site and are bordered by a network of drainage ditches which form a single ditch / watercourse which in turn forms a tributary of the Pinkeen Stream. The watercourse in question joins the Pinkeen Stream approximately 2 km east of the site.

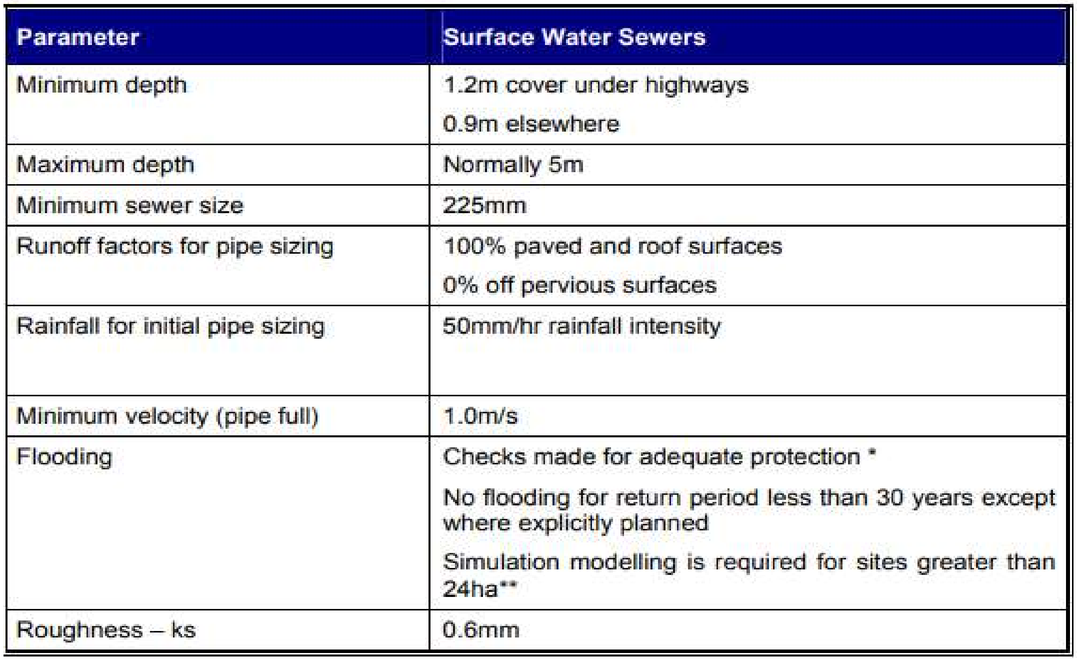
2.4 Proposed Surface Water Network

2.4.1 Overview

The proposed surface water networks for the development collect runoff from roofs, roads and other hard standing areas in a sealed system of pipes and gullies. There are three separate surface water drainage networks in the proposed development which flow to separate surface water attenuation ponds from which attenuated flows are discharged, via carrier drains, to the adjacent ditch/watercourse, described in Section 2.3, along the southern boundary of the site.

2.4.2 Surface Water Network Design

The pipe network is designed in accordance with the requirement of Table 6.4 of the Greater Dublin Strategic Drainage Study (GDSDS) – See Fig 2.1 below.



Parameter	Surface Water Sewers
Minimum depth	1.2m cover under highways 0.9m elsewhere
Maximum depth	Normally 5m
Minimum sewer size	225mm
Runoff factors for pipe sizing	100% paved and roof surfaces 0% off pervious surfaces
Rainfall for initial pipe sizing	50mm/hr rainfall intensity
Minimum velocity (pipe full)	1.0m/s
Flooding	Checks made for adequate protection * No flooding for return period less than 30 years except where explicitly planned Simulation modelling is required for sites greater than 24ha**
Roughness – ks	0.6mm

Fig 2.1 – GDSDS Pipe Design Criteria

Manholes shall be provided at junctions in the network, at changes of direction and gradient and at no more than 90m centres.

In order to reduce the extent of the earthworks required for the attenuation ponds the dock levellers serving the buildings are to be drained via pumping to the gravity system (the exception to this is DC 3 which can be drained by gravity.

The surface water pipe network has been modelled using WinDes^{TM} software.

2.4.3 SuDS Implementation

The main elements of the SuDS design are “Quantity”, “Quality” and “Amenity”. “Quantity” refers to the quantity of surface water generated by the development of the discharge to local watercourses, and must be restricted to the pre-development greenfield run-off rate. This can be achieved by storage of surface water. The main types of storage used in a SuDS design are Interception Storage and Treatment Storage.

Interception storage includes filter drains where appropriate however site investigation carried out on site indicate that the soil on site has poor permeability (See BRE 365 test results in Appendix E). Treatment storage includes the provision of a permanent wet pool in the retention ponds.

2.4.4 Water Quality

In accordance with Appendix E to Volume 2 of the GDSDS and Table 16.4 of the Greater Dublin Regional Drainage Code of Practice it is proposed to provided treatment storage as a wet pool in the retention ponds. The wet pool is sized based on an 80% runoff from paved areas during a 15mm rainfall event. The treatment storage volumes for each of the three catchments are outlined in Table 2.2 below.

Catchment	Catchment Area (m^2)	Retention Pond Base Area (m^2)	Treatment Volume Required (m^3)	Depth of Wet Pool (m)
Catchment 1	68,890	4,762	826	0.175
Catchment 2	38,690	1,582	464	0.290
Catchment 3	45,900	2,405	550	0.230

Table 2.1 – Treatment Volume Summary

Further surface water treatment techniques incorporated into the design in terms of water quality include the provision of SurfSep^{TM} screening units and petrol interceptors which are to be provided upstream of all retention ponds.

The SurfSep^{TM} screening units protect downstream receiving systems from fine solids and debris that would otherwise accumulate over time.

It is proposed to provide a Class 1 full retention separators downstream of any fuel unloading area in accordance with Section 20 of the Greater Dublin Regional Code of Practice. The full retention separator is designed to treat the full design flow that can be delivered in the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 50mm/hour.

It is proposed to provide a Class 1 bypass interceptor upstream of the surface water attenuation system upstream of the surface water attenuation system to capture the remainder of the roads and car parking areas. The bypass separator is designed to fully treat all flows generated by rainfall rates up to 5mm/hour. This covers 99% of all rainfall events. All petrol interceptors are to be sized in accordance with the EN 858 and PPG3.

Details of the petrol interceptors are provided in Appendix B and details of the proposed SurfSep^{TM} screening units are provided in Appendix C.

2.4.5 Water Quantity

The surface water network has been designed to provide sufficient capacity to contain and convey all surface water runoff associated with the 1 in 100 year event to the attenuation basins without any overland flooding. This complies with Criterion 3 of Table 6.3 of Volume 2 the GDSDS.

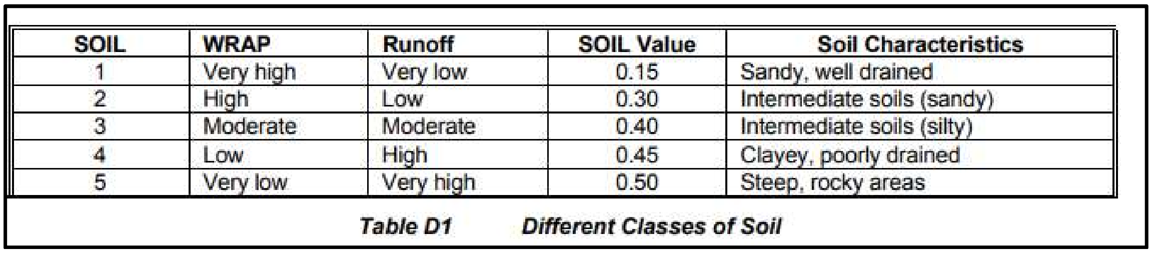
All calculations have allowed for an additional allowance of 10% in rainfall intensities to allow for climate change as per Table 6.1 of Volume 2 of the GDSDS.

The allowable discharge rate from the site (QBAR) has been calculated in accordance with the following equation as per Section 6.3.1.2.2 of the GDSDS:-

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

Where

QBAR = Mean Annual Flood Flow (m^3/s)
AREA = Area of catchment (km^2) (Initially calculated based on 50 hectares and adjusted pro-rata to catchment area).
SAAR = Standard Annual Rainfall (mm) Calculated based on Met Eireann Data) (Site Co-Ordinates E = 302884; N = 243109) (https://www.met.ie/climate/what-we-measure/rainfall)
SOIL = Soil index (based on site investigation data and Table D1 in Appendix D to Volume 2 of the GDSDS (See Figure 2.2 below).



SOIL	WRAP	Runoff	SOIL Value	Soil Characteristics
1	Very high	Very low	0.15	Sandy, well drained
2	High	Low	0.30	Intermediate soils (sandy)
3	Moderate	Moderate	0.40	Intermediate soils (silty)
4	Low	High	0.45	Clayey, poorly drained
5	Very low	Very high	0.50	Steep, rocky areas

Table D1 Different Classes of Soil

Fig 2.2 – GDSDS Table D1

It should be noted that there are different soil characteristics across the site. As discussed with Mr. Paul Aspell different soil index values can be applied to the particular catchments subject to the site investigation data available. As can be seen from the site investigation data provided in Appendix E to this report soil characteristics in the western part of the site have evidence of sandy gravelly clay whilst in the eastern part of the site silt is encountered.

The allowable discharge rates from the different catchment on site are summarised in Table 2.2 overleaf.

Catchment	AREA (km^2)	SAAR (mm)	SOIL	QBAR (for 50 Ha) (m^3/s)	Total Catchment Area (Ha)	QBAR (m^3/s)	QBAR (l/s)
Catchment 1	0.5	815	0.3	0.11	11.2	0.024	24.39
Catchment 2	0.5	815	0.4	0.20	4.77	0.019	19.37
Catchment 3	0.5	815	0.4	0.20	5.60	0.029	29.37

Table 2.2 –Allowable Discharge (QBAR) Summary

Discharge from the proposed wet ponds is controlled by a flow control devices downstream of the each pond. Details of each flow control device is provided in Appendix D of this report.

The attenuation storage volume required during the 1 in 100 year return period has been simulated using Windes^{TM} software. The results of the analysis are summarised in Table 2.3 below. See Appendix F for details of the Windes^{TM} calculations.

Catchment	Wet Pond Invert Level (m OD)	Outlet Invert Level (m OD)	Ground Level (m OD)	Critical Storm Duration (mins)	High Water Level in 100 year event (m OD)	Attenuation Storage Volume (m^3)
Catchment 1	68.275	68.450	70.000	1440	68.922	3,833
Catchment 2	67.160	67.450	69.000	480	68.167	1,344
Catchment 3	66.020	66.250	68.350	960	66.784	1,760

Table 2.3 –Attenuation Volume Summary

In addition to the three primary drainage catchments on site there are two further areas of the site which are captured in separate networks. The area around the future MV substation in the south west of the site will be separate planning application while the access road which connects to the L1010 in the north west of the site will discharge to swale locally. Outflow from this swale to the adjacent watercourse will be attenuated to 0.86 l/sec and will have approximately 90 m^3 of storage to accommodate the 1 in 100 year storm event. Swale calculations are provided in Appendix G.

3 Foul Water Drainage

3.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 12st August 2019 which addressed water and wastewater demand for the development. The reference number for the Pre-Connection Enquiry is CDS 19006045. A copy of the PCE is provided in Appendix J to this report.

3.2 Drawings

The following drawings provided in support of this planning application are applicable to wastewater drainage:-

- ENGN-CSE-00-XX-DR-C-4200 – Proposed & Existing Foul Water Drainage Overall Layout Plan
- ENGN-CSE-00-XX-DR-C-4201 – Proposed Foul Water Drainage Layout Plan Sheet 1 of 3
- ENGN-CSE-00-XX-DR-C-4202– Proposed Foul Water Drainage Layout Plan Sheet 2 of 3
- ENGN-CSE-00-XX-DR-C-4203 – Proposed Foul Water Drainage Layout Plan Sheet 3 of 3
- ENGN-CSE-00-XX-DR-C-4903 – Proposed Standard Trench Details

3.3 Existing Infrastructure

There is an existing 140mmø OD foul water rising main located in the R147 to the east of the site. This rising main to pumped from the Takeda Biologics facility c. 2.5 km to the north of the site to the 9C Trunk Sewer in Mulhuddart (adjacent to the Kepak Facility). Following discussions with Mr. Paul Aspell, Executive Engineer, of Meath County Council, it was agreed that the proposed development would connect to this 140mmø OD foul water rising main by diverting the main into a new intermediate pumping station (Referred to as IW pumping station) on site. Details of this proposal have been included in the PCE submitted to Irish Water (IW) and it is anticipated that the intermediate pumping station will be vested by Irish Water upon completion.

3.4 Proposed Foul Water Drainage Network

3.4.1 Overview

The proposed wastewater drainage network collects domestic wastewater flows from the administration block of the proposed Data Storage Facilities. In addition rainfall which pass through in the generator exhaust stacks is collected in the wastewater network which discharges to hydrocarbon interceptor before connecting to the main wastewater pipe network.

Due to site topography it is necessary to provide a wastewater pumping station (referred to as Site Pumping Station) to serve the development. This pumping station is located to the to the south west of DC 2 and pumps by means of an 80mmø rising main to the IW Pumping Station at the western boundary of the site. As noted in Section 3.3 the IW Pumping Station will pump foul water to the 9C Sewer at Mulhuddart.

3.4.2 Daily Foul Water Demand

Foul demand for the proposed development has been estimated using Appendix D of the Irish Water Code of Practice for Wastewater Infrastructure (Document No. IW-CDS-5030-03). The aforementioned document states that the recommended wastewater daily loading rate for industrial developments without canteen facilities is 50 litres per person.

The staff occupancy for the development is 245 persons thus the wastewater loading for the proposed development is calculated in Table 3.1 below:-

Building	Population	Daily Flow (litres / day)	Average Flow (litres / sec)
DC 1	50	2,500	0.029
DC 2	50	2,500	0.029
DC 3	50	2,500	0.029
DC 4	50	2,500	0.029
Energy Centre	30	1,500	0.017
Admin / Security	15	750	0.009
Total	**245**	**12,250**	**0.14**

Table 3.1 Average Foul Loading

3.4.3 Foul Water Pipe Design

The network has been designed to ensure that the foul discharge maintains a self-cleansing velocity. The proposed network adheres to the minimum pipe gradients set out in Table 6 of the “Building Regulations Technical Guidance Document H”. It is proposed to take all foul drainage from the buildings by means of 100mmø pipes with minimum gradients of 1:60 which connect to 150mmø pipes laid at minimum gradients of 1:100. The key design parameters are summarised as follows:-

- Minimum Self-Cleansing Velocity for Gravity Sewer = 0.75 m/s;
- Minimum gradient of gravity sewer = 1:150
- Roughness Co-efficient for Gravity Sewer (k_s) = 1.5mm
- Peak Design Flow = EN 12056 method

Peak foul water flow from the proposed development has been calculated using the discharge units methodology outlined in EN 12056-2. The number of appliances are not finalised at this stage that the Discharge Units have been estimated based on similar projects. The peak foul water flow from the development is estimated at 8.57 litres /sec (Please refer to Appendix H for calculations).

Based on the Colebrook-White Equation a 150mmø pipe at a gradient of between 1:82 and 1 :150 provide adequate capacity and maintain velocities of at least 0.75 m/s in accordance with the requirements of Irish Water Code of Practice for Wastewater Infrastructure (Document No. IW-CDS-5030-03. Pipe network calculations are provided in Appendix H.

3.4.4 Foul Water Pumping Station Requirements (IW Pumping Station)

As noted in Section 3.3 Meath County Council have advised that the preferred foul water outfall from the site is to discharge into the existing 140mmø OD foul water rising main located in the R147 to the east of the site. This rising main connects the Takeda Biologics plant in Dunboyne with the 9C Trunk Sewer in Mulhuddart (adjacent to the Kepak Facility). In order to achieve this connection it is necessary to provide an intermediate pumping station on the 140mmø OD foul water rising main. This intermediate pumping station is referred to as the IW Pumping Station.

The detail design of this pumping station is to be developed a part of the IW connection process and design information associated with the IW Pumping Station is provided in the flow balancing and pumping section of the PCE which is provided in Appendix J to this report.

A high level assessment has been carried out for the purposes of determining what type of pumping station is required. Section 5 of the Irish Water Code of Practice for Wastewater Infrastructure (Document No. IW-CDS-5030-03) states that Type 3 pumping stations will have incoming peak flows in excess of 1 litre / sec and an overall power capacity less than 20 kW installed power. Based on an estimated flow rate of 14 litres / sec (to achieve a minimum velocity of 1.1 m/sec for a 140mmø OD Rising Main) and an estimate total head loss of 50 m the installed power is estimated using the equation below.

$P = y \times Q \times H_{TOTAL} / E$ where

P = Power (in kW)
Q = 14 litres /sec => 0.014 m^3/sec
Y = Unit weight of water = 9.81 kN/m^2
H_{TOTAL} = 50m (Estimate based on topography and friction loss for 140mmø OD which a flow rate of 14 litres /sec)
E = Efficiency = 80%

⇨ 9.81 x 0.014 x 50 / 0.8 = 8.5 kW < 20 kW

Further to the above it is assumed for planning purposes that the proposed IW Pumping Station will be a Type 3 pumping station as per Section 5 of the Irish Water Code of Practice for Wastewater Infrastructure (Document No. IW-CDS-5030-03) however the foregoing is subject to design development with IW. As per consultation with a Meath County Council a spur is to be left on the site boundary to facilitate a connection from Bracetown Business Park and ‘The Hub’ Logistics Park.

3.4.5 Foul Water Pumping Station Requirements (Site Pumping Station)

Due to site topography and the need to maintain pipe gradients which maintain adequate self-cleansing velocity (as described in Section 3.4.3 above) it is necessary to provide a wastewater pumping station to serve the development. The pumping station is referred to as the Site Pumping Station. The Site Pumping Station is located adjacent to DC 2 immediately downstream of manhole FMH 1.12 and will discharge via an 80mmø rising main which outfalls via a stand-off manhole to the east of DC 1 where it outfalls to the a gravity pipe to the Irish Water Pumping Station. The key design parameters for the wastewater pumping station and rising main are summarised as follows:-

- Storage Volume (24 hours) = 12250 litres = 12.25m^3
- Flow Rate (Q) = 6 litres/sec
- Rising Main Diameter = 80mm
- Rising Main Length = 390m
- Rising Main Volume = 2.0m^3
- No. of times Rising Main empties per day = 6
- Mean Rising Main Velocity = 1.2 m/sec
- Roughness Value (Ks) = 0.15mm
- Static Head = 7m
- Friction Head Loss (FHL) (Estimate based on Colebrook-White) = 1m/42m = 9.2m
- Fitting (Estimate) = 0.46m (5% of FHL)
- Total Estimated Design Head = 11.23m approx. (Subject to Detailed Design).

It is envisaged that a proprietary package pumping station solution will be developed at detailed design stage which takes account of the above design criteria

3.4.6 Pollution Control Measures on Foul Water Network

An additional foul sewer is to be provided to the north of the proposed building in order to capture possible contaminated rainwater from the generator flue stacks. The drainage from flues is to pass into a Class 1 full retention separator located downstream of the flue stacks serving each building.

4 Water Supply

4.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 12st August 2019 which addressed water and wastewater demand for the development. The reference number for the Pre-Connection Enquiry is CDS 19006045. A copy of the PCE is provided in Appendix J to this report.

4.2 Drawings

- ENGN-CSE-00-XX-DR-C-4300 – Proposed & Existing Water Supply Overall Layout Plan
- ENGN-CSE-00-XX-DR-C-4301 – Proposed Water Supply Layout Plan Sheet 1 of 4
- ENGN-CSE-00-XX-DR-C-4302– Proposed Water Supply Layout Plan Sheet 2 of 4
- ENGN-CSE-00-XX-DR-C-4303 – Proposed Water Supply Layout Plan Sheet 3 of 4
- ENGN-CSE-00-XX-DR-C-4304 – Proposed Water Supply Layout Plan Sheet 4 of 4
- ENGN-CSE-00-XX-DR-C-4903 – Proposed Standard Trench Details

4.3 Existing Infrastructure

There is an existing 450mmø water main located in the R147. Meath County Council have indicated at the preliminary drainage and water services pre-planning meeting on 18th July 2019 that this watermain is suitable to provide a connection to serve the development subject to agreement with Irish Water.

4.4 Proposed Water Supply

It is proposed to connect to the existing 450mmø main with a new 250mmø which will serve the data storage facilities, energy centre and administration building. Water supply connections will also be provided to the security gate houses.

4.4.1 Domestic Water Demand

Domestic water demand for the proposed development has been estimated using Section 3.28 of the Irish Water Code of Practice for Water Supply Infrastructure (Document No. IW-CDS-5020-03). The aforementioned document states that the recommended wastewater daily loading rate for industrial developments without canteen facilities is 45 litres per person.

The staff occupancy for the development is 245 persons thus the wastewater loading for the proposed development is calculated in Table 4.1 overleaf:-

Building	Population	Daily Demand (litres / day)	Average Demand (litres / sec)
DC 1	50	2,250	0.026
DC 2	50	2,250	0.026
DC 3	50	2,250	0.026
DC 4	50	2,250	0.026
Energy Centre	30	1,350	0.016
Admin / Security	15	675	0.008
Total	**245**	**11,250**	**0.12**

Table 4.1 Water Supply Demand

Peak demand for the proposed development has been calculated using the methodology outlined in EN 806. The number of appliances are not finalised at this stage that the Loading Units have been estimated based on similar projects. The peak water demand from the development is estimated at 1.5 litres /sec (Please refer to Appendix I for calculations).

4.4.2 Industrial Water Demand

The industrial water peak flow rate occurs when all evaporative coolers in AHU's and CRAH's units call for cooling during hot weather events when the temperature is above 25^{o} Celsius. This peak flow rate of circa 97 litres / sec will occur for an estimate 20 minutes and then drop off to an estimated for a rate of 60.52 litres / sec. On a peak day it is estimated that the system will operate at 60.52 litres / sec for 6 hours. Detailed calculations demonstrating the forgoing have been submitted to Irish Water in support of the PCE.

4.4.3 Fire Hydrant Main

The proposed development will be served by a 250mmø fire hydrant main which is connected to sprinkler tanks which serve each building. The site wide hydrant main will also serve the sprinkler system for the energy centre. The fire hydrants will be provided at appropriate locations in accordance with the specialist fire protection contractors design and Meath County Council requirements

5 Flood Risk Assessment

The Tolka River is the principal surface water body in the area, at its closest point it is approximately 50m south of the Master Plan site (south of the M3 motorway embankment). It rises southeast of Dunshaughlin, County Meath and flows in a south easterly direction through County Meath, via Clonee where it is joined by the Clonee Stream and Pinkeen River and flows on to Dublin where it enters Dublin Bay between East Wall and Fairview.

The Tolka is fed by, amongst others, the Portan Stream (a tributary of the Pinkeen River which is located 1.2 km to the east of the Master Plan site) and the Pace Stream, which rises on the south eastern portion of the Master Plan site.

While CFRAM mapping was produced for this area, this has currently been withdrawn with the available map displaying the following text:

“This draft flood map is under review following an objection, submission and/or further information received as part the statutory consultation on the draft maps. It may be amended prior to finalisation”.

A Strategic Flood Risk Assessment (SFRA) was developed as part of the Meath County Development Plan 2013-2019. In this it shows the site as being outside any identified flood zones and does not indicate the site is at risk from any fluvial, pluvial or coastal flooding event.

No historic flood events have been recorded within the confines of the subject site. There are two recorded fluvial flood events, approximately 200m to the west, within the immediate environs of the Tolka River, which occurred in 2000 and 2002 as a result of heavy rainfall. The OPW flood map of the site area is depicted in Figure 5.1 below.

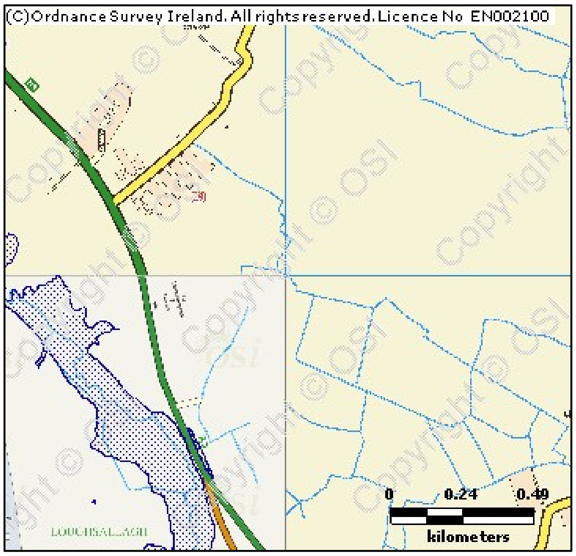


Figure 5.1 OPW Flood Map

The subject site and the Hub Logistics Park are located at the source of the Pinkeen Stream, which discharges in a southeasterly direction, through zoned lands which are currently under development, into the Tolka River.

A review of available information has identified no flood hazards for the proposed development therefore, in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities, the site is deemed to be located within Flood Zone C, where the probability of flooding is low.

Appendix A – Correspondence with Meath County Council

MINUTES OF MEETING

PROJECT: 18_086 – EngineNode Data Centre
Situated at:
For: Clifton Scannell Emerson Associates
Location: Meath County Council Head Office
Title: Preliminary Drainage and Water Supply Meeting
Subject: Drainage and Water Supply
Next meeting: N/A

Date: 18/07/19
Time: 3pm
Ref: MTG-18_086-002

Attendance:

Paul Aspell (PA)	Meath County Council
Peter Fagan (PF)	CSEA
Laurence McCrudden (LMcC)	CSEA
Conor Doherty (CD)	CSEA

Apologies:

	Points Discussed	Action by
1	**Site Masterplan**	
1.1	LMcC / PF explain the site masterplan which comprises of the development of 4 no. Data Centre buildings, 1 no. Energy Centre building, an MV substation and various ancillary buildings. The site is approximately 25 hectares in area and is located at Bracetown, Co. Meath.	Note
2	**Surface Water Drainage (Outfall to Pinkeen Stream)**	
2.1	CD explained that the existing lands fall in a south easterly direction towards a system of ditches / watercourses which converge to a ditch in the south east corner of the site which flows in a south easterly direction towards the Pinkeen Stream.	Note
2.2	South east of the site the existing ditch / watercourse traverses lands which are currently either part of the existing Facebook Data Centre campus, lands subject to planning application(s) for future development by Facebook and other 3rd party lands. The hedgerows are indicated as ‘to be protected’ on the landscaping drawings provided in support of the Facebook Project Runways Extension planning application (Reg Ref RA180671). Reference to this planning application should be made in the Drainage Report.	Note
2.3	PA indicated CSEA should liaise with Area Engineer Mr. Phillip Traynor in relation to the outfall in order to establish if any other issues exist. PA to send contact details to CSEA	MCC
3	**Surface Water Drainage (Scheme Design)**	
3.1	CD explain there will be 4 drainage catchments in the development. All catchments will be attenuated before discharging to the ditch / watercourse which runs along the southern boundary of the site. Attenuation systems will typically be ponds with the exception of the catchment serving the MV substation which will most likely be a storm tech system due to the nature of the development in this section of the site.	Note
3.1	CD noted that site investigation has been carried out on site and queried if the site investigation information could be used to establish the soil factor required to	Note

	calculate QBAR. Different soil conditions encountered in the east and west sections of the site so different allowable discharge rates may arise between different site catchments. PA had no objection to this approach provided information and calculations are provided in supporting documentation.	
3.2	PA indicated MCC's preference is to have petrol interceptors located upstream of attenuation systems.	Note
3.3	CD explained that surface water collected in the generator exhaust stacks will drain to a foul drain due to the potential presence of soot / hydrocarbons. A petrol interceptor will be fitted to any foul drains connected to exhaust stacks.	Note
3.4	CD explained the design intent for re-fuelling areas and fuel tank bunds. No gravity outlet from bund which will be inspected/tested after rainfall event. If oil present it will be disposed of off-site. If clean rainwater will be pumped to adjacent gully. Truck parking and gullies adjacent to bund to discharge to the surface water network via a forecourt interceptor (10,000 litre oil capacity). PA satisfied with this design approach.	Note
3.5	All AHU's and CRAH air conditioning units to drain to surface water drainage network.	Note
4	**Foul Water Drainage**	
4.1	Foul drainage from site will need to be pumped to nearest outfall. Foul sewer, pumping station and rising main design to be developed in accordance with Irish Water (IW) Code of Practice. Flow metering to be provided at pumping station if required by IW.	Note
4.2	The location of the nearest foul sewer outfall is unclear. Adjacent developments at Takeda and Facebook are pumping to the 9C gravity sewer in Damastown / Blanchardstown. The potential solutions are outlined below 1. Pump to gravity outfall which discharges to pumping station which serves Takeda c.3km to the north. 2. Pump to gravity outfall which discharge to Kilbride pumping station c.5km to the east. 3. Pump to 9C sewer in Damastown c.3km to the south east.	Note
4.3	MCC to liaise with Mr. Paul Fuller of IW regard suitable foul sewer connection point.	MCC
4.5	CSEA to submit Pre-Connection Enquiry (PCE) Form to IW.	CSEA
4.6	PA noted that night-time pumping only is normally stipulated for discharge to 9C Sewer.	Note
5	**Water Supply**	
5.1	450mmø watermain located in the R147 adjacent to the site. PA indicated that this is suitable to provide supply to the development. MCC to forward drawings of infrastructure installed in R147.	MCC
5.2	Bulk meter to be provided at tie-in to network.	Note
5.3	CSEA to submit Pre-Connection Enquiry (PCE) Form to IW.	CSEA
5.4	Particular requirements in relation to valving etc. to be determined by IW during connection enquiry process.	Note
6	**General**	
6.1	PA noted that MCC can facilitate a further meeting mid-August when the design is further developed.	Note

Conor Doherty

From: Philip Traynor <philip.traynor@meathcoco.ie>
Sent: Tuesday 20 August 2019 09:29
To: Conor Doherty; David Keyes
Subject: FW: 18_086 - EngineNode Data Centre
Attachments: ENGN-CSE-00-XX-DR-C-1010 - Surface Water Outfall to Pinkeen Stream.pdf

Conor,
I am not aware of any legacy issues regarding flooding at this location, however, by way of this email, I have forwarded on to David Keyes, SEO, Environment for follow up.
Regards,
Phillip

From: Conor Doherty [mailto:Conor.Doherty@csea.ie]
Sent: 19 August 2019 14:32
To: Philip Traynor
Subject: FW: 18_086 - EngineNode Data Centre

Philip,

Just to follow up our phone call this morning we would be grateful if you could advise if there are any issues with discharging attenuated surface water flow to the ditch/watercourse shown in blue on the attached drawing.

If you would like to meet to discuss please let us know.

Regards,

Conor

From: Conor Doherty
Sent: Friday 16 August 2019 11:46
To: Philip.traynor@meathcoco.ie
Cc: Laurence McCrudden <Laurence.McCrudden@csea.ie>
Subject: 18_086 - EngineNode Data Centre

Philip,

We are working on a planning application for development of a Data Centre campus at a site in Bracetown Co. Meath. I received your contact details from Paul Aspell who asked us to get in touch with you regarding Surface Water Drainage from the site. (A layout plan indicating the site location relative to local watercourses is attached for your information).

Would it be possible to meet with you at a time of your convenience next week?

Many thanks for your assistance.

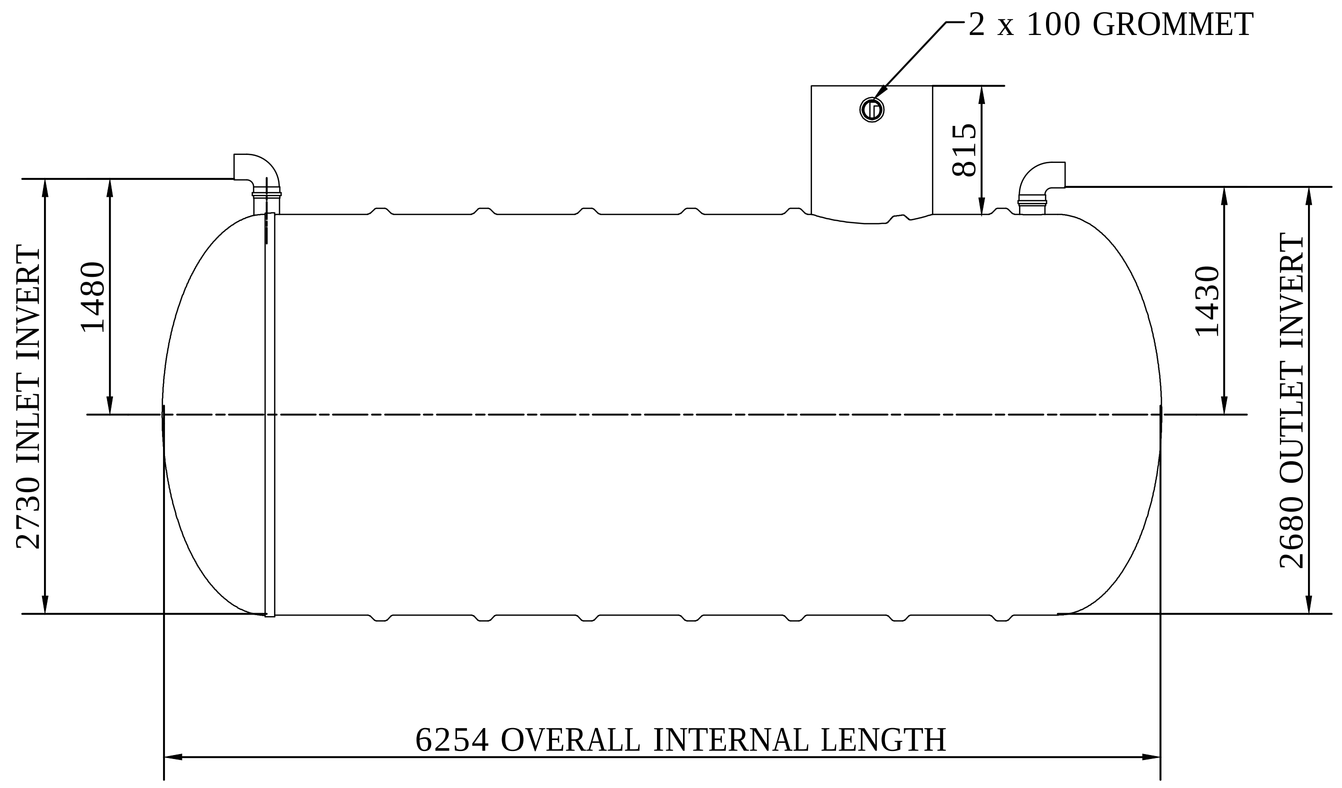
Kind Regards,

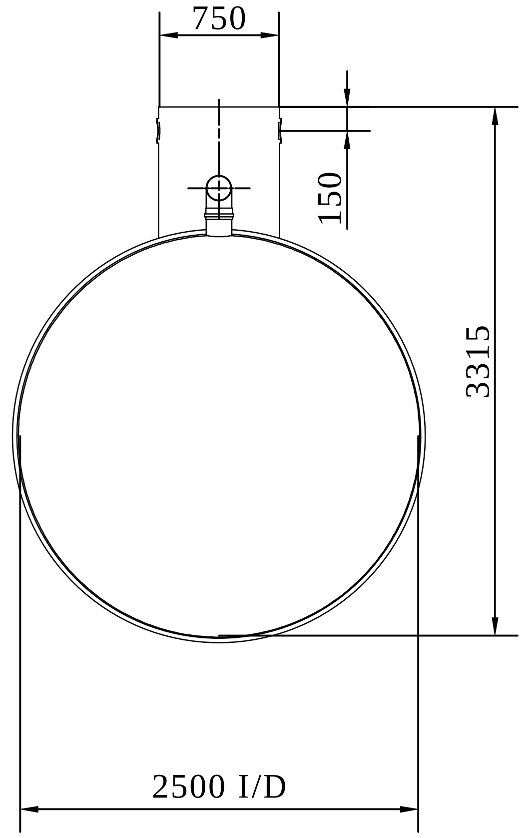
Conor Doherty
Senior Civil Engineer

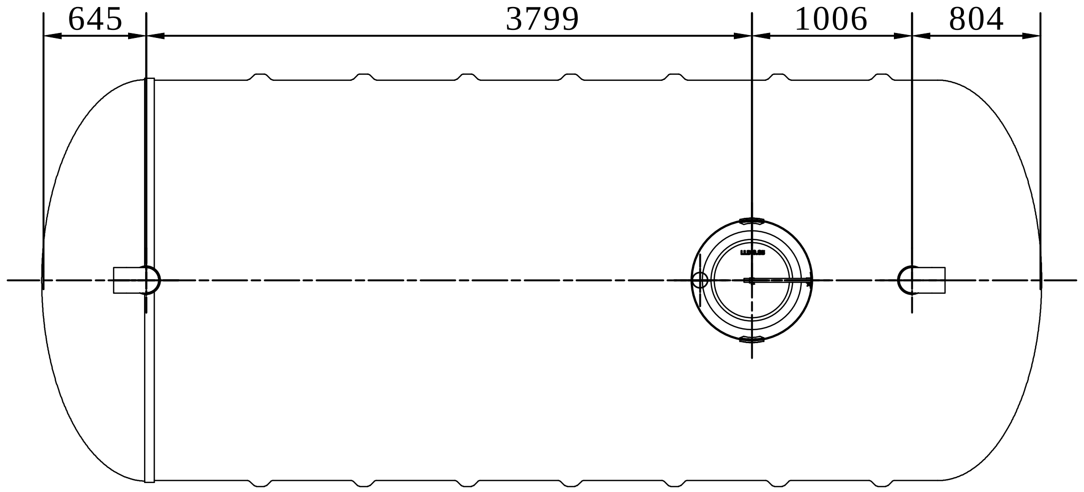
Clifton Scannell Emerson Associates Consulting Engineers
CSEA, Seafort Lodge, Castledawson Avenue, Blackrock, Co. Dublin
T. +353 1 2885006 | F. +353 1 2833466 | Web. www.csea.ie | Email. conor.doherty@csea.ie

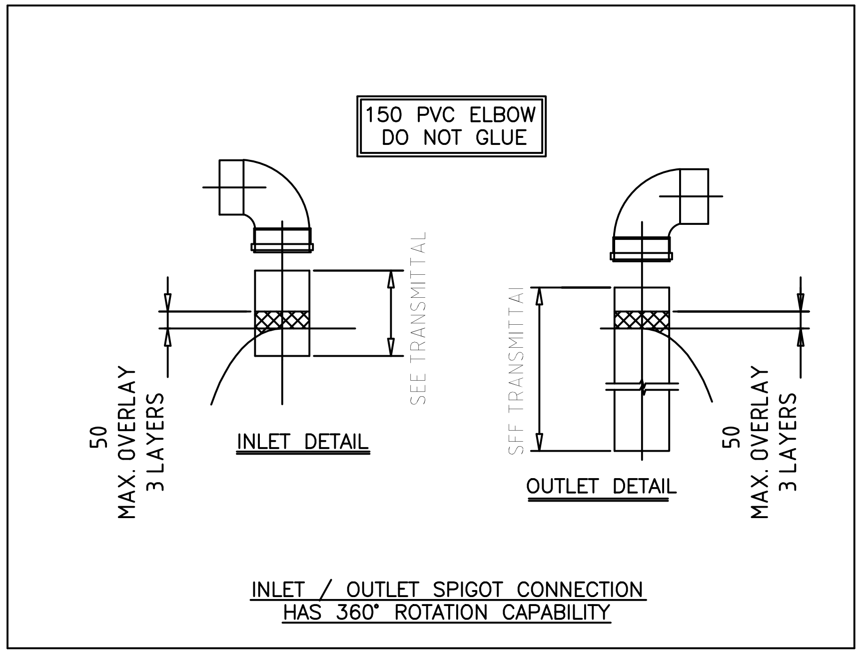
Appendix B – Petrol Interceptor Details

MODEL SHOWN WITH 150 OSMA PIPEWORK









1. PRODUCT INFORMATION
The Conder range of light liquid separators is produced from high grade GRP. Inlets and outlets are provided as spigots, Connections may be made by steel-banded flexible couplings, nitrile seal joints, rope-seal and mortar or any other appropriate jointing method.
Ventilation specifications should be in accordance with Local Authority requirements. Vent pipework from multiple chambers must never be manifolded below ground level.

2. PERFORMANCE CHARACTERISTICS
Separators are based on the requirements stated in Draft European Standard prEN858-1 and Environment Agency guideline PPG3, in particular:-
a. The nominal size has been established from performance tests where the residual oil at the outlet is less than 5mg/l for class 1 separators and less than 100mg/l for class 2 separators.

3. MAINTENANCE AND USE
It is important to recognise that light liquid separators require regular maintenance. The period between maintenance operations can vary depending on the location and use of the separator, therefore routine inspections shall be undertaken at least every six months and a log maintained of inspection date, depth of oil, depth of silt and any cleaning that is undertaken.
A Conder Alarm should be fitted to every separator to give automatic warning that the light liquid capacity has been reached.
Access to the separator should be kept clear and not used for storage.

4. PRODUCT DEVELOPMENT
In line with our policy of constant improvement and development, we reserve the right to change specification without prior notice.

PIPE SIZE VARIANT:

100, 150, 225 PVC
300, 375 GRP

REV	DATE	BY	CHKD	APPD	DESCRIPTION
3	11/04/13	DG	KB	RP	PIPE SIZE VARIANT ADDED

DO NOT SCALE
IF IN DOUBT ASK
ALL DIMENSIONS IN MM

TOLERANCES (unless noted otherwise)
GENERAL LINEAR DIMS : +/- 5mm
ANGULAR DIMENSIONS : +/- 1/2~

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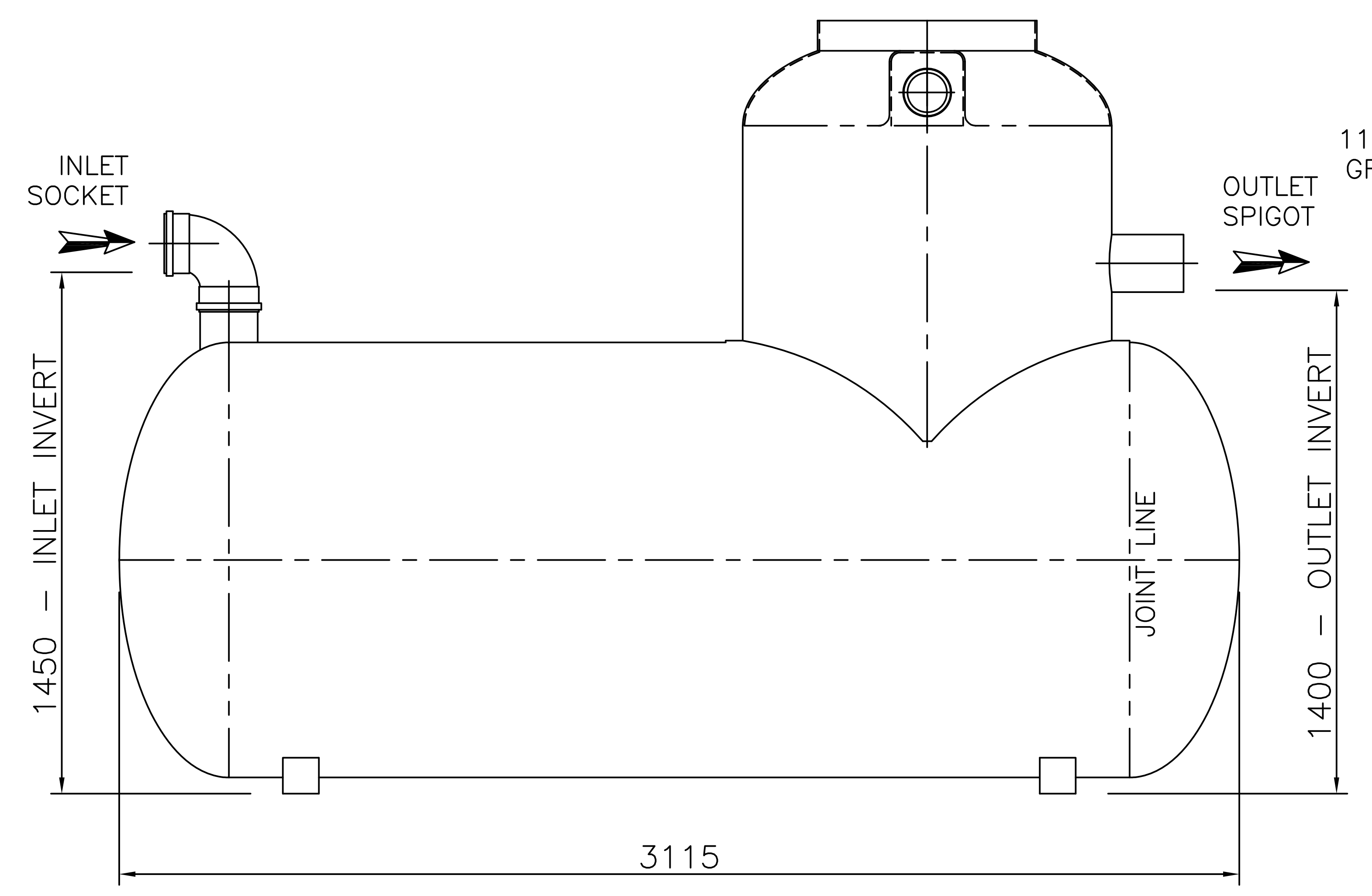
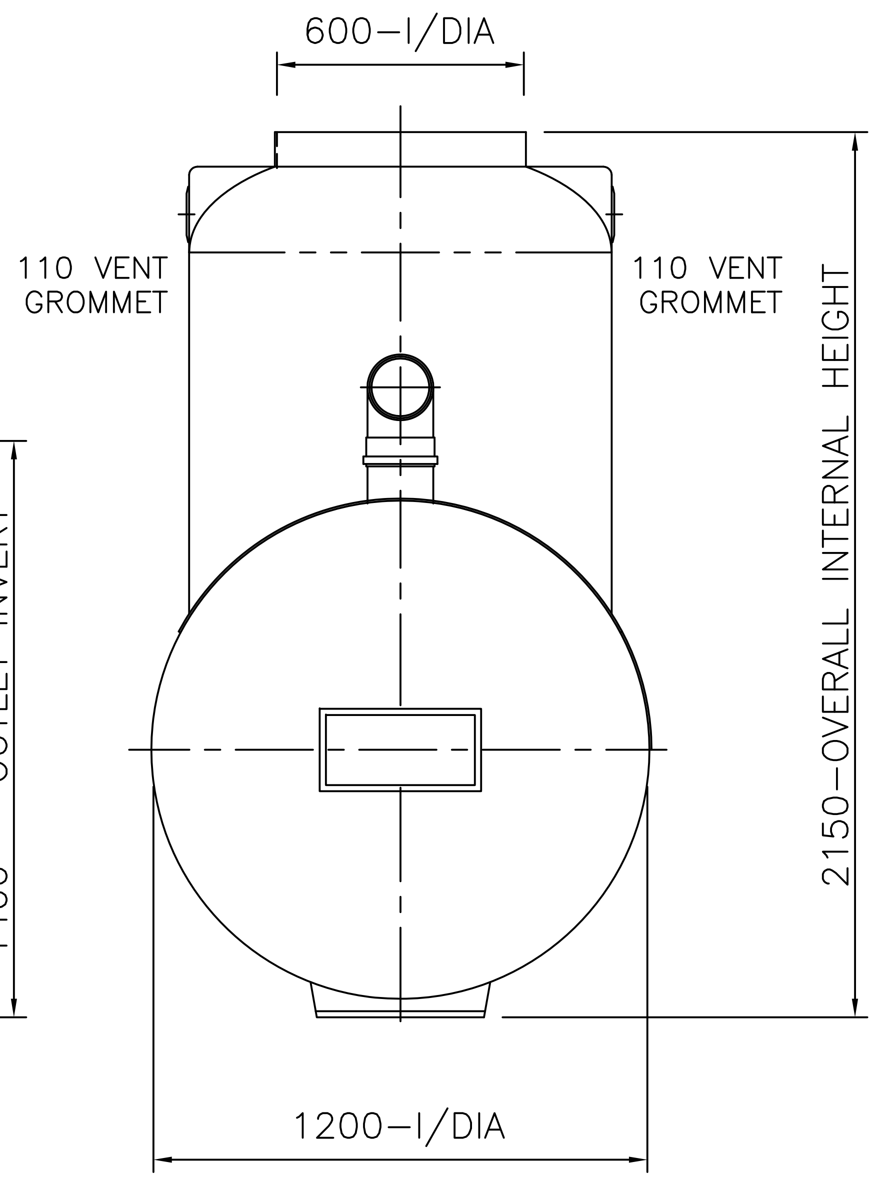
Designed by	DG 20/05/2011	Checked by	DG 20/05/2011	Approved by	RU 20/05/2011

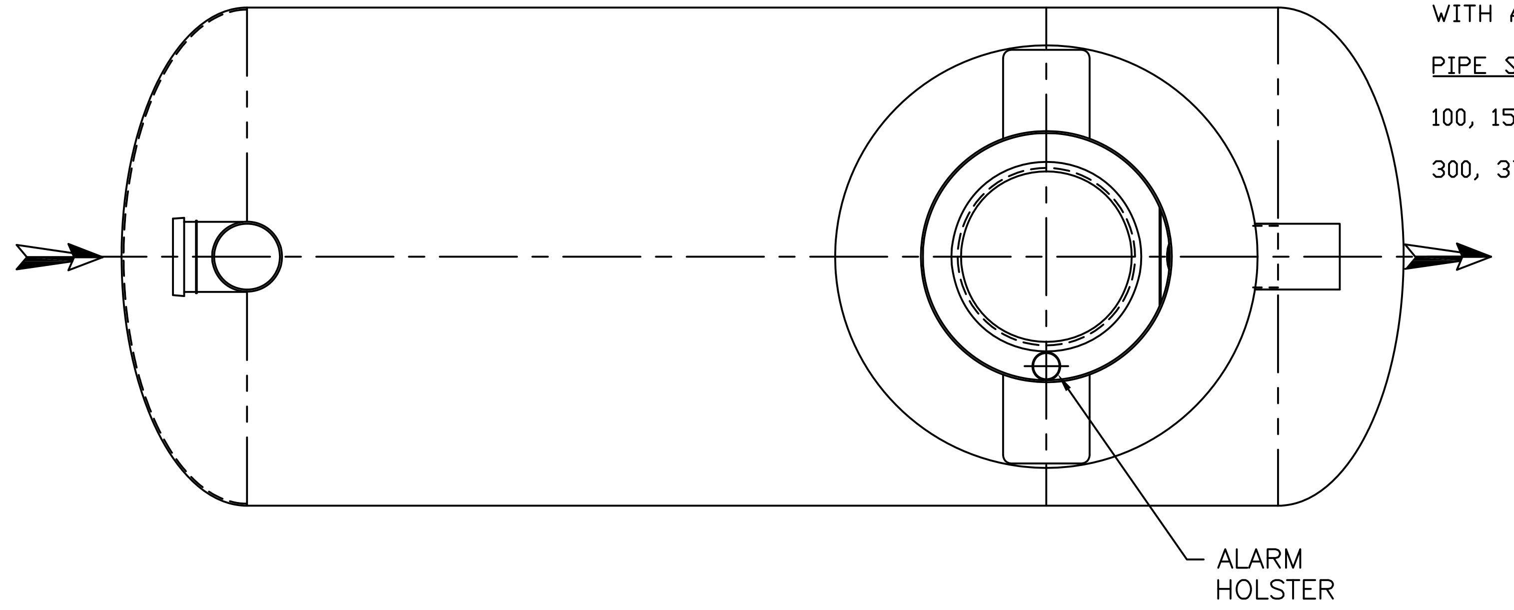
PREMIER TECH
AQUA

SEPARATOR - FULL RETENTION - CNS80S

CNS80S-11-SALES







IMPORTANT NOTE

DUE TO THE COMPACT DESIGN AND EASE OF INSTALLATION, CONDER SEPARATORS ARE NOW SUPPLIED AS STANDARD WITH AN IN LINE CONFIGURATION.

PIPE SIZE VARIANTS

100, 150, 225 PVC

300, 375, GRP

NOTES:

1. PRODUCT INFORMATION

The Conder range of light liquid separators is produced from high grade GRP. Inlets are provided as sockets and outlets as spigots, Connections may be made by steel-banded flexible couplings, nitrile seal joints, rope-seal and mortar or any other appropriate jointing method.

Ventilation specifications should be in accordance with Local Authority requirements. Vent pipework from multiple chambers must never be manifolded below ground level.

2. PERFORMANCE CHARACTERISTICS

Separators are based on the requirements stated in European Standard EN858-1 and Environment Agency guideline PPG3, in particular:-

a. The nominal size has been established from performance tests where the residual oil at the outlet is less than 5mg/l for class 1 separators and less than 100mg/l for class 2 separators.

3. MAINTENANCE AND USE

It is important to recognise that light liquid separators require regular maintenance. The period between maintenance operations can vary depending on the location and use of the separator, therefore routine inspections shall be undertaken at least every six months and a log maintained of inspection date, depth of oil, depth of silt and any cleaning that is undertaken.

A Conder Alarm should be fitted to every separator to give automatic warning that the light liquid capacity has been reached.

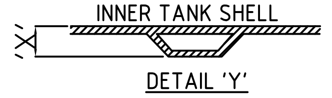
Access to the separator should be kept clear and not used for storage.

4. PRODUCT DEVELOPMENT

In line with our policy of constant improvement and development, we reserve the right to change specification without prior notice.

IMPORTANT INVERT LEVEL NOTE (RIBBED TANKS ONLY!):

The inlet and outlet Invert Level(IL) shown on this drawing is to internals of the shell unless otherwise stated.
For Invert level to the outside of the shell ribs, see the conversion below:
Ø1.0m, 1.2m, 1.5m, 1.8m, 2.5m IL+50mm ('X')
Ø3.0m,4.0m IL+75mm ('X')



TANKS SUPPLIED WITH LOOSE SHAFTS DO NOT COME SUPPLIED WITH A FIXING KIT.
THIS IS THE RESPONSIBILITY OF THE SITE CONTRACTOR.

PREMIER TECH AQUA

1ST ANGLE PROJECTION

TITLE
CNSB20S/21/SALES
BYPASS SEPARATOR

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION
7	11.04.13	DG	KB	RP	PIPE VARIANT SIZES AMENDED

A3

DO NOT SCALE
IF IN DOUBT ASK
ALL DIMENSIONS IN MM

GENERAL TOLERANCES (unless noted otherwise)				
GRP FABRICATED MACHINED	LINEAR	± 5mm ± 2mm ± 0.5mm	ANGLE	±0.5° ±0.2° ±0.1°

THIS DRAWING IS THE PROPERTY OF PREMIER TECH AQUA Ltd. AND IS NOT TO BE COPIED IN PART OR WHOLE WITHOUT WRITTEN PERMISSION

DRAWN BY	CHKD.	APPD.	SCALE	DRAWING No.	REVISION
RU	PB	RP	NTS	CNSB20S/21 SALES	7
DATE 23.03.09	DATE 23.03.09	DATE 23.03.09			

Appendix C – SurfSep^{TM} Details

CDS Dimensions (mm)

	CDS10404	CDS0604	CDS0606	CDS0804	CDS0806	CDS0808	CDS1010	CDS1012	CDS1015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table — CDS Polypropylene Manhole Units

Model Reference	Hydraulic Peak Flow Rate l/s	Treatment Flow Rate l/s	Drainage Area — Impermeable m^2	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
CDS 0404	30	12.5	2,000	900	150/225
CDS 0604	70	23	5,000	1200	225
CDS 0606/01	140	38	10,000	1200	225-375
CDS 0606/02	200	38	15,000	1200	225-375
CDS 0806	350	49	25,000	1500	450
CDS 0808	400	72	30,000	1500	450
CDS 1010	480	116	35,000	2000	450
CDS 1012	550	152	40,000	2000	450/750
CDS 1015	**700**	**211**	**50,000**	**2000**	**450/750**
CDS 0804	**275**	**31**	**20,000**	**1500**	**300**

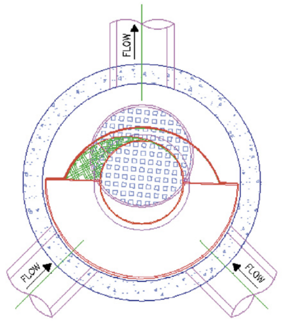
Proposed Peak Fow Rate for each model calculated using Rational Lloyd Davis with a rainfall intensity of 50mm/hr. For greater flows — special design/ construction required.

In-Line CDS

For small catchment, these units are used within the drainage system in-line and are supplied as BBA Approved* complete manhole polypropylene units from the selection table above.

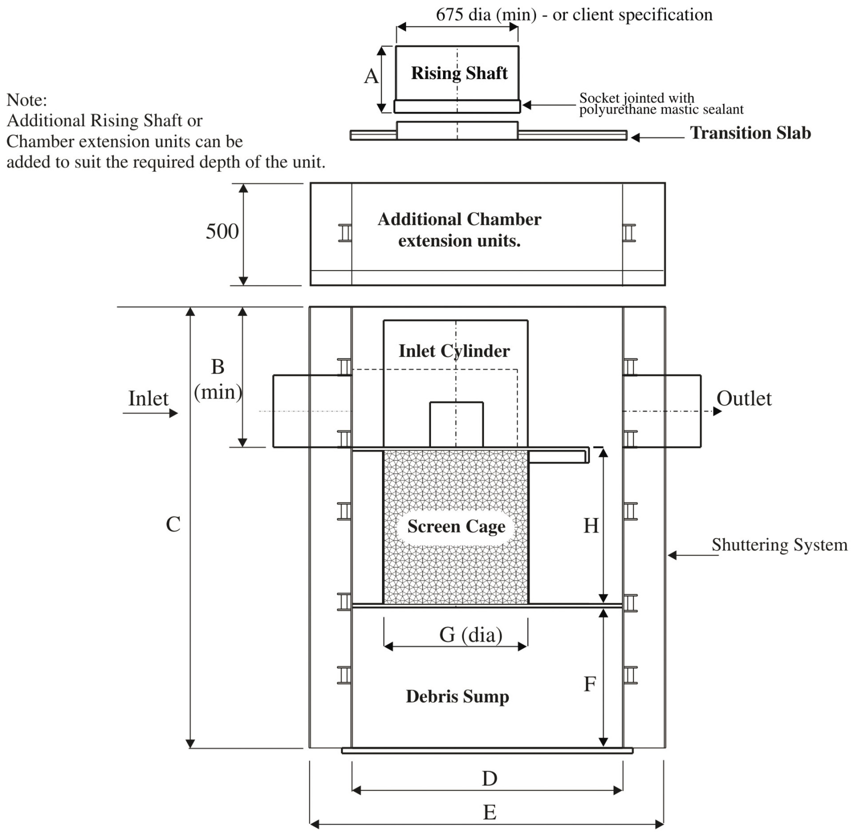
Off-Line CDS

Larger catchment areas and retrofit projects designed with larger surface runoff conveyance capacity can receive treatment using a CDS unit placed adjacent to the storm pipeline. Water is channeled to these offline CDS configurations using a diversion structure. The diversion structure and its weir send the water quality flow to the offline CDS unit and also ensure larger flow events from less frequent storm events properly bypass the offline unit without cause flooding upstream of the unit.



Model Designation

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a CDS screen for installation into standard commercially available pre-fabricated manhole chambers. Example: CDS 0806 designates a separation screen dia. 0.8 m and screen height of 0.6m.


Note:
Additional Rising Shaft or
Chamber extension units can be
added to suit the required depth of the unit.

Support

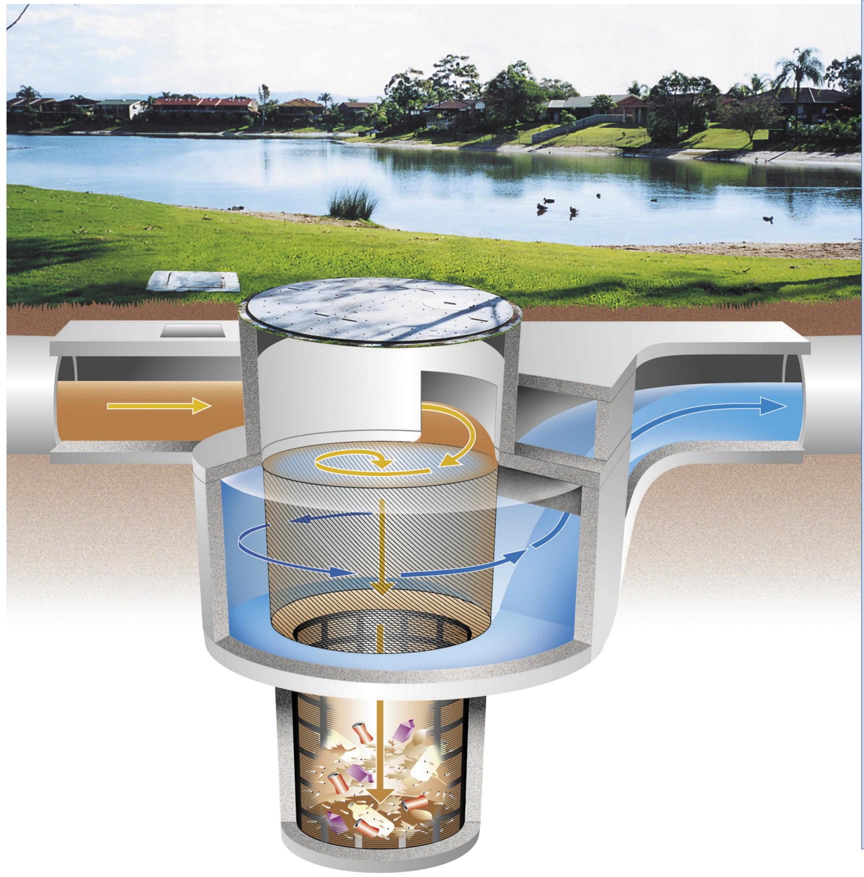
- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.

800.338.1122
contechstormwater.com

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266 related foreign patents or other patents pending.

Surface Water Treatment SUDs Protector

CONSTRUCTION PRODUCTS INC.



Primary Features

- Effective — Targets 80% solids removal
- Non-Blocking — Unique design takes advantage of indirect screening and properly proportioned hydraulic forces that virtually makes the unit unblockable.
- Non-Mechanical — The unit has no moving parts and requires no mechanical devices to support the solid separation function.
- Low Maintenance Costs — The system has no moving parts and is fabricated of durable materials.
- Compact & Flexible — Design and size flexibility enables the use of various configurations.
- High-flow Effectiveness — The technology remains highly effective across a broad spectrum of flow ranges.
- Assured Pollutant Capture — All materials captured are retained during high flow conditions.
- Safe & Easy Pollutant Removal — Extraction methods allow safe and easy removal of pollutants without manual handling.

The CDS Non Blocking screening technology is an innovative method of liquid/solid separation for stormwater runoff.

The technology accomplishes high efficiency separation of settleable particulate matter and capture of floatable material.

A unique feature is it’s compact design. It is available as packaged systems, which can either be installed inside pre-cast concrete chamber rings, or complete BBA Approved Polyethylene manholes.

Applications

- Commercial/residential developments
- Municipal/roadway development
- Industrial development
- Pre-treatment for wetlands, ponds and swales
- Rainwater harvesting
- Pre-treatment for oil separators
- Pre-treatment for media and ground in-filtration systems
- Pre-treatment for underground detention/retention system

Sustainable Urban Drainage System (SUDS)

Developments that achieve SUDS integrate techniques for managing the surface water runoff so that it more closely replicates the natural pre-development conditions of the catchments. Additionally, best practices to control pollution close to their source of generation and achieve surface water quality improvements as well as provide amenity benefits are also required in achieving sustainable urban drainage systems.

Presently in the UK, Scotland and Ireland, SUDS is a planning requirement to be incorporated into the surface water drainage whenever possible and in Scotland, this is a legal requirement.

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* BBA - this certificate relates to Pipex universal manholes and access chambers which are manufactures from welded polypropylene (PP)

Sizing Unit Selection

In stormwater applications, an analysis of the catchment in terms of its size, topography and land use will provide information for determining flow to be expected for various return periods.

The CDS is designed to treat flow that mobilizes the gross pollutants within the catchment. Since there are variations in catchment response due to region, land use and topography, it is recommended that the selection of flow to be treated will be for return periods of between 3 months and 1 year.

Balancing the cost to the operator against the benefits to the environment

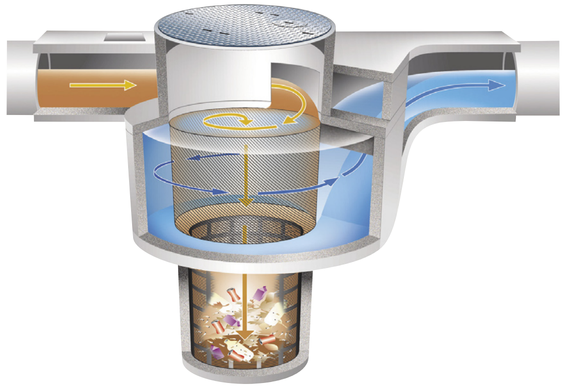
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity for the conveyance facility – typically known as the 'first flush'.

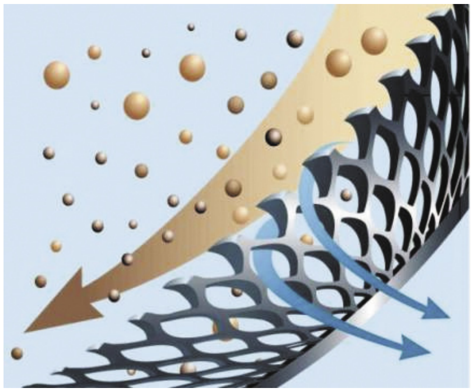
Therefore it is typical not to design the CDS models to process the conveyance system's maximum flow in order to achieve a very high level of pollutant removal.

The added value benefit to the operator is reduced civil costs without compromising the benefits to the environment.

How it works

Water and pollutants enter the system and are introduced tangentially inside the separation chamber forming a circular flow motion. Floatables and suspended solids are diverted to the slow moving centre of the flow. Negatively buoyant solids settle out to an undisturbed sump chamber below, while the water passes countercurrently through the separation screen. Floatables remain at the water surface and retained within the screen.





Surface Water Treatment Systems

Hydraulic Design

Every application requires a detailed hydraulic analysis to ensure the final installation will optimize solids separation without blocking the screen.

After the design flow has been determined, the appropriate standard model can be selected. A selection table is provided on page 4.

The Ultimate SUDs Protector

There are four principal areas of proprietary SUDs technology:

- Infiltration
- Flow control
- Storage/attenuation
- Treatment

When installed upstream of any proprietary SUDs technology, the CDS protects the receiving SUDs from fine solids and debris that would otherwise accumulate over time rendering the SUDs non-operational, as the worse case.

To remove fine solids and debris that would otherwise accumulate over time reducing the down stream effectiveness of downstream SUDs assets, CDS units have been successfully installed in front of:

- Soakaways
- Infiltration Trenches
- Filters
- Wetlands
- Ponds and Water Features
- Detention and Retention Systems
- Oil Separators
- Create storage systems

Infiltration

CDS units have been successfully installed in front of ground infiltration systems to remove grit. Fine solids and debris which accumulates in and around the SUDs causing visual degradation in the short term and accumulation of silt and grits leading to reduced volume in the long term.

Studies have also shown that heavy metals & PAH's accumulate within the SUDs over time before being released back to the environment resulting in elevated concentrations.

Operation & Performance

Performance Criteria

Note: Screen apertures of 4.8 mm and 2.4 mm are available.

Typical Aperture Performance

- Shall remove all solids with a single dimension greater than aperture size and positively contain those solids until the unit is cleaned.
- Shall remove and positively contain 100 percent of all neutrally buoyant particles with a single dimension greater than aperture size for all flow conditions to design capacity.
- Shall remove and positively contain 100 percent of all floating trash and debris with a single dimension greater than aperture size for all flow conditions to the design capacity
- Shall remove a minimum of 50 percent of oil and grease (as defined as the floating portion of total hexane extractable materials) for all flow conditions to the design capacity, without the addition of absorbents.
- Shall provide the following minimum particle removal efficiencies (based on a specific gravity of 2.65):

Maintenance

CDS maintenance can be site and drainage area specific. The installation should be inspected periodically to assure its condition to handle anticipated runoff. If pollutant loadings are known, then a preventive maintenance schedule can be developed based on runoff volumes processed.

New Installations

Check the condition of the installation after the first few events. This includes a visual inspection to ascertain that the unit is operating correctly and measuring the amount of deposition that has occurred in the unit. This may be achieved using a 'Dip Stick'.

Ongoing Operation

For the first 12 months the sediment sump capacity should be inspected quarterly and recorded. When the inspection indicates that the sediment is approaching the top of the sump (base of screen) a cleanout should be undertaken.

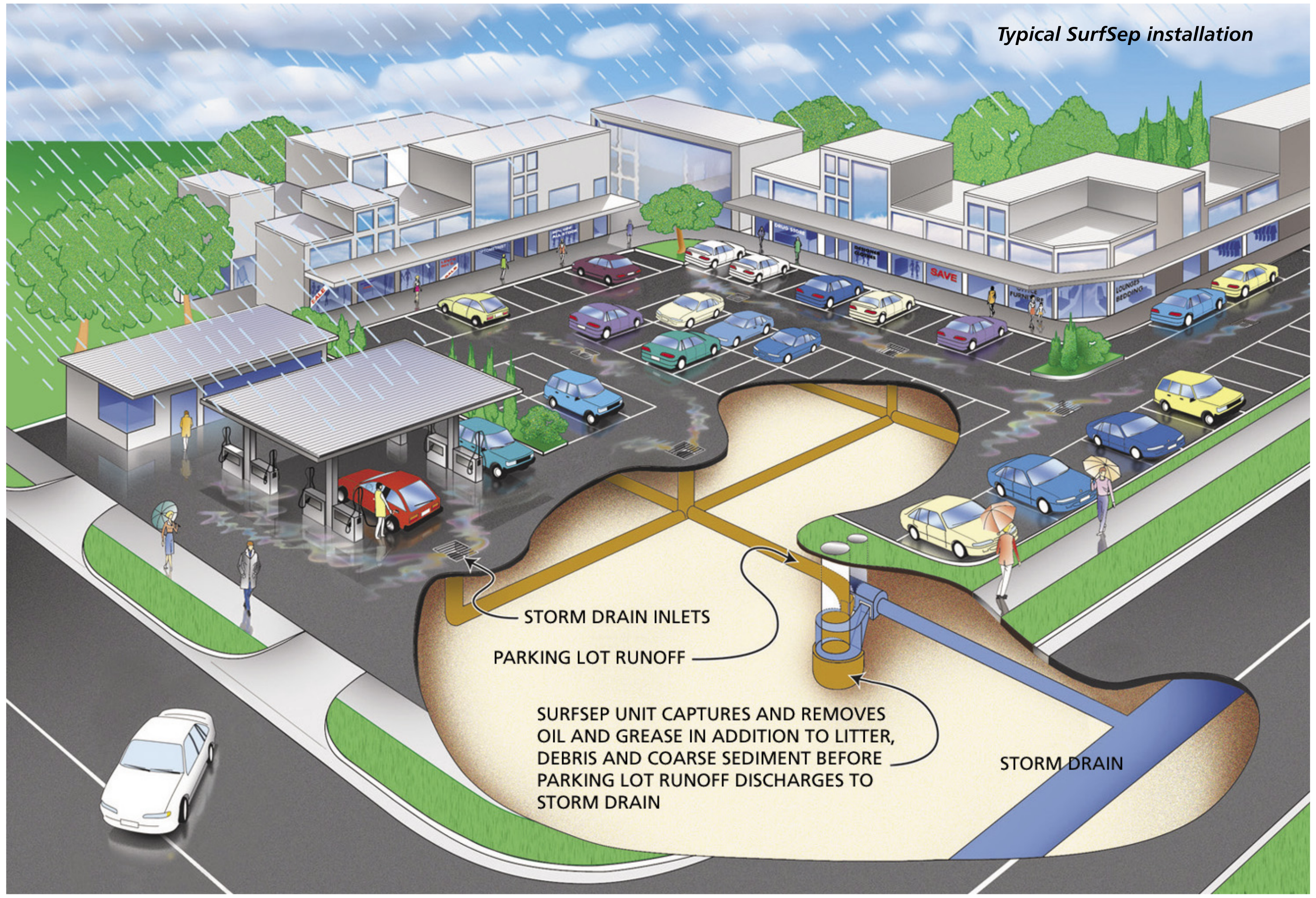
Cleaning Methods

- Eduction (Suction)
- Basket Removal
- Mechanical Grab

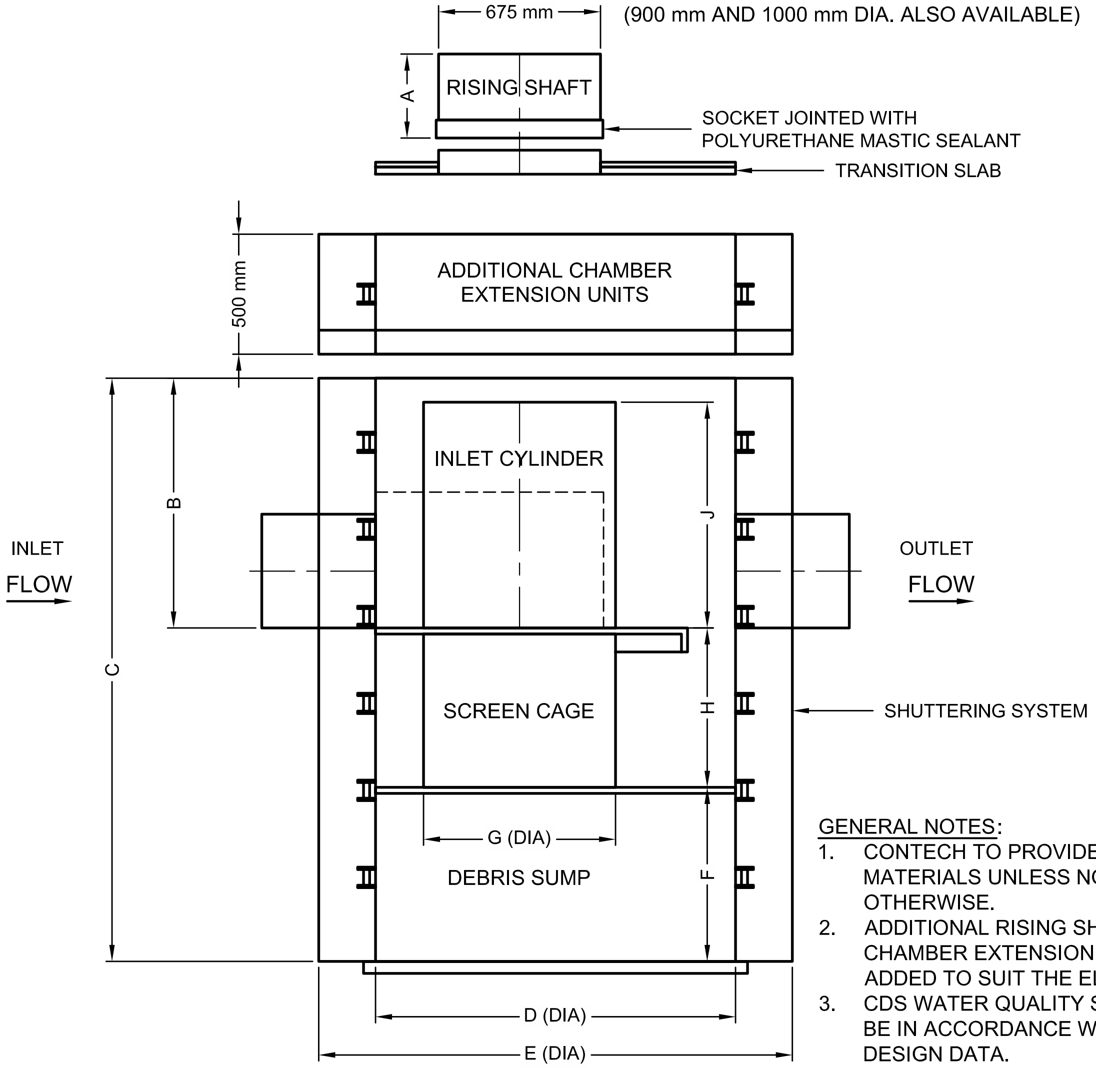
Maintenance Cycle

Minimum once per year. Depending on the pollutant load it may be necessary to maintain the installation more frequently.

The operator shall be able to devise the most efficient maintenance schedule for any particular installation over a 12 month operating cycle.



Typical SurfSep installation



GENERAL NOTES:

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. ADDITIONAL RISING SHAFT OR CHAMBER EXTENSION UNITS CAN BE ADDED TO SUIT THE ELEVATIONS.
3. CDS WATER QUALITY SYSTEM SHALL BE IN ACCORDANCE WITH SITE DESIGN DATA.

DIMENSIONS (ALL FIGURES IN mm)

	CDS 0404	CDS 0604	CDS 0606	CDS 0804	CDS 0806	CDS 0808	CDS 1010	CDS 1012	CDS 1015
A	350	350	350	350	350	350	350	350	350
B	397	789	789	1021	1026	1026	969	1289	1289
C	1245	1973	2173	2230	2430	2630	3040	3560	3860
D (DIA)	800	1200	1200	1500	1500	1500	2000	2000	2000
E (DIA)	1112	1576	1576	1994	1994	1994	2524	2524	2524
F	403	700	700	720	720	720	1030	1030	1030
G (DIA)	405	610	610	810	810	810	960	960	960
H	425	484	684	489	684	884	1041	1241	1541
J	375	629	629	829	828	828	800	1109	1109

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

PROPRIETARY INFORMATION -
NOT TO BE USED FOR CONSTRUCTION PURPOSES

CONTECH®
CONSTRUCTION PRODUCTS INC.
www.contech-cpl.com
5670 Greenwood Plaza Blvd., Suite 530, Greenwood Village, CO 80111
800-526-3999 303-796-2233 303-796-2239 FAX

TYPICAL DETAIL
CDS® SURFSEP SYSTEM
PLASTIC CHAMBER CONFIGURATION

DATE:10/27/11 | SCALE: NONE | FILE NAME: SURFSEP TYP. DET. W/ TABLE | DRAWN: SCF | CHECKED: JAG

\AD.CONTECH-CPI.COM\ROOT\STORMWATER\COMMOPS\22 CDS\100 SURFSEP\DRAFTING\CONTECH CDS-PP STANDARD DETAIL.DWG 10/27/2011 2:08 PM

Appendix D – Hydrobrake^{TM} Details

DATA SHEET

Technical Specification

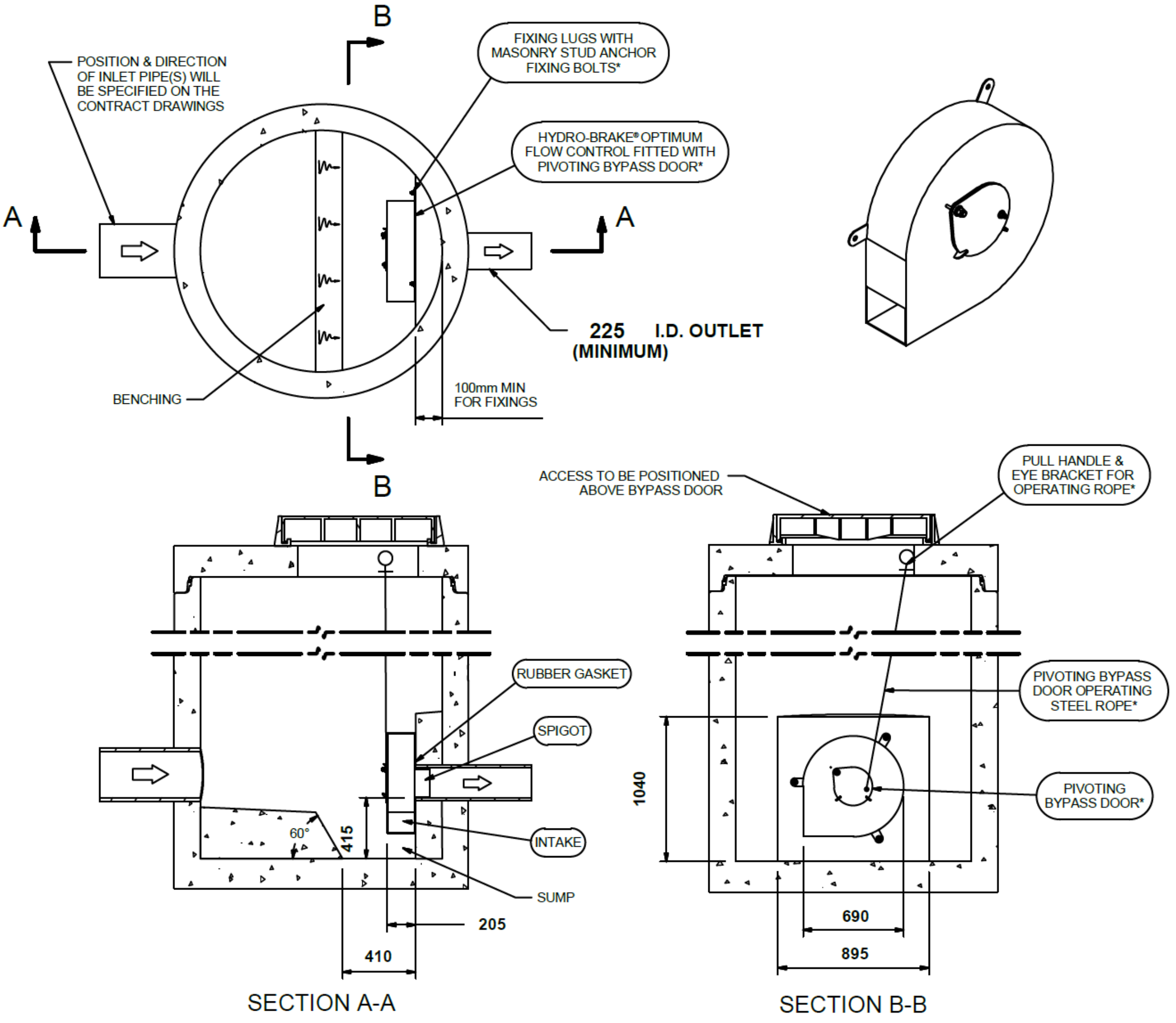
Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	19.739
Flush-Flo™	0.341	19.734
Kick-Flo®	0.721	16.906
Mean Flow		16.617

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 08/4596

WRc Approved™
PT/329/0412



IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0198-1975-1000-1975 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

DATE	8/23/2019 12:52:39 PM
SITE	DUB 55

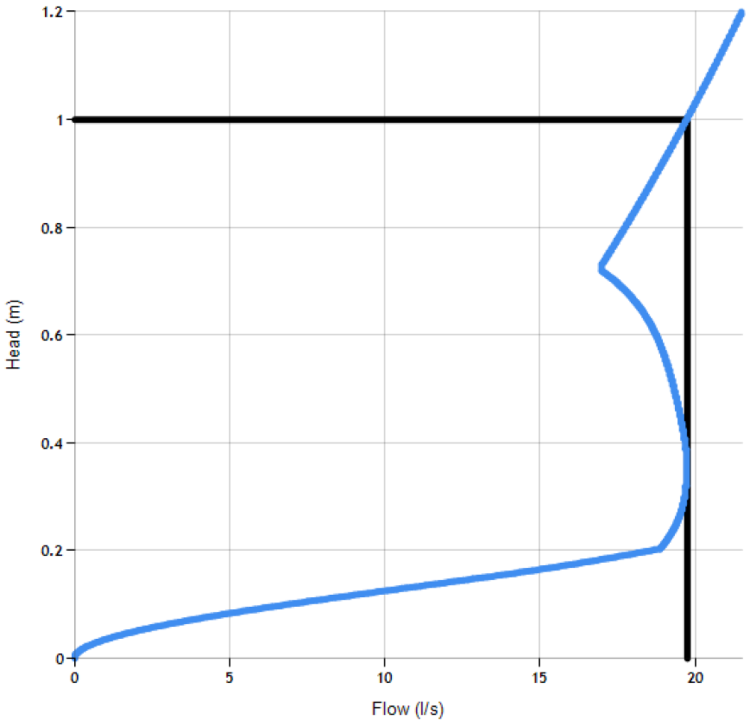
SHE-0198-1975-1000-1975
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	19.739
Flush-Flo™	0.341	19.734
Kick-Flo®	0.721	16.906
Mean Flow		16.617

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.034	0.936
0.069	3.498
0.103	7.242
0.138	11.598
0.172	15.788
0.207	18.931
0.241	19.336
0.276	19.582
0.310	19.704
0.345	19.734
0.379	19.697
0.414	19.614
0.448	19.503
0.483	19.371
0.517	19.221
0.552	19.045
0.586	18.826
0.621	18.538
0.655	18.145
0.690	17.605
0.724	16.948
0.759	17.313
0.793	17.682
0.828	18.042
0.862	18.395
0.897	18.741
0.931	19.080
0.966	19.412
1.000	19.739

DESIGN ADVICE
!

The head/flow characteristics of this SHE-0198-1975-1000-1975 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

DATE	8/23/2019 12:52:39 PM
SITE	DUB 55

SHE-0198-1975-1000-1975
Hydro-Brake Optimum®

Technical Specification

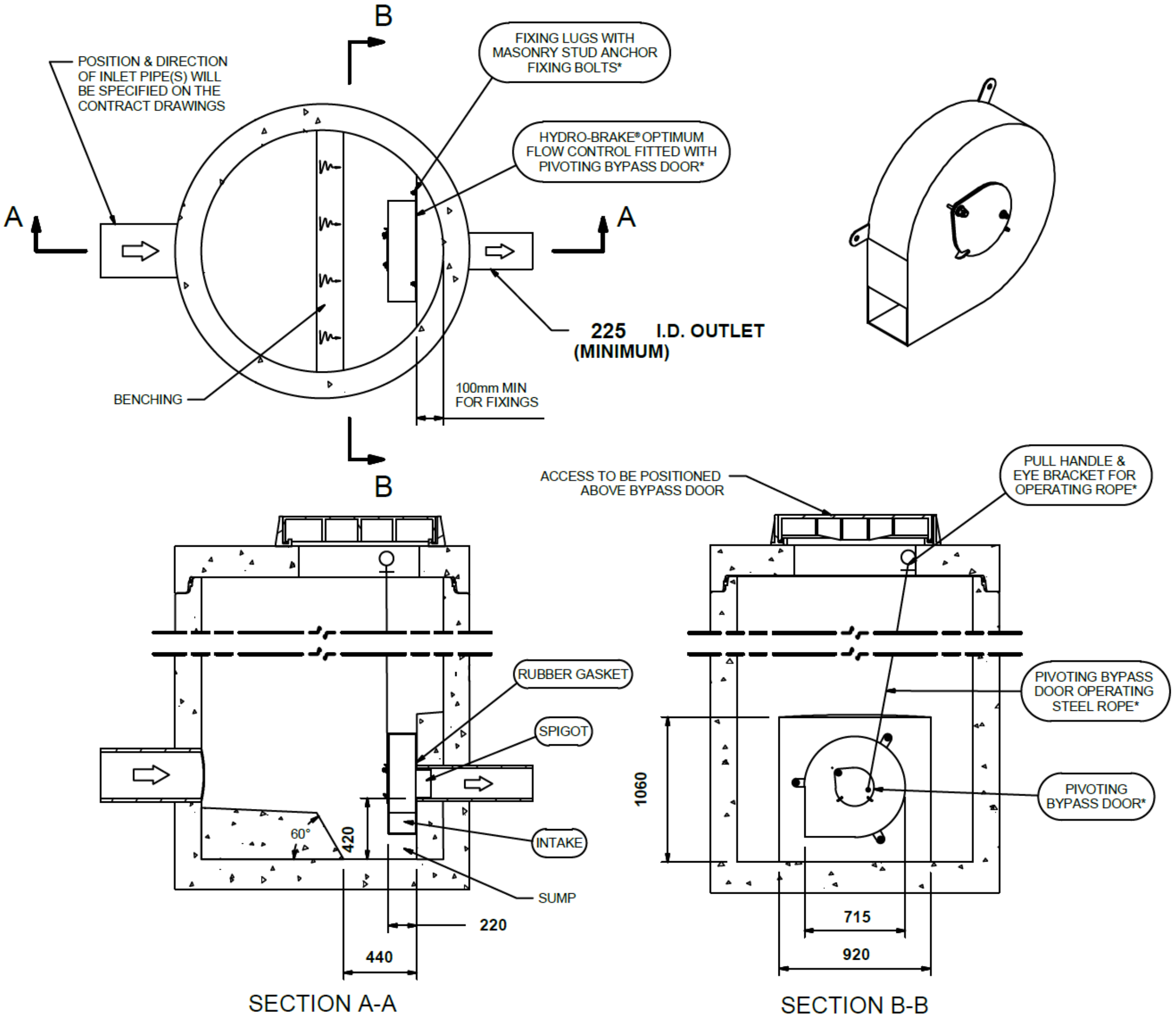
Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	22.735
Flush-Flo™	0.352	22.735
Kick-Flo®	0.729	19.565
Mean Flow		19.028

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 08/4596

WRc Approved
PT/329/0412



IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0210-2275-1000-2275 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve. **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

SHE-0210-2275-1000-2275
Hydro-Brake® Optimum

DATA SHEET

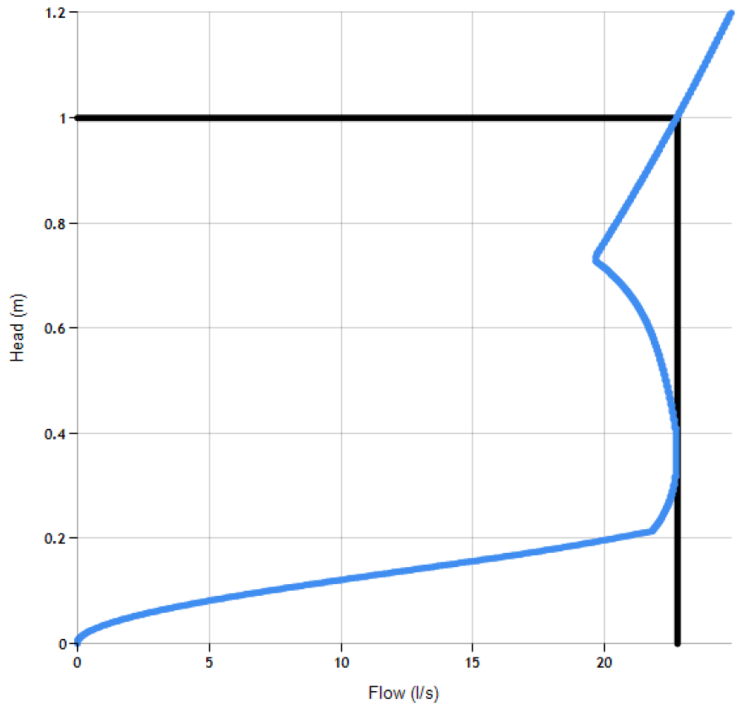
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	22.735
Flush-Flo™	0.352	22.735
Kick-Flo®	0.729	19.565
Mean Flow		19.028

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

Head (m)	Flow (l/s)
0.000	0.000
0.034	0.970
0.069	3.642
0.103	7.596
0.138	12.301
0.172	17.076
0.207	21.036
0.241	22.187
0.276	22.501
0.310	22.672
0.345	22.733
0.379	22.712
0.414	22.633
0.448	22.515
0.483	22.370
0.517	22.202
0.552	22.006
0.586	21.767
0.621	21.459
0.655	21.048
0.690	20.488
0.724	19.728
0.759	19.936
0.793	20.361
0.828	20.777
0.862	21.184
0.897	21.583
0.931	21.974
0.966	22.358
1.000	22.735



DESIGN ADVICE
!

The head/flow characteristics of this SHE-0210-2275-1000-2275 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

SHE-0210-2275-1000-2275

Hydro-Brake Optimum®

Technical Specification

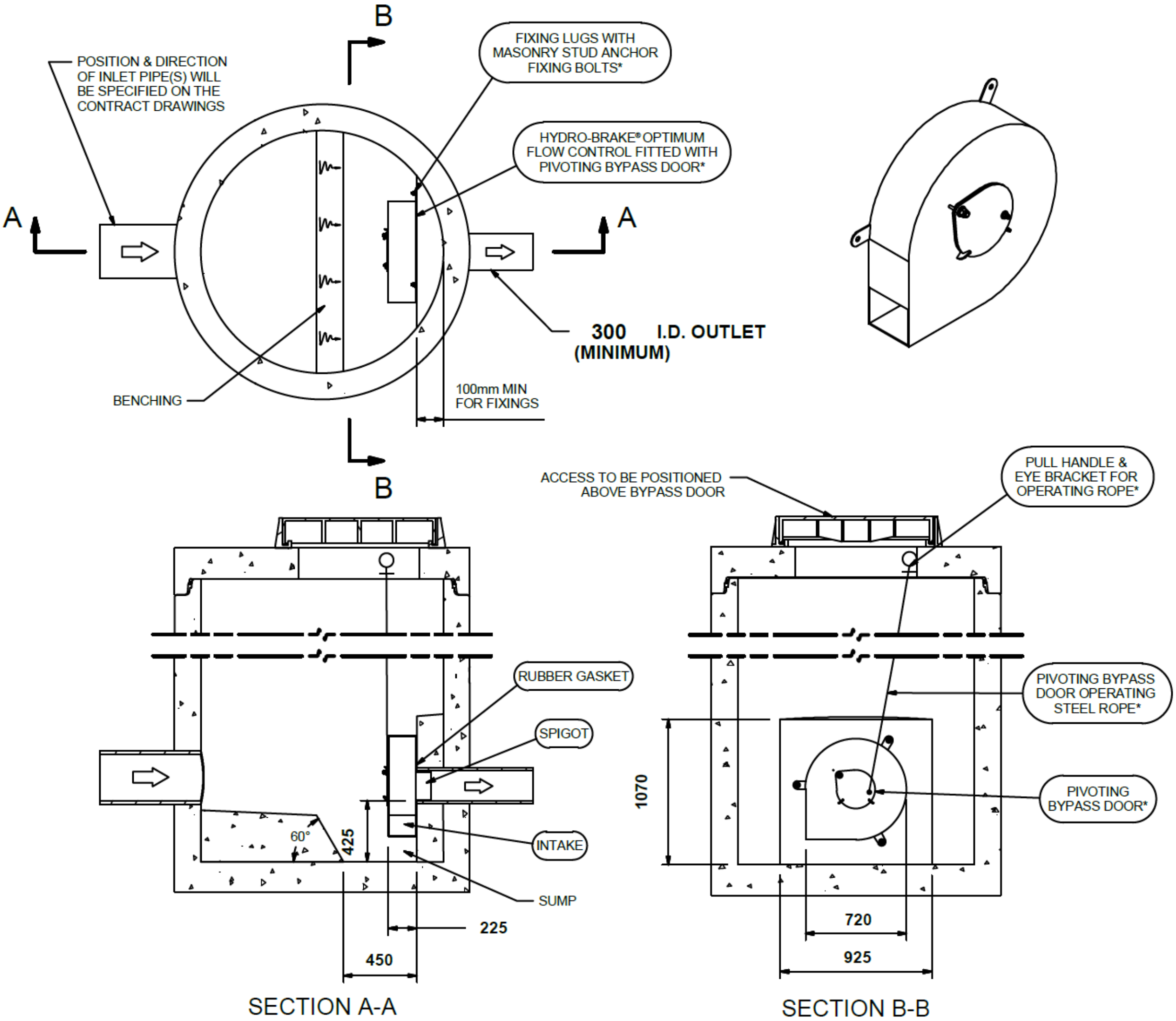
Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	23.995
Flush-Flo™	0.357	23.952
Kick-Flo®	0.732	20.688
Mean Flow		20.021

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412



IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0215-2400-1000-2400 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

SHE-0215-2400-1000-2400
Hydro-Brake® Optimum

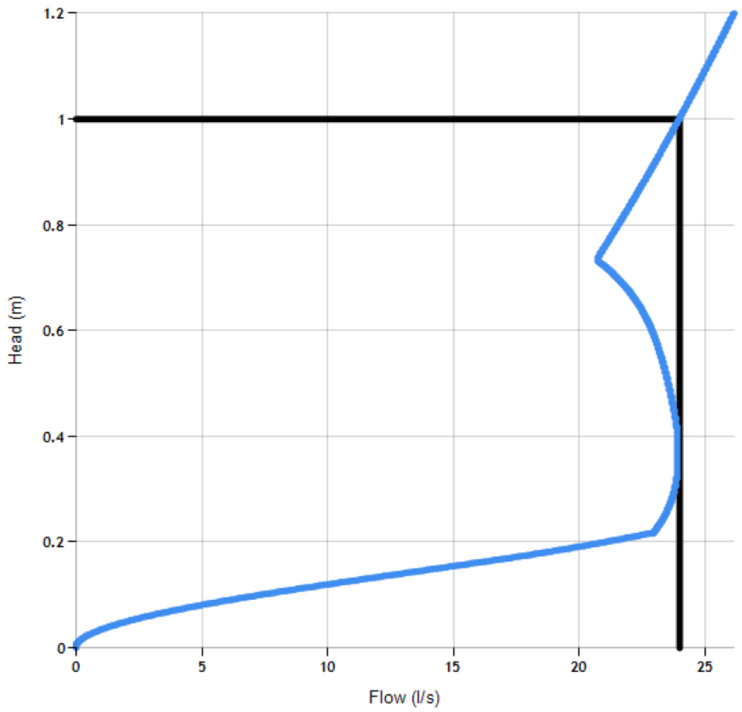
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	23.995
Flush-Flo™	0.357	23.952
Kick-Flo®	0.732	20.688
Mean Flow		20.021

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

Head (m)	Flow (l/s)
0.000	0.000
0.034	0.983
0.069	3.698
0.103	7.732
0.138	12.569
0.172	17.562
0.207	21.776
0.241	23.323
0.276	23.671
0.310	23.867
0.345	23.947
0.379	23.938
0.414	23.866
0.448	23.750
0.483	23.604
0.517	23.432
0.552	23.232
0.586	22.988
0.621	22.677
0.655	22.261
0.690	21.698
0.724	20.934
0.759	21.039
0.793	21.488
0.828	21.927
0.862	22.357
0.897	22.779
0.931	23.192
0.966	23.597
1.000	23.995



DESIGN ADVICE
!

The head/flow characteristics of this SHE-0215-2400-1000-2400 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

SHE-0215-2400-1000-2400
Hydro-Brake Optimum®

Appendix E – Site Investigation Information

TRIAL PIT RECORD

REPORT NUMBER 21674

CONTRACT	EngineNode Data Centre	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**CO-ORDINATES**	702,621.44 E 743,092.34 N
		GROUND LEVEL (m)	70.32
CLIENT	EngineNode	**DATE STARTED**	01/04/2019
ENGINEER	Clifton Scannell Emerson Associates	**DATE COMPLETED**	01/04/2019
		EXCAVATION METHOD	JCB

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Brown SILT/CLAY with roots		0.10	70.22						
	Grey brown silty sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse and subangular to rounded. Cobbles are subrounded to rounded.		0.60	69.72		117170	B	0.50-0.50		
1.0						117171	B	1.00-1.00		
	Stiff black slightly sandy gravelly CLAY with low cobble content. Sand is fine to medium. Gravel is fine to medium and subangular to rounded.		1.80	68.52						
2.0						117172	B	2.00-2.00		
3.0	End of Trial Pit at 3.00m		3.00	67.32		117173	B	3.00-3.00		
4.0										

Groundwater Conditions

Stability
Stable

General Remarks

TRIAL PIT RECORD

REPORT NUMBER 21674

CONTRACT EngineNode Data Centre

TRIAL PIT NO. TP07
SHEET Sheet 1 of 1

LOGGED BY FC

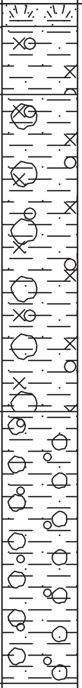
CO-ORDINATES 703,032.89 E
742,999.34 N

GROUND LEVEL (m) 68.45

DATE STARTED 01/04/2019
DATE COMPLETED 01/04/2019

CLIENT EngineNode
ENGINEER Clifton Scannell Emerson Associates

EXCAVATION METHOD JCB



Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
					Sample Ref	Type	Depth		
TOPSOIL		0.10	68.35						
Soft brown sandy SILT/CLAY with occasional gravel		0.40	68.05						
Firm brown/grey sandy SILT/CLAY with some gravel and occasional cobbles		1.80	66.65		AA117189 AA117190	B B	0.50 1.00		
Stiff to very stiff dark grey and black sandy gravelly CLAY with some cobbles		3.00	65.45		AA117191 AA117192	B B	2.00 3.00		
End of Trial Pit at 3.00m									

Groundwater Conditions
Pit was dry

Stability
Pit was stable.

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	21674		
CONTRACT	EngineNode Data Centre	**TRIAL PIT NO.**	**TP10**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**DATE STARTED**	01/04/2019
CO-ORDINATES	703,205.08 E 743,114.10 N	**DATE COMPLETED**	01/04/2019
GROUND LEVEL (m)	68.82	**EXCAVATION METHOD**	JCB
CLIENT	EngineNode		
ENGINEER	Clifton Scannell Emerson Associates		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.40	68.42						
	Soft light brown gravelly sandy SILT. Sand is fine to medium. Gravel is fine to coarse and angular to subangular.		0.90	67.92		117166	B	0.50-0.50		
1.0	Firm grey sandy very gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse and subangular to subrounded.		1.80	67.02		117167	B	1.00-1.00		
2.0	Stiff to very stiff black sandy very gravelly CLAY with low cobble content. Sand is fine to medium. Gravel is fine to coarse and subangular to rounded. Cobbles are subrounded to rounded.		3.00	65.82	1 (Seepage)	117168	B	2.00-2.00		
3.0	End of Trial Pit at 3.00m					117169	B	3.00-3.00		
4.0										

Groundwater Conditions
Seepage @ 2.8m

Stability
Stable

General Remarks

Appendix 4

Infiltration Test Records

Soakaway Design f -value from field tests (F2C) IGSL

Contract:	EngineNode Data Centre	Contract No.:	21675
Test No.:	SA01		
Client:	Clifton Scannell Emerson Associates		
Date:	#########		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.40	TOPSOIL	Not Encountered
0.40	1.60	Brown silty very sandy GRAVEL.	
1.60	2.00	Brown silty very sandy GRAVEL with low cobble content.	

Notes:

Field Data

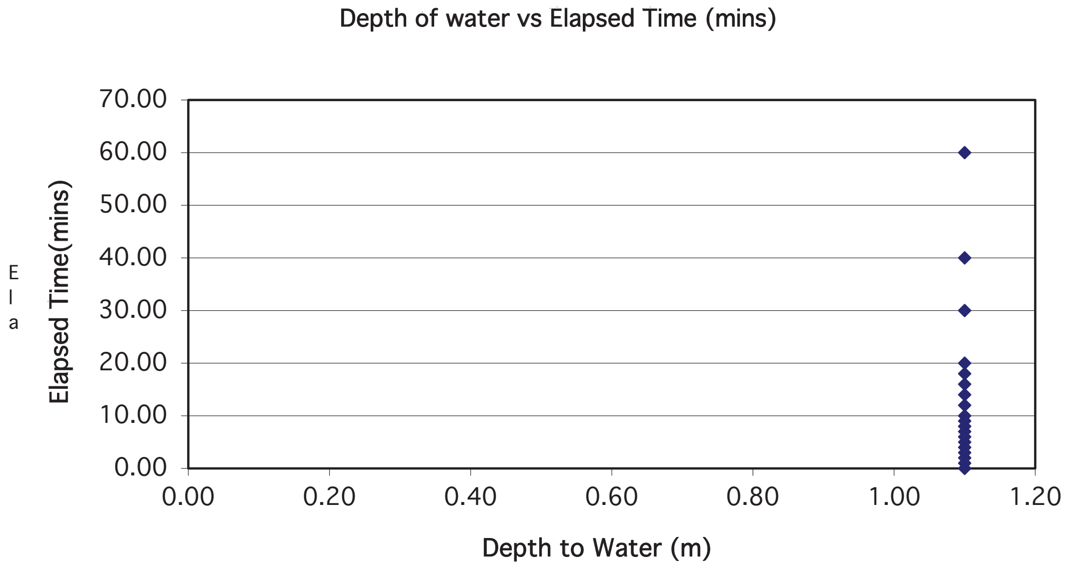
Depth to Water (m)	Elapsed Time (min)
1.10	0.00
1.10	1.00
1.10	2.00
1.10	3.00
1.10	4.00
1.10	5.00
1.10	6.00
1.10	7.00
1.10	8.00
1.10	9.00
1.10	10.00
1.10	12.00
1.10	14.00
1.10	16.00
1.10	18.00
1.10	20.00
1.10	30.00
1.10	40.00
1.10	60.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.30	m
Length of Pit (L)	1.00	m
Initial depth to Water =	1.10	m
Final depth to water =	1.10	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.00	m
Base of permeable soil	2.00	m
Base area=	0.3	m2
*Av. side area of permeable stratum over test period	2.34	m2
Total Exposed area =	2.64	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract: EngineNode Data Centre Contract No.: 21675
Test No.: SA02
Client: Clifton Scannell Emerson Associates
Date: #########

Summary of ground conditions

from	to	Description	Ground water
0.00	0.40	TOPSOIL	Not Encountered
0.40	1.60	Brown silty very sandy GRAVEL.	
1.60	2.00	Firm to stiff grey slightly gravelly CLAY.	

Notes:

Field Data

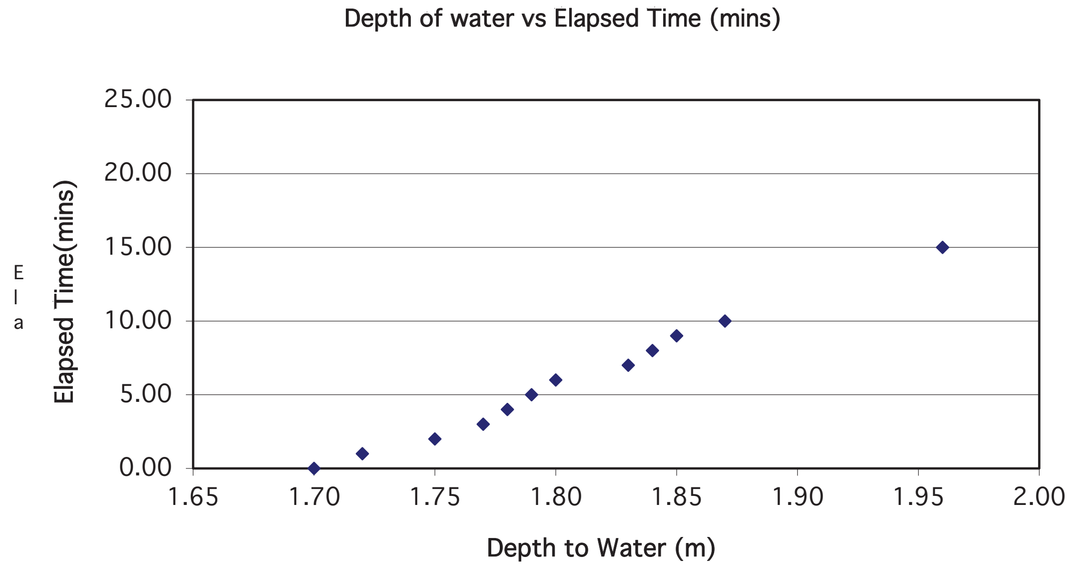
Depth to Water (m)	Elapsed Time (min)
1.70	0.00
1.70	1.00
1.72	2.00
1.75	3.00
1.77	4.00
1.78	5.00
1.79	6.00
1.80	7.00
1.83	8.00
1.84	9.00
1.85	10.00
1.87	15.00
1.96	20.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.30	m
Length of Pit (L)	1.00	m
Initial depth to Water =	1.70	m
Final depth to water =	1.96	m
Elapsed time (mins)=	20.00	
Top of permeable soil	0.00	m
Base of permeable soil	2.00	m
Base area=	0.3	m2
*Av. side area of permeable stratum over test perio	0.442	m2
Total Exposed area =	0.742	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00526 m/min or 8.76E-05 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract: EngineNode Data Centre Contract No.: 21675
Test No.: SA03
Client: Clifton Scannell Emerson Associates
Date: #########

Summary of ground conditions

from	to	Description	Ground water
0.00	0.50	TOPSOIL	Seepage @ 2.0m
0.50	1.50	Firm grey / black sandy very gravelly CLAY.	
1.50	2.00	Firm to stiff black gravelly CLAY with low cobble content.	

Notes:

Field Data

Depth to Water (m)	Elapsed Time (min)
1.07	0.00
1.07	1.00
1.07	2.00
1.07	3.00
1.07	4.00
1.07	5.00
1.07	6.00
1.07	7.00
1.07	8.00
1.07	9.00
1.07	10.00
1.07	15.00
1.07	20.00
1.07	30.00
1.07	40.00
1.07	50.00
1.07	60.00

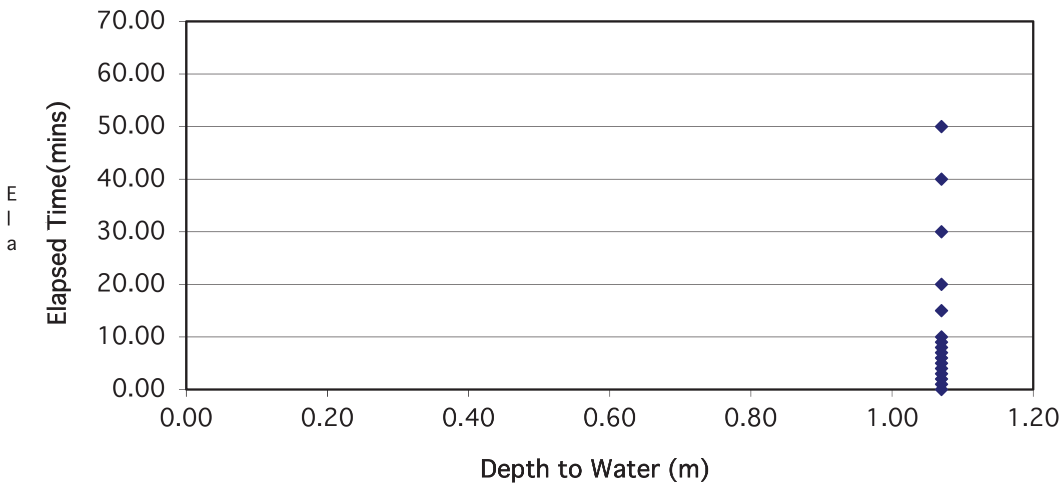
Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.30	m
Length of Pit (L)	1.00	m
Initial depth to Water =	1.07	m
Final depth to water =	1.07	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.3	m2
*Av. side area of permeable stratum over test perioc	2.418	m2
Total Exposed area =	2.718	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests (F2C) IGSL

Contract: EngineNode Data Centre Contract No.: 21675
Test No.: SA04
Client: Clifton Scannell Emerson Associates
Date: #########

Summary of ground conditions

from	to	Description	Ground water
0.00	0.40	TOPSOIL	Seepage @ 2.0m
0.40	1.50	Firm grey / black sandy gravelly CLAY.	
1.50	2.00	Firm to stiff black gravelly CLAY with low cobble content.	

Notes:

Field Data

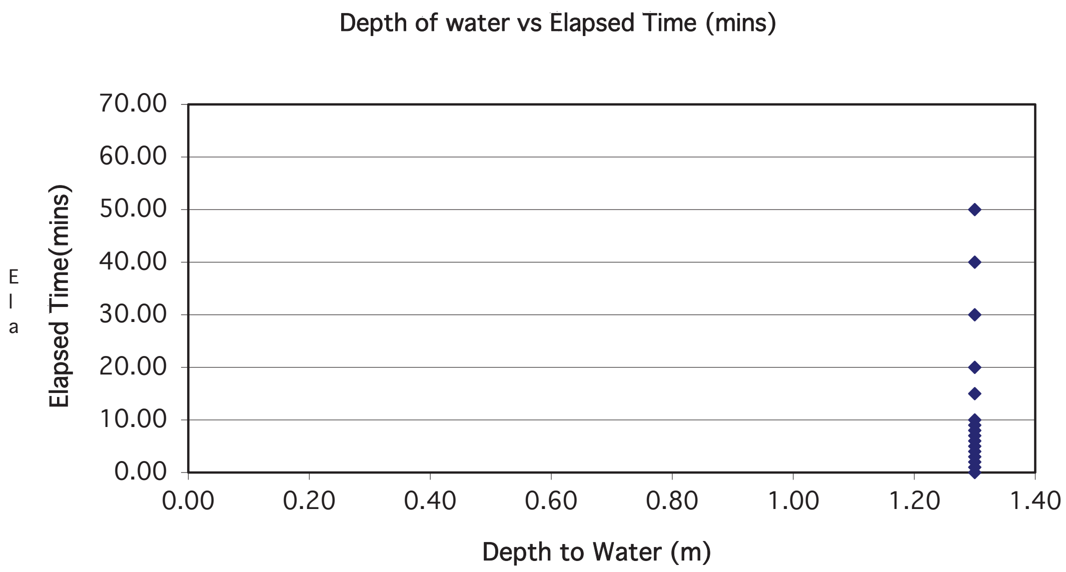
Depth to Water (m)	Elapsed Time (min)
1.30	0.00
1.30	1.00
1.30	2.00
1.30	3.00
1.30	4.00
1.30	5.00
1.30	6.00
1.30	7.00
1.30	8.00
1.30	9.00
1.30	10.00
1.30	15.00
1.30	20.00
1.30	30.00
1.30	40.00
1.30	50.00
1.30	60.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.30	m
Length of Pit (L)	1.00	m
Initial depth to Water =	1.30	m
Final depth to water =	1.30	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.3	m2
*Av. side area of permeable stratum over test period	1.82	m2
Total Exposed area =	2.12	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

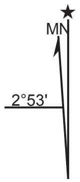
f= 0 m/min or 0 m/sec



ExpertGPS Basemap: mapbox, OpenStreetMap

Engine Node Date Centre

Scale: 1 : 4000.



Appendix F – Surface Water Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.800	Add Flow / Climate Change (%)	0
Ratio R	0.323	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.750
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.059	4-8	2.524	8-12	3.686	12-16	0.619

Total Area Contributing (ha) = 6.888

Total Pipe Volume (m³) = 450.281

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	51.577	0.172	300.0	0.276	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S3.001	25.093	0.084	300.0	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S4.000	19.881	0.066	300.0	0.032	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.95	69.445	0.276	0.0	0.0	0.0	0.90	63.8	37.3
S3.001	50.00	6.42	69.273	0.327	0.0	0.0	0.0	0.90	63.8	44.2
S4.000	50.00	5.37	69.700	0.032	0.0	0.0	0.0	0.90	63.8	4.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.000	35.356	0.118	300.0	0.115	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.001	27.383	0.091	300.9	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S4.002	60.062	0.200	300.3	0.124	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S3.002	25.151	0.056	449.1	0.083	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.003	82.492	0.183	450.0	0.152	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.004	87.889	0.195	450.0	0.099	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.005	38.209	0.085	450.0	0.065	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.006	9.872	0.020	493.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S3.007	16.960	0.100	169.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.000	76.899	0.171	450.0	0.521	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S6.001	17.089	0.038	450.0	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.002	44.455	0.099	450.0	0.210	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.003	49.696	0.110	450.0	0.172	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.004	66.906	0.149	450.0	0.156	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S6.005	62.002	0.124	500.0	0.143	0.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S7.000	41.629	0.111	375.0	0.162	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S6.006	14.829	0.028	529.6	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S5.000	50.00	5.65	69.750	0.115	0.0	0.0	0.0	0.90	63.8	15.6
S4.001	50.00	6.16	69.632	0.192	0.0	0.0	0.0	0.90	63.7	26.0
S4.002	50.00	7.27	69.541	0.316	0.0	0.0	0.0	0.90	63.8	42.8
S3.002	50.00	7.71	69.039	0.725	0.0	0.0	0.0	0.95	151.5	98.2
S3.003	50.00	9.15	68.983	0.877	0.0	0.0	0.0	0.95	151.4	118.8
S3.004	50.00	10.69	68.800	0.976	0.0	0.0	0.0	0.95	151.4	132.2
S3.005	50.00	11.36	68.605	1.041	0.0	0.0	0.0	0.95	151.4	140.9
S3.006	50.00	11.54	68.520	1.041	0.0	0.0	0.0	0.91	144.5	140.9
S3.007	50.00	11.72	68.450	1.041	0.0	0.0	0.0	1.56	247.8	140.9
S6.000	50.00	6.35	69.267	0.521	0.0	0.0	0.0	0.95	151.4	70.6
S6.001	50.00	6.65	69.096	0.590	0.0	0.0	0.0	0.95	151.4	79.9
S6.002	50.00	7.42	69.058	0.800	0.0	0.0	0.0	0.95	151.4	108.3
S6.003	50.00	8.29	68.959	0.972	0.0	0.0	0.0	0.95	151.4	131.6
S6.004	50.00	9.36	68.774	1.128	0.0	0.0	0.0	1.05	227.2	152.7
S6.005	50.00	10.40	68.652	1.270	0.0	0.0	0.0	0.99	215.4	172.0
S7.000	50.00	5.75	68.925	0.162	0.0	0.0	0.0	0.93	102.7	21.9
S6.006	50.00	10.65	68.528	1.433	0.0	0.0	0.0	0.97	209.2	194.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.007	128.614	0.100	1286.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S8.000	66.564	0.222	299.8	0.136	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S8.001	62.672	0.179	350.1	0.215	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S8.002	12.828	0.034	377.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S9.000	51.225	0.137	375.0	0.379	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S9.001	11.430	0.030	375.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S8.003	76.069	0.190	400.4	0.171	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S10.000	63.020	0.140	450.0	0.266	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S10.001	79.775	0.177	450.0	0.209	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S8.004	67.190	0.140	479.9	0.211	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S8.005	8.730	0.020	436.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S8.006	70.784	0.100	707.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S11.000	30.634	0.082	373.6	0.048	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S11.001	71.701	0.191	375.4	0.224	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S11.002	64.030	0.142	450.9	0.272	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S11.003	9.527	0.021	453.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.007	50.00	14.13	68.450	1.433	0.0	0.0	0.0	0.62	133.3«	194.0
S8.000	50.00	6.23	69.585	0.136	0.0	0.0	0.0	0.90	63.8	18.4
S8.001	50.00	7.31	69.288	0.350	0.0	0.0	0.0	0.96	106.3	47.4
S8.002	50.00	7.54	69.109	0.350	0.0	0.0	0.0	0.93	102.4	47.4
S9.000	50.00	5.92	69.800	0.379	0.0	0.0	0.0	0.93	102.7	51.3
S9.001	50.00	6.12	69.663	0.379	0.0	0.0	0.0	0.93	102.7	51.3
S8.003	50.00	8.80	69.000	0.900	0.0	0.0	0.0	1.01	160.6	121.9
S10.000	50.00	6.10	69.322	0.266	0.0	0.0	0.0	0.95	151.4	36.0
S10.001	50.00	7.50	69.182	0.475	0.0	0.0	0.0	0.95	151.4	64.3
S8.004	50.00	9.81	68.660	1.586	0.0	0.0	0.0	1.10	312.4	214.8
S8.005	50.00	9.94	68.520	1.586	0.0	0.0	0.0	1.16	327.7	214.8
S8.006	50.00	11.24	68.450	1.586	0.0	0.0	0.0	0.91	256.6	214.8
S11.000	50.00	5.63	69.684	0.048	0.0	0.0	0.0	0.81	57.1	6.6
S11.001	50.00	6.92	69.527	0.272	0.0	0.0	0.0	0.93	102.6	36.9
S11.002	50.00	8.04	69.261	0.544	0.0	0.0	0.0	0.95	151.2	73.7
S11.003	50.00	8.21	69.119	0.544	0.0	0.0	0.0	0.95	150.8	73.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S12.000	32.276	0.108	298.9	0.104	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S12.001	10.407	0.035	297.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S11.004	31.398	0.070	448.5	0.087	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S13.000	83.500	0.167	500.0	0.519	5.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S13.001	83.500	0.167	500.0	0.358	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S11.005	73.956	0.123	600.0	0.220	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S14.000	74.921	0.200	374.6	0.208	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S14.001	74.921	0.200	374.6	0.217	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S11.006	14.850	0.025	594.0	0.059	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S15.000	55.222	0.158	350.0	0.167	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S15.001	64.122	0.183	350.4	0.188	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S15.002	60.444	0.173	350.0	0.042	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S11.007	44.617	0.059	756.2	0.116	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒
S11.008	8.824	0.021	420.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S12.000	50.00	5.59	69.400	0.104	0.0	0.0	0.0	0.90	63.9	14.0
S12.001	50.00	5.79	69.292	0.104	0.0	0.0	0.0	0.91	64.1	14.0
S11.004	50.00	8.76	69.098	0.735	0.0	0.0	0.0	0.95	151.6	99.5
S13.000	50.00	6.40	69.295	0.519	0.0	0.0	0.0	0.99	215.4	70.2
S13.001	50.00	7.80	69.128	0.877	0.0	0.0	0.0	0.99	215.4	118.8
S11.005	50.00	10.01	68.878	1.832	0.0	0.0	0.0	0.99	279.0	248.1
S14.000	50.00	6.34	69.380	0.208	0.0	0.0	0.0	0.93	102.7	28.1
S14.001	50.00	7.68	69.180	0.425	0.0	0.0	0.0	0.93	102.7	57.5
S11.006	50.00	10.26	68.755	2.316	0.0	0.0	0.0	0.99	280.4«	313.6
S15.000	50.00	5.96	69.470	0.167	0.0	0.0	0.0	0.96	106.3	22.6
S15.001	50.00	7.07	69.312	0.354	0.0	0.0	0.0	0.96	106.3	48.0
S15.002	50.00	8.11	69.129	0.397	0.0	0.0	0.0	0.96	106.3	53.7
S11.007	50.00	10.99	68.580	2.829	0.0	0.0	0.0	1.01	446.1	383.1
S11.008	50.00	11.10	68.521	2.829	0.0	0.0	0.0	1.36	600.3	383.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.009	48.419	0.100	484.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒
S3.008	70.492	0.050	1409.8	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.009	50.00	11.74	68.450	2.829	0.0	0.0	0.0	1.26	558.9	383.1
S3.008	50.00	15.73	68.350	6.888	0.0	0.0	0.0	0.74	325.3«	932.8

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Back
SWMH-20.1	70.800	1.355	Open Manhole	1200	S3.000	69.445	300				
SWMH-20.2	70.750	1.477	Open Manhole	1200	S3.001	69.273	300	S3.000	69.273	300	
SWMH-21.1	71.397	1.697	Open Manhole	1200	S4.000	69.700	300				
SWMH-22.1	71.720	1.970	Open Manhole	1200	S5.000	69.750	300				
SWMH-21.2	71.567	1.935	Open Manhole	1200	S4.001	69.632	300	S4.000	69.634	300	
								S5.000	69.632	300	
SWMH-21.3	71.143	1.602	Open Manhole	1200	S4.002	69.541	300	S4.001	69.541	300	
SWMH-20.3	70.850	1.811	Open Manhole	1350	S3.002	69.039	450	S3.001	69.189	300	
								S4.002	69.341	300	
SWMH-20.4	70.645	1.662	Open Manhole	1350	S3.003	68.983	450	S3.002	68.983	450	
SWMH-20.5	70.645	1.845	Open Manhole	1350	S3.004	68.800	450	S3.003	68.800	450	
SWMH-20.6	70.645	2.040	Open Manhole	1350	S3.005	68.605	450	S3.004	68.605	450	
SWMH-20.7	70.645	2.125	Open Manhole	1350	S3.006	68.520	450	S3.005	68.520	450	
SWMH-20.8	70.806	2.356	Open Manhole	1350	S3.007	68.450	450	S3.006	68.500	450	
SWMH-10.1	70.778	1.511	Open Manhole	1350	S6.000	69.267	450				
SWMH-10.2	71.138	2.042	Open Manhole	1350	S6.001	69.096	450	S6.000	69.096	450	
SWMH-10.3	70.725	1.667	Open Manhole	1350	S6.002	69.058	450	S6.001	69.058	450	
SWMH-10.4	70.600	1.641	Open Manhole	1350	S6.003	68.959	450	S6.002	68.959	450	
SWMH-10.5	70.550	1.776	Open Manhole	1500	S6.004	68.774	525	S6.003	68.849	450	
SWMH-10.6	70.525	1.900	Open Manhole	1500	S6.005	68.652	525	S6.004	68.625	525	
SWMH-11.1	70.630	1.705	Open Manhole	1350	S7.000	68.925	375				
SWMH-10.7	70.200	1.672	Open Manhole	1500	S6.006	68.528	525	S6.005	68.528	525	
								S7.000	68.814	375	
SWMH-10.8	70.692	2.242	Open Manhole	1500	S6.007	68.450	525	S6.006	68.500	525	
SWMH-30.1	71.234	1.649	Open Manhole	1200	S8.000	69.585	300				
SWMH-30.2	71.156	1.868	Open Manhole	1350	S8.001	69.288	375	S8.000	69.363	300	
SWMH-30.3	71.151	2.042	Open Manhole	1350	S8.002	69.109	375	S8.001	69.109	375	
SWMH-31.1	70.850	1.050	Open Manhole	1350	S9.000	69.800	375				
SWMH-31.2	71.003	1.339	Open Manhole	1350	S9.001	69.663	375	S9.000	69.663	375	
SWMH-30.4	71.026	2.026	Open Manhole	1350	S8.003	69.000	450	S8.002	69.075	375	
								S9.001	69.633	375	
SWMH-32.1	70.939	1.617	Open Manhole	1350	S10.000	69.322	450				
SWMH-32.2	70.950	1.768	Open Manhole	1350	S10.001	69.182	450	S10.000	69.182	450	
SWMH-30.5	71.091	2.431	Open Manhole	1500	S8.004	68.660	600	S8.003	68.810	450	
								S10.001	69.005	450	
SWMH-30.6	70.443	1.923	Open Manhole	1500	S8.005	68.520	600	S8.004	68.520	600	
SWMH-30.7	70.200	1.750	Open Manhole	1500	S8.006	68.450	600	S8.005	68.500	600	
SWMH-40.1	71.060	1.376	Open Manhole	1200	S11.000	69.684	300				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)
SWMH-40.2	71.035	1.508	Open Manhole	1350	S11.001	69.527	375	S11.000	69.602	300
SWMH-40.3	70.575	1.314	Open Manhole	1350	S11.002	69.261	450	S11.001	69.336	375
SWMH-40.4	71.175	2.056	Open Manhole	1350	S11.003	69.119	450	S11.002	69.119	450
SWMH-44.1	70.593	1.193	Open Manhole	1200	S12.000	69.400	300			
SWMH-44.2	70.931	1.639	Open Manhole	1200	S12.001	69.292	300	S12.000	69.292	300
SWMH-40.5	71.270	2.172	Open Manhole	1350	S11.004	69.098	450	S11.003	69.098	450
								S12.001	69.257	300
SWMH-41.1	70.890	1.595	Open Manhole	1500	S13.000	69.295	525			
SWMH-41.2	70.831	1.703	Open Manhole	1500	S13.001	69.128	525	S13.000	69.128	525
SWMH-40.6	70.940	2.062	Open Manhole	1500	S11.005	68.878	600	S11.004	69.028	450
								S13.001	68.961	525
SWMH-42.1	70.950	1.570	Open Manhole	1350	S14.000	69.380	375			
SWMH-42.2	70.950	1.770	Open Manhole	1350	S14.001	69.180	375	S14.000	69.180	375
SWMH-40.7	70.800	2.045	Open Manhole	1500	S11.006	68.755	600	S11.005	68.755	600
								S14.001	68.980	375
SWMH-43.1	70.595	1.125	Open Manhole	1350	S15.000	69.470	375			
SWMH-43.2	70.440	1.128	Open Manhole	1350	S15.001	69.312	375	S15.000	69.312	375
SWMH-43.3	70.370	1.241	Open Manhole	1350	S15.002	69.129	375	S15.001	69.129	375
SWMH-40.8	70.840	2.260	Open Manhole	1800	S11.007	68.580	750	S11.006	68.730	600
								S15.002	68.957	375
SWMH-40.9	70.340	1.819	Open Manhole	1800	S11.008	68.521	750	S11.007	68.521	750
SWMH-40.10	70.200	1.750	Open Manhole	1800	S11.009	68.450	750	S11.008	68.500	750
SWMH-OUTFALL	70.000	1.650	Open Manhole	1800	S3.008	68.350	750	S3.007	68.350	450
								S6.007	68.350	525
								S8.006	68.350	600
								S11.009	68.350	750
SWMH-	69.957	1.657	Open Manhole	0		OUTFALL		S3.008	68.300	750

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)
S3.000	o	300	SWMH-20.1	70.800	69.445	1.055	Open Manhole	1200
S3.001	o	300	SWMH-20.2	70.750	69.273	1.177	Open Manhole	1200
S4.000	o	300	SWMH-21.1	71.397	69.700	1.397	Open Manhole	1200
S5.000	o	300	SWMH-22.1	71.720	69.750	1.670	Open Manhole	1200
S4.001	o	300	SWMH-21.2	71.567	69.632	1.635	Open Manhole	1200
S4.002	o	300	SWMH-21.3	71.143	69.541	1.302	Open Manhole	1200
S3.002	o	450	SWMH-20.3	70.850	69.039	1.361	Open Manhole	1350
S3.003	o	450	SWMH-20.4	70.645	68.983	1.212	Open Manhole	1350
S3.004	o	450	SWMH-20.5	70.645	68.800	1.395	Open Manhole	1350
S3.005	o	450	SWMH-20.6	70.645	68.605	1.590	Open Manhole	1350
S3.006	o	450	SWMH-20.7	70.645	68.520	1.675	Open Manhole	1350
S3.007	o	450	SWMH-20.8	70.806	68.450	1.906	Open Manhole	1350
S6.000	o	450	SWMH-10.1	70.778	69.267	1.061	Open Manhole	1350
S6.001	o	450	SWMH-10.2	71.138	69.096	1.592	Open Manhole	1350
S6.002	o	450	SWMH-10.3	70.725	69.058	1.217	Open Manhole	1350
S6.003	o	450	SWMH-10.4	70.600	68.959	1.191	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)
S3.000	51.577	300.0	SWMH-20.2	70.750	69.273	1.177	Open Manhole	1200
S3.001	25.093	300.0	SWMH-20.3	70.850	69.189	1.361	Open Manhole	1350
S4.000	19.881	300.0	SWMH-21.2	71.567	69.634	1.633	Open Manhole	1200
S5.000	35.356	300.0	SWMH-21.2	71.567	69.632	1.635	Open Manhole	1200
S4.001	27.383	300.9	SWMH-21.3	71.143	69.541	1.302	Open Manhole	1200
S4.002	60.062	300.3	SWMH-20.3	70.850	69.341	1.209	Open Manhole	1350
S3.002	25.151	449.1	SWMH-20.4	70.645	68.983	1.212	Open Manhole	1350
S3.003	82.492	450.0	SWMH-20.5	70.645	68.800	1.395	Open Manhole	1350
S3.004	87.889	450.0	SWMH-20.6	70.645	68.605	1.590	Open Manhole	1350
S3.005	38.209	450.0	SWMH-20.7	70.645	68.520	1.675	Open Manhole	1350
S3.006	9.872	493.6	SWMH-20.8	70.806	68.500	1.856	Open Manhole	1350
S3.007	16.960	169.6	SWMH-OUTFALL	70.000	68.350	1.200	Open Manhole	1800
S6.000	76.899	450.0	SWMH-10.2	71.138	69.096	1.592	Open Manhole	1350
S6.001	17.089	450.0	SWMH-10.3	70.725	69.058	1.217	Open Manhole	1350
S6.002	44.455	450.0	SWMH-10.4	70.600	68.959	1.191	Open Manhole	1350
S6.003	49.696	450.0	SWMH-10.5	70.550	68.849	1.251	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)**
S6.004	o	525	SWMH-10.5	70.550	68.774	1.251	Open Manhole	1500
S6.005	o	525	SWMH-10.6	70.525	68.652	1.348	Open Manhole	1500
S7.000	o	375	SWMH-11.1	70.630	68.925	1.330	Open Manhole	1350
S6.006	o	525	SWMH-10.7	70.200	68.528	1.147	Open Manhole	1500
S6.007	o	525	SWMH-10.8	70.692	68.450	1.717	Open Manhole	1500
S8.000	o	300	SWMH-30.1	71.234	69.585	1.349	Open Manhole	1200
S8.001	o	375	SWMH-30.2	71.156	69.288	1.493	Open Manhole	1350
S8.002	o	375	SWMH-30.3	71.151	69.109	1.667	Open Manhole	1350
S9.000	o	375	SWMH-31.1	70.850	69.800	0.675	Open Manhole	1350
S9.001	o	375	SWMH-31.2	71.003	69.663	0.964	Open Manhole	1350
S8.003	o	450	SWMH-30.4	71.026	69.000	1.576	Open Manhole	1350
S10.000	o	450	SWMH-32.1	70.939	69.322	1.167	Open Manhole	1350
S10.001	o	450	SWMH-32.2	70.950	69.182	1.318	Open Manhole	1350
S8.004	o	600	SWMH-30.5	71.091	68.660	1.831	Open Manhole	1500

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)**
S6.004	66.906	450.0	SWMH-10.6	70.525	68.625	1.375	Open Manhole	1500
S6.005	62.002	500.0	SWMH-10.7	70.200	68.528	1.147	Open Manhole	1500
S7.000	41.629	375.0	SWMH-10.7	70.200	68.814	1.011	Open Manhole	1500
S6.006	14.829	529.6	SWMH-10.8	70.692	68.500	1.667	Open Manhole	1500
S6.007	128.614	1286.1	SWMH-OUTFALL	70.000	68.350	1.125	Open Manhole	1800
S8.000	66.564	299.8	SWMH-30.2	71.156	69.363	1.493	Open Manhole	1350
S8.001	62.672	350.1	SWMH-30.3	71.151	69.109	1.667	Open Manhole	1350
S8.002	12.828	377.3	SWMH-30.4	71.026	69.075	1.576	Open Manhole	1350
S9.000	51.225	375.0	SWMH-31.2	71.003	69.663	0.964	Open Manhole	1350
S9.001	11.430	375.0	SWMH-30.4	71.026	69.633	1.018	Open Manhole	1350
S8.003	76.069	400.4	SWMH-30.5	71.091	68.810	1.831	Open Manhole	1500
S10.000	63.020	450.0	SWMH-32.2	70.950	69.182	1.318	Open Manhole	1350
S10.001	79.775	450.0	SWMH-30.5	71.091	69.005	1.636	Open Manhole	1500
S8.004	67.190	479.9	SWMH-30.6	70.443	68.520	1.323	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)
S8.005	o	600	SWMH-30.6	70.443	68.520	1.323	Open Manhole	1500
S8.006	o	600	SWMH-30.7	70.200	68.450	1.150	Open Manhole	1500
S11.000	o	300	SWMH-40.1	71.060	69.684	1.076	Open Manhole	1200
S11.001	o	375	SWMH-40.2	71.035	69.527	1.133	Open Manhole	1350
S11.002	o	450	SWMH-40.3	70.575	69.261	0.864	Open Manhole	1350
S11.003	o	450	SWMH-40.4	71.175	69.119	1.606	Open Manhole	1350
S12.000	o	300	SWMH-44.1	70.593	69.400	0.893	Open Manhole	1200
S12.001	o	300	SWMH-44.2	70.931	69.292	1.339	Open Manhole	1200
S11.004	o	450	SWMH-40.5	71.270	69.098	1.722	Open Manhole	1350
S13.000	o	525	SWMH-41.1	70.890	69.295	1.070	Open Manhole	1500
S13.001	o	525	SWMH-41.2	70.831	69.128	1.178	Open Manhole	1500
S11.005	o	600	SWMH-40.6	70.940	68.878	1.462	Open Manhole	1500
S14.000	o	375	SWMH-42.1	70.950	69.380	1.195	Open Manhole	1350
S14.001	o	375	SWMH-42.2	70.950	69.180	1.395	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)
S8.005	8.730	436.5	SWMH-30.7	70.200	68.500	1.100	Open Manhole	1500
S8.006	70.784	707.8	SWMH-OUTFALL	70.000	68.350	1.050	Open Manhole	1800
S11.000	30.634	373.6	SWMH-40.2	71.035	69.602	1.133	Open Manhole	1350
S11.001	71.701	375.4	SWMH-40.3	70.575	69.336	0.864	Open Manhole	1350
S11.002	64.030	450.9	SWMH-40.4	71.175	69.119	1.606	Open Manhole	1350
S11.003	9.527	453.7	SWMH-40.5	71.270	69.098	1.722	Open Manhole	1350
S12.000	32.276	298.9	SWMH-44.2	70.931	69.292	1.339	Open Manhole	1200
S12.001	10.407	297.3	SWMH-40.5	71.270	69.257	1.713	Open Manhole	1350
S11.004	31.398	448.5	SWMH-40.6	70.940	69.028	1.462	Open Manhole	1500
S13.000	83.500	500.0	SWMH-41.2	70.831	69.128	1.178	Open Manhole	1500
S13.001	83.500	500.0	SWMH-40.6	70.940	68.961	1.454	Open Manhole	1500
S11.005	73.956	600.0	SWMH-40.7	70.800	68.755	1.445	Open Manhole	1500
S14.000	74.921	374.6	SWMH-42.2	70.950	69.180	1.395	Open Manhole	1350
S14.001	74.921	374.6	SWMH-40.7	70.800	68.980	1.445	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)
S11.006	o	600	SWMH-40.7	70.800	68.755	1.445	Open Manhole	1500
S15.000	o	375	SWMH-43.1	70.595	69.470	0.750	Open Manhole	1350
S15.001	o	375	SWMH-43.2	70.440	69.312	0.753	Open Manhole	1350
S15.002	o	375	SWMH-43.3	70.370	69.129	0.866	Open Manhole	1350
S11.007	o	750	SWMH-40.8	70.840	68.580	1.510	Open Manhole	1800
S11.008	o	750	SWMH-40.9	70.340	68.521	1.069	Open Manhole	1800
S11.009	o	750	SWMH-40.10	70.200	68.450	1.000	Open Manhole	1800
S3.008	o	750	SWMH-OUTFALL	70.000	68.350	0.900	Open Manhole	1800

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)
S11.006	14.850	594.0	SWMH-40.8	70.840	68.730	1.510	Open Manhole	1800
S15.000	55.222	350.0	SWMH-43.2	70.440	69.312	0.753	Open Manhole	1350
S15.001	64.122	350.4	SWMH-43.3	70.370	69.129	0.866	Open Manhole	1350
S15.002	60.444	350.0	SWMH-40.8	70.840	68.957	1.508	Open Manhole	1800
S11.007	44.617	756.2	SWMH-40.9	70.340	68.521	1.069	Open Manhole	1800
S11.008	8.824	420.2	SWMH-40.10	70.200	68.500	0.950	Open Manhole	1800
S11.009	48.419	484.2	SWMH-OUTFALL	70.000	68.350	0.900	Open Manhole	1800
S3.008	70.492	1409.8	SWMH-	69.957	68.300	0.907	Open Manhole	0

Area Summary for Storm

Pipe Number	**PIMP Type**	**PIMP Name**	**PIMP (%)**	**Gross Area (ha)**	**Imp. Area (ha)**	**Pipe Total (ha)**
3.000	Classification	Gravel	75	0.187	0.140	0.140
	Classification	Roof	100	0.048	0.048	0.188
	Classification	Road	100	0.088	0.088	0.276
3.001	Classification	Road	100	0.051	0.051	0.051
4.000	Classification	Road	100	0.032	0.032	0.032
5.000	Classification	Gravel	75	0.123	0.092	0.092
	Classification	Grass	30	0.076	0.023	0.115
4.001	Classification	Road	100	0.018	0.018	0.018
	Classification	Road	100	0.027	0.027	0.045
4.002	Classification	Road	100	0.124	0.124	0.124
3.002	Classification	Road	100	0.083	0.083	0.083
3.003	Classification	Road	100	0.152	0.152	0.152
3.004	Classification	Road	100	0.099	0.099	0.099
3.005	Classification	Road	100	0.065	0.065	0.065
3.006	-	-	100	0.000	0.000	0.000
3.007	-	-	100	0.000	0.000	0.000
6.000	Classification	Grass	30	0.273	0.082	0.082
	Classification	Road	100	0.127	0.127	0.209
	Classification	Gravel	75	0.078	0.058	0.267
	Classification	Roof	100	0.254	0.254	0.521
6.001	Classification	Grass	30	0.127	0.038	0.038
	Classification	Gravel	75	0.041	0.031	0.069
6.002	Classification	Gravel	75	0.045	0.034	0.034
	Classification	Road	100	0.084	0.084	0.119
	Classification	Grass	30	0.073	0.022	0.141
	Classification	Roof	100	0.069	0.069	0.210
6.003	Classification	Road	100	0.100	0.100	0.100
	Classification	Roof	100	0.072	0.072	0.172
6.004	Classification	Road	100	0.122	0.122	0.122
	Classification	Gravel	75	0.045	0.034	0.156
6.005	Classification	Gravel	75	0.121	0.091	0.091
	Classification	Road	100	0.052	0.052	0.143
7.000	Classification	Road	100	0.063	0.063	0.063
	Classification	Gravel	75	0.132	0.099	0.162
6.006	-	-	100	0.000	0.000	0.000
6.007	-	-	100	0.000	0.000	0.000
8.000	Classification	Grass	30	0.209	0.063	0.063
	Classification	Road	100	0.073	0.073	0.136
8.001	Classification	Grass	30	0.199	0.060	0.060
	Classification	Road	100	0.065	0.065	0.125
	Classification	Road	100	0.090	0.090	0.215
8.002	-	-	100	0.000	0.000	0.000
9.000	Classification	Grass	30	0.174	0.052	0.052
	Classification	Road	100	0.066	0.066	0.119
	Classification	Gravel	75	0.083	0.062	0.181
	Classification	Roof	100	0.198	0.198	0.379
9.001	-	-	100	0.000	0.000	0.000
8.003	Classification	Gravel	75	0.096	0.072	0.072
	Classification	Road	100	0.099	0.099	0.171
10.000	Classification	Roof	100	0.266	0.266	0.266
10.001	Classification	Roof	100	0.209	0.209	0.209

Area Summary for Storm

Pipe Number	**PIMP Type**	**PIMP Name**	**PIMP (%)**	**Gross Area (ha)**	**Imp. Area (ha)**	**Pipe Total (ha)**
8.004	Classification	Road	100	0.211	0.211	0.211
8.005	-	-	100	0.000	0.000	0.000
8.006	-	-	100	0.000	0.000	0.000
11.000	Classification	Road	100	0.036	0.036	0.036
	Classification	Grass	30	0.042	0.012	0.048
11.001	Classification	Road	100	0.040	0.040	0.040
	Classification	Grass	30	0.179	0.054	0.094
	Classification	Gravel	75	0.173	0.130	0.224
11.002	Classification	Grass	30	0.268	0.080	0.080
	Classification	Road	100	0.047	0.047	0.128
	Classification	Gravel	75	0.192	0.144	0.272
11.003	-	-	100	0.000	0.000	0.000
12.000	Classification	Grass	30	0.207	0.062	0.062
	Classification	Road	100	0.041	0.041	0.104
12.001	-	-	100	0.000	0.000	0.000
11.004	Classification	Road	100	0.034	0.034	0.034
	Classification	Gravel	75	0.071	0.053	0.087
13.000	Classification	Gravel	75	0.166	0.124	0.124
	Classification	Road	100	0.069	0.069	0.193
	Classification	Gravel	75	0.114	0.085	0.278
	Classification	Roof	100	0.240	0.240	0.519
13.001	Classification	Gravel	75	0.098	0.074	0.074
	Classification	Road	100	0.065	0.065	0.139
	Classification	Roof	100	0.219	0.219	0.358
11.005	Classification	Road	100	0.090	0.090	0.090
	Classification	Gravel	75	0.172	0.129	0.220
14.000	Classification	Roof	100	0.208	0.208	0.208
14.001	Classification	Roof	100	0.217	0.217	0.217
11.006	Classification	Road	100	0.038	0.038	0.038
	Classification	Gravel	75	0.028	0.021	0.059
15.000	Classification	Gravel	75	0.148	0.111	0.111
	Classification	Road	100	0.055	0.055	0.167
15.001	Classification	Gravel	75	0.163	0.123	0.123
	Classification	Road	100	0.065	0.065	0.188
15.002	Classification	Road	100	0.042	0.042	0.042
11.007	Classification	Road	100	0.116	0.116	0.116
11.008	-	-	100	0.000	0.000	0.000
11.009	-	-	100	0.000	0.000	0.000
3.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				8.736	6.888	6.888

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S3.000	SWMH-20.1	300	1.055	1.177	Unclassified	1200	0	1.055	Unclassified
S3.001	SWMH-20.2	300	1.177	1.361	Unclassified	1200	0	1.177	Unclassified
S4.000	SWMH-21.1	300	1.397	1.633	Unclassified	1200	0	1.397	Unclassified
S5.000	SWMH-22.1	300	1.635	1.670	Unclassified	1200	0	1.670	Unclassified
S4.001	SWMH-21.2	300	1.302	1.635	Unclassified	1200	0	1.635	Unclassified
S4.002	SWMH-21.3	300	1.209	1.302	Unclassified	1200	0	1.302	Unclassified
S3.002	SWMH-20.3	450	1.212	1.361	Unclassified	1350	0	1.361	Unclassified
S3.003	SWMH-20.4	450	1.212	1.395	Unclassified	1350	0	1.212	Unclassified
S3.004	SWMH-20.5	450	1.395	1.590	Unclassified	1350	0	1.395	Unclassified
S3.005	SWMH-20.6	450	1.590	1.686	Unclassified	1350	0	1.590	Unclassified
S3.006	SWMH-20.7	450	1.675	1.856	Unclassified	1350	0	1.675	Unclassified
S3.007	SWMH-20.8	450	1.200	1.990	Unclassified	1350	0	1.906	Unclassified
S6.000	SWMH-10.1	450	1.061	1.592	Unclassified	1350	0	1.061	Unclassified
S6.001	SWMH-10.2	450	1.217	1.592	Unclassified	1350	0	1.592	Unclassified
S6.002	SWMH-10.3	450	1.191	1.445	Unclassified	1350	0	1.217	Unclassified
S6.003	SWMH-10.4	450	1.191	1.441	Unclassified	1350	0	1.191	Unclassified
S6.004	SWMH-10.5	525	1.251	1.548	Unclassified	1500	0	1.251	Unclassified
S6.005	SWMH-10.6	525	1.147	1.461	Unclassified	1500	0	1.348	Unclassified
S7.000	SWMH-11.1	375	1.011	1.330	Unclassified	1350	0	1.330	Unclassified
S6.006	SWMH-10.7	525	1.147	1.667	Unclassified	1500	0	1.147	Unclassified
S6.007	SWMH-10.8	525	1.125	1.906	Unclassified	1500	0	1.717	Unclassified
S8.000	SWMH-30.1	300	1.193	1.493	Unclassified	1200	0	1.349	Unclassified
S8.001	SWMH-30.2	375	1.400	1.667	Unclassified	1350	0	1.493	Unclassified
S8.002	SWMH-30.3	375	1.522	1.667	Unclassified	1350	0	1.667	Unclassified
S9.000	SWMH-31.1	375	0.675	0.964	Unclassified	1350	0	0.675	Unclassified
S9.001	SWMH-31.2	375	0.962	1.018	Unclassified	1350	0	0.964	Unclassified
S8.003	SWMH-30.4	450	1.576	1.831	Unclassified	1350	0	1.576	Unclassified
S10.000	SWMH-32.1	450	1.167	1.318	Unclassified	1350	0	1.167	Unclassified
S10.001	SWMH-32.2	450	1.318	1.636	Unclassified	1350	0	1.318	Unclassified
S8.004	SWMH-30.5	600	1.323	1.838	Unclassified	1500	0	1.831	Unclassified
S8.005	SWMH-30.6	600	1.100	1.939	Unclassified	1500	0	1.323	Unclassified
S8.006	SWMH-30.7	600	1.050	1.960	Unclassified	1500	0	1.150	Unclassified
S11.000	SWMH-40.1	300	1.076	1.133	Unclassified	1200	0	1.076	Unclassified
S11.001	SWMH-40.2	375	0.864	1.133	Unclassified	1350	0	1.133	Unclassified
S11.002	SWMH-40.3	450	0.864	1.606	Unclassified	1350	0	0.864	Unclassified
S11.003	SWMH-40.4	450	0.970	1.722	Unclassified	1350	0	1.606	Unclassified
S12.000	SWMH-44.1	300	0.893	1.339	Unclassified	1200	0	0.893	Unclassified
S12.001	SWMH-44.2	300	0.966	1.713	Unclassified	1200	0	1.339	Unclassified
S11.004	SWMH-40.5	450	1.187	1.722	Unclassified	1350	0	1.722	Unclassified
S13.000	SWMH-41.1	525	1.042	1.178	Unclassified	1500	0	1.070	Unclassified
S13.001	SWMH-41.2	525	1.178	1.454	Unclassified	1500	0	1.178	Unclassified
S11.005	SWMH-40.6	600	0.987	1.462	Unclassified	1500	0	1.462	Unclassified
S14.000	SWMH-42.1	375	1.144	1.395	Unclassified	1350	0	1.195	Unclassified
S14.001	SWMH-42.2	375	1.234	1.458	Unclassified	1350	0	1.395	Unclassified
S11.006	SWMH-40.7	600	0.629	1.510	Unclassified	1500	0	1.445	Unclassified
S15.000	SWMH-43.1	375	0.750	0.843	Unclassified	1350	0	0.750	Unclassified
S15.001	SWMH-43.2	375	0.753	0.866	Unclassified	1350	0	0.753	Unclassified
S15.002	SWMH-43.3	375	0.693	1.508	Unclassified	1350	0	0.866	Unclassified
S11.007	SWMH-40.8	750	0.958	1.510	Unclassified	1800	0	1.510	Unclassified

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S11.008	SWMH-40.9	750	0.950	1.747	Unclassified	1800	0	1.069	Unclassified
S11.009	SWMH-40.10	750	0.900	1.784	Unclassified	1800	0	1.000	Unclassified
S3.008	SWMH-OUTFALL	750	0.746	0.907	Unclassified	1800	0	0.900	Unclassified

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)
S3.008	SWMH-	69.957	68.300	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m^3/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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.800	Storm Duration (mins)	30
Ratio R	0.323		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SWMH-OUTFALL, DS/PN: S3.008, Volume (m^3): 74.3

Unit Reference	MD-SHE-0216-2440-1000-2440
Design Head (m)	1.000
Design Flow (l/s)	24.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	216
Invert Level (m)	68.350
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	24.4
Flush-Flo™	0.359	24.3
Kick-Flo®	0.733	21.0
Mean Flow over Head Range	-	20.3

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)**
0.100	7.3	1.200	26.6	3.000	41.3	7.000	62.3
0.200	21.2	1.400	28.6	3.500	44.5	7.500	64.4
0.300	24.2	1.600	30.5	4.000	47.5	8.000	66.5
0.400	24.3	1.800	32.3	4.500	50.3	8.500	68.5
0.500	23.9	2.000	34.0	5.000	52.9	9.000	70.4
0.600	23.2	2.200	35.6	5.500	55.4	9.500	72.3
0.800	21.9	2.400	37.1	6.000	57.8		
1.000	24.4	2.600	38.6	6.500	60.1		

Storage Structures for Storm

Tank or Pond Manhole: SWMH-OUTFALL, DS/PN: S3.008

Invert Level (m) 68.350

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	6242.0	1.000	7593.0	1.650	8502.0

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
S3.000	SWMH-20.1	0.500
S3.001	SWMH-20.2	0.500
S4.000	SWMH-21.1	0.500
S5.000	SWMH-22.1	0.500
S4.001	SWMH-21.2	0.500
S4.002	SWMH-21.3	0.500
S3.002	SWMH-20.3	0.500
S3.003	SWMH-20.4	0.500
S3.004	SWMH-20.5	0.500
S3.005	SWMH-20.6	0.500
S3.006	SWMH-20.7	0.500
S3.007	SWMH-20.8	0.500
S6.000	SWMH-10.1	0.500
S6.001	SWMH-10.2	0.500
S6.002	SWMH-10.3	0.500
S6.003	SWMH-10.4	0.500
S6.004	SWMH-10.5	0.500
S6.005	SWMH-10.6	0.500
S7.000	SWMH-11.1	0.500
S6.006	SWMH-10.7	0.500
S6.007	SWMH-10.8	0.500
S8.000	SWMH-30.1	0.500
S8.001	SWMH-30.2	0.500
S8.002	SWMH-30.3	0.500
S9.000	SWMH-31.1	0.500
S9.001	SWMH-31.2	0.500
S8.003	SWMH-30.4	0.500
S10.000	SWMH-32.1	0.500
S10.001	SWMH-32.2	0.500
S8.004	SWMH-30.5	0.500
S8.005	SWMH-30.6	0.500
S8.006	SWMH-30.7	0.500
S11.000	SWMH-40.1	0.500
S11.001	SWMH-40.2	0.500
S11.002	SWMH-40.3	0.500
S11.003	SWMH-40.4	0.500
S12.000	SWMH-44.1	0.500
S12.001	SWMH-44.2	0.500
S11.004	SWMH-40.5	0.500
S13.000	SWMH-41.1	0.500
S13.001	SWMH-41.2	0.500
S11.005	SWMH-40.6	0.500
S14.000	SWMH-42.1	0.500
S14.001	SWMH-42.2	0.500
S11.006	SWMH-40.7	0.500
S15.000	SWMH-43.1	0.500
S15.001	SWMH-43.2	0.500
S15.002	SWMH-43.3	0.500
S11.007	SWMH-40.8	0.500
S11.008	SWMH-40.9	0.500
S11.009	SWMH-40.10	0.500

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
S3.008	SWMH-OUTFALL	0.500

5 year Return Period 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 2.000
         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 Storage Structures 1
   Number of Online Controls 1 Number of Time/Area Diagrams 0
  Number of Offline Controls 0 Number of Real Time Controls 0
```

Synthetic Rainfall Details

```
Rainfall Model                FSR     Ratio R 0.323
        Region Scotland and Ireland Cv (Summer) 0.750
 M5-60 (mm)                17.800 Cv (Winter) 0.840

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

               Profile(s)                         Summer and Winter
        Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
     Return Period(s) (years)                                5, 30, 100
         Climate Change (%)                                  10, 10, 10
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PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.000	SWMH-20.1	15 Winter	5	+10%	30/15 Summer			
S3.001	SWMH-20.2	15 Winter	5	+10%	30/15 Summer			
S4.000	SWMH-21.1	15 Winter	5	+10%	30/15 Summer			
S5.000	SWMH-22.1	15 Winter	5	+10%	30/15 Winter			
S4.001	SWMH-21.2	15 Winter	5	+10%	30/15 Summer			
S4.002	SWMH-21.3	15 Winter	5	+10%	30/15 Summer			
S3.002	SWMH-20.3	15 Winter	5	+10%	30/15 Summer			
S3.003	SWMH-20.4	15 Winter	5	+10%	30/15 Summer			
S3.004	SWMH-20.5	30 Winter	5	+10%	30/15 Summer			
S3.005	SWMH-20.6	15 Winter	5	+10%	30/15 Summer			
S3.006	SWMH-20.7	60 Summer	5	+10%	30/15 Summer			
S3.007	SWMH-20.8	30 Winter	5	+10%	100/15 Winter			
S6.000	SWMH-10.1	15 Winter	5	+10%	30/15 Summer			
S6.001	SWMH-10.2	15 Winter	5	+10%	30/15 Summer			
S6.002	SWMH-10.3	15 Winter	5	+10%	30/15 Summer			
S6.003	SWMH-10.4	15 Winter	5	+10%	30/15 Summer			
S6.004	SWMH-10.5	30 Winter	5	+10%	30/15 Summer			
S6.005	SWMH-10.6	30 Winter	5	+10%	30/15 Summer			
S7.000	SWMH-11.1	15 Winter	5	+10%	100/15 Summer			
S6.006	SWMH-10.7	15 Summer	5	+10%	30/15 Summer			
S6.007	SWMH-10.8	30 Winter	5	+10%	5/30 Winter			

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH-20.1	69.682	-0.063	0.000	0.92		55.4	OK	
S3.001	SWMH-20.2	69.560	-0.014	0.000	1.00		57.0	OK	
S4.000	SWMH-21.1	69.824	-0.176	0.000	0.12		6.4	OK	
S5.000	SWMH-22.1	69.885	-0.165	0.000	0.40		23.8	OK	
S4.001	SWMH-21.2	69.818	-0.114	0.000	0.62		35.8	OK	
S4.002	SWMH-21.3	69.766	-0.075	0.000	0.89		54.1	OK	
S3.002	SWMH-20.3	69.420	-0.070	0.000	0.95		121.4	OK	
S3.003	SWMH-20.4	69.343	-0.091	0.000	0.95		135.9	OK	
S3.004	SWMH-20.5	69.195	-0.056	0.000	0.84		120.1	OK	
S3.005	SWMH-20.6	69.055	0.000	0.000	0.92		123.0	OK	
S3.006	SWMH-20.7	68.970	0.000	0.000	1.35		105.9	OK	
S3.007	SWMH-20.8	68.726	-0.174	0.000	0.69		123.2	OK	
S6.000	SWMH-10.1	69.569	-0.148	0.000	0.70		100.0	OK	
S6.001	SWMH-10.2	69.478	-0.068	0.000	0.94		97.7	OK	
S6.002	SWMH-10.3	69.438	-0.071	0.000	0.91		123.8	OK	
S6.003	SWMH-10.4	69.370	-0.039	0.000	1.00		136.9	OK	
S6.004	SWMH-10.5	69.197	-0.101	0.000	0.68		141.0	OK	
S6.005	SWMH-10.6	69.128	-0.049	0.000	0.76		148.4	OK	
S7.000	SWMH-11.1	69.083	-0.217	0.000	0.37		34.4	OK	
S6.006	SWMH-10.7	69.053	0.000	0.000	1.02		117.1	OK	
S6.007	SWMH-10.8	69.003	0.028	0.000	1.03		149.4	SURCHARGED	

5 year Return Period 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
S8.000	SWMH-30.1	15 Winter	5	+10%	100/15 Summer		
S8.001	SWMH-30.2	15 Winter	5	+10%	30/15 Summer		
S8.002	SWMH-30.3	15 Winter	5	+10%	30/15 Summer		
S9.000	SWMH-31.1	15 Winter	5	+10%	30/15 Summer		
S9.001	SWMH-31.2	15 Winter	5	+10%	30/15 Summer		
S8.003	SWMH-30.4	15 Winter	5	+10%	30/15 Summer		
S10.000	SWMH-32.1	15 Winter	5	+10%			
S10.001	SWMH-32.2	15 Winter	5	+10%	100/15 Summer		
S8.004	SWMH-30.5	15 Winter	5	+10%	30/15 Summer		
S8.005	SWMH-30.6	15 Winter	5	+10%	30/15 Summer		
S8.006	SWMH-30.7	15 Winter	5	+10%	30/15 Summer		
S11.000	SWMH-40.1	15 Winter	5	+10%	100/15 Summer		
S11.001	SWMH-40.2	15 Winter	5	+10%	30/15 Winter		
S11.002	SWMH-40.3	15 Winter	5	+10%	30/15 Summer		
S11.003	SWMH-40.4	15 Winter	5	+10%	30/15 Summer		
S12.000	SWMH-44.1	15 Winter	5	+10%	30/15 Summer		
S12.001	SWMH-44.2	30 Winter	5	+10%	30/15 Summer		
S11.004	SWMH-40.5	15 Winter	5	+10%	30/15 Summer		
S13.000	SWMH-41.1	15 Winter	5	+10%	30/15 Winter		
S13.001	SWMH-41.2	15 Winter	5	+10%	30/15 Summer		
S11.005	SWMH-40.6	15 Winter	5	+10%	30/15 Summer		
S14.000	SWMH-42.1	15 Winter	5	+10%	100/15 Summer		
S14.001	SWMH-42.2	15 Winter	5	+10%	30/15 Summer		
S11.006	SWMH-40.7	60 Summer	5	+10%	30/15 Summer		
S15.000	SWMH-43.1	15 Winter	5	+10%	100/15 Winter		
S15.001	SWMH-43.2	15 Winter	5	+10%	100/15 Summer		
S15.002	SWMH-43.3	15 Winter	5	+10%	100/15 Summer		
S11.007	SWMH-40.8	30 Winter	5	+10%	30/15 Summer		
S11.008	SWMH-40.9	30 Winter	5	+10%	100/15 Summer		
S11.009	SWMH-40.10	30 Winter	5	+10%	100/15 Summer		
S3.008	SWMH-OUTFALL	1440 Winter	5	+10%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S8.000	SWMH-30.1		69.731	-0.154	0.000	0.44		26.7	OK
S8.001	SWMH-30.2		69.507	-0.156	0.000	0.61		61.2	OK
S8.002	SWMH-30.3		69.402	-0.082	0.000	0.85		60.1	OK
S9.000	SWMH-31.1		70.066	-0.109	0.000	0.80		75.9	OK
S9.001	SWMH-31.2		69.984	-0.054	0.000	1.00		69.7	OK
S8.003	SWMH-30.4		69.373	-0.077	0.000	0.97		145.3	OK
S10.000	SWMH-32.1		69.525	-0.247	0.000	0.37		52.3	OK
S10.001	SWMH-32.2		69.435	-0.197	0.000	0.59		83.5	OK
S8.004	SWMH-30.5		69.195	-0.065	0.000	0.77		218.1	OK
S8.005	SWMH-30.6		69.120	0.000	0.000	1.27		208.9	OK
S8.006	SWMH-30.7		68.894	-0.156	0.000	0.90		209.4	OK

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S11.000	SWMH-40.1		69.777	-0.207	0.000	0.19		10.0	OK
S11.001	SWMH-40.2		69.719	-0.183	0.000	0.48		46.9	OK
S11.002	SWMH-40.3		69.569	-0.142	0.000	0.59		82.5	OK
S11.003	SWMH-40.4		69.528	-0.041	0.000	0.84		70.9	OK
S12.000	SWMH-44.1		69.528	-0.172	0.000	0.37		21.5	OK
S12.001	SWMH-44.2		69.512	-0.080	0.000	0.31		15.8	OK
S11.004	SWMH-40.5		69.507	-0.041	0.000	0.68		89.4	OK
S13.000	SWMH-41.1		69.581	-0.239	0.000	0.49		98.0	OK
S13.001	SWMH-41.2		69.516	-0.137	0.000	0.65		129.6	OK
S11.005	SWMH-40.6		69.466	-0.012	0.000	0.83		211.8	OK
S14.000	SWMH-42.1		69.558	-0.197	0.000	0.41		40.2	OK
S14.001	SWMH-42.2		69.433	-0.122	0.000	0.71		68.8	OK
S11.006	SWMH-40.7		69.355	0.000	0.000	1.58		221.7	OK
S15.000	SWMH-43.1		69.625	-0.220	0.000	0.34		33.6	OK
S15.001	SWMH-43.2		69.533	-0.154	0.000	0.62		61.8	OK
S15.002	SWMH-43.3		69.355	-0.149	0.000	0.66		65.3	OK
S11.007	SWMH-40.8		69.224	-0.106	0.000	0.87		323.9	OK
S11.008	SWMH-40.9		69.111	-0.160	0.000	1.15		322.9	OK
S11.009	SWMH-40.10		68.908	-0.292	0.000	0.69		323.2	OK
S3.008	SWMH-OUTFALL		68.672	-0.428	0.000	0.07		24.0	OK

PN	US/MH Name	Level Exceeded
S8.000	SWMH-30.1	
S8.001	SWMH-30.2	
S8.002	SWMH-30.3	
S9.000	SWMH-31.1	
S9.001	SWMH-31.2	
S8.003	SWMH-30.4	
S10.000	SWMH-32.1	
S10.001	SWMH-32.2	
S8.004	SWMH-30.5	
S8.005	SWMH-30.6	
S8.006	SWMH-30.7	
S11.000	SWMH-40.1	
S11.001	SWMH-40.2	
S11.002	SWMH-40.3	
S11.003	SWMH-40.4	
S12.000	SWMH-44.1	
S12.001	SWMH-44.2	
S11.004	SWMH-40.5	
S13.000	SWMH-41.1	
S13.001	SWMH-41.2	
S11.005	SWMH-40.6	
S14.000	SWMH-42.1	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S14.001	SWMH-42.2	
S11.006	SWMH-40.7	
S15.000	SWMH-43.1	
S15.001	SWMH-43.2	
S15.002	SWMH-43.3	
S11.007	SWMH-40.8	
S11.008	SWMH-40.9	
S11.009	SWMH-40.10	
S3.008	SWMH-OUTFALL	

30 year Return Period 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	2.000
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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.323
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.800	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	5, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.000	SWMH-20.1	15 Winter	30	+10%	30/15 Summer			
S3.001	SWMH-20.2	15 Winter	30	+10%	30/15 Summer			
S4.000	SWMH-21.1	15 Winter	30	+10%	30/15 Summer			
S5.000	SWMH-22.1	15 Winter	30	+10%	30/15 Winter			
S4.001	SWMH-21.2	15 Winter	30	+10%	30/15 Summer			
S4.002	SWMH-21.3	15 Winter	30	+10%	30/15 Summer			
S3.002	SWMH-20.3	15 Winter	30	+10%	30/15 Summer			
S3.003	SWMH-20.4	15 Winter	30	+10%	30/15 Summer			
S3.004	SWMH-20.5	15 Winter	30	+10%	30/15 Summer			
S3.005	SWMH-20.6	30 Winter	30	+10%	30/15 Summer			
S3.006	SWMH-20.7	30 Winter	30	+10%	30/15 Summer			
S3.007	SWMH-20.8	1440 Winter	30	+10%	100/15 Winter			
S6.000	SWMH-10.1	15 Winter	30	+10%	30/15 Summer			
S6.001	SWMH-10.2	15 Winter	30	+10%	30/15 Summer			
S6.002	SWMH-10.3	15 Winter	30	+10%	30/15 Summer			
S6.003	SWMH-10.4	30 Winter	30	+10%	30/15 Summer			
S6.004	SWMH-10.5	30 Winter	30	+10%	30/15 Summer			
S6.005	SWMH-10.6	30 Winter	30	+10%	30/15 Summer			
S7.000	SWMH-11.1	30 Winter	30	+10%	100/15 Summer			
S6.006	SWMH-10.7	30 Winter	30	+10%	30/15 Summer			
S6.007	SWMH-10.8	30 Winter	30	+10%	5/30 Winter			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH-20.1	70.056	0.311	0.000	1.20		72.4	SURCHARGED	
S3.001	SWMH-20.2	69.829	0.256	0.000	1.44		81.9	SURCHARGED	
S4.000	SWMH-21.1	70.045	0.045	0.000	0.15		8.5	SURCHARGED	
S5.000	SWMH-22.1	70.078	0.028	0.000	0.55		32.3	SURCHARGED	
S4.001	SWMH-21.2	70.037	0.105	0.000	0.86		49.3	SURCHARGED	
S4.002	SWMH-21.3	69.974	0.133	0.000	1.21		73.7	SURCHARGED	
S3.002	SWMH-20.3	69.685	0.196	0.000	1.26		160.0	SURCHARGED	
S3.003	SWMH-20.4	69.612	0.179	0.000	1.21		172.8	SURCHARGED	
S3.004	SWMH-20.5	69.378	0.128	0.000	1.16		166.3	SURCHARGED	
S3.005	SWMH-20.6	69.117	0.063	0.000	1.25		167.4	SURCHARGED	
S3.006	SWMH-20.7	68.983	0.013	0.000	2.14		167.3	SURCHARGED	
S3.007	SWMH-20.8	68.805	-0.095	0.000	0.10		18.5	OK	
S6.000	SWMH-10.1	69.942	0.225	0.000	0.94		133.1	SURCHARGED	
S6.001	SWMH-10.2	69.820	0.274	0.000	1.41		145.8	SURCHARGED	
S6.002	SWMH-10.3	69.766	0.258	0.000	1.31		178.1	SURCHARGED	
S6.003	SWMH-10.4	69.646	0.237	0.000	1.32		181.9	SURCHARGED	
S6.004	SWMH-10.5	69.488	0.189	0.000	0.95		196.9	SURCHARGED	
S6.005	SWMH-10.6	69.362	0.185	0.000	1.06		208.2	SURCHARGED	
S7.000	SWMH-11.1	69.243	-0.057	0.000	0.42		39.1	OK	
S6.006	SWMH-10.7	69.228	0.175	0.000	1.96		226.2	SURCHARGED	
S6.007	SWMH-10.8	69.166	0.191	0.000	1.49		215.0	SURCHARGED	

30 year Return Period 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
S8.000	SWMH-30.1	15 Winter	30	+10%	100/15 Summer		
S8.001	SWMH-30.2	15 Winter	30	+10%	30/15 Summer		
S8.002	SWMH-30.3	15 Winter	30	+10%	30/15 Summer		
S9.000	SWMH-31.1	15 Winter	30	+10%	30/15 Summer		
S9.001	SWMH-31.2	15 Winter	30	+10%	30/15 Summer		
S8.003	SWMH-30.4	15 Winter	30	+10%	30/15 Summer		
S10.000	SWMH-32.1	15 Winter	30	+10%			
S10.001	SWMH-32.2	15 Winter	30	+10%	100/15 Summer		
S8.004	SWMH-30.5	15 Winter	30	+10%	30/15 Summer		
S8.005	SWMH-30.6	15 Winter	30	+10%	30/15 Summer		
S8.006	SWMH-30.7	15 Winter	30	+10%	30/15 Summer		
S11.000	SWMH-40.1	15 Winter	30	+10%	100/15 Summer		
S11.001	SWMH-40.2	15 Winter	30	+10%	30/15 Winter		
S11.002	SWMH-40.3	15 Winter	30	+10%	30/15 Summer		
S11.003	SWMH-40.4	15 Winter	30	+10%	30/15 Summer		
S12.000	SWMH-44.1	15 Winter	30	+10%	30/15 Summer		
S12.001	SWMH-44.2	15 Winter	30	+10%	30/15 Summer		
S11.004	SWMH-40.5	15 Winter	30	+10%	30/15 Summer		
S13.000	SWMH-41.1	15 Winter	30	+10%	30/15 Winter		
S13.001	SWMH-41.2	15 Winter	30	+10%	30/15 Summer		
S11.005	SWMH-40.6	15 Winter	30	+10%	30/15 Summer		
S14.000	SWMH-42.1	15 Winter	30	+10%	100/15 Summer		
S14.001	SWMH-42.2	30 Winter	30	+10%	30/15 Summer		
S11.006	SWMH-40.7	15 Winter	30	+10%	30/15 Summer		
S15.000	SWMH-43.1	15 Winter	30	+10%	100/15 Winter		
S15.001	SWMH-43.2	15 Winter	30	+10%	100/15 Summer		
S15.002	SWMH-43.3	15 Winter	30	+10%	100/15 Summer		
S11.007	SWMH-40.8	15 Winter	30	+10%	30/15 Summer		
S11.008	SWMH-40.9	30 Winter	30	+10%	100/15 Summer		
S11.009	SWMH-40.10	15 Winter	30	+10%	100/15 Summer		
S3.008	SWMH-OUTFALL	1440 Winter	30	+10%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S8.000	SWMH-30.1		69.868	-0.017	0.000	0.63		38.6	OK
S8.001	SWMH-30.2		69.807	0.144	0.000	0.82		81.5	SURCHARGED
S8.002	SWMH-30.3		69.708	0.224	0.000	1.09		77.0	SURCHARGED
S9.000	SWMH-31.1		70.242	0.067	0.000	1.13		108.0	SURCHARGED
S9.001	SWMH-31.2		70.054	0.016	0.000	1.54		107.2	SURCHARGED
S8.003	SWMH-30.4		69.673	0.223	0.000	1.33		200.5	SURCHARGED
S10.000	SWMH-32.1		69.602	-0.170	0.000	0.55		77.0	OK
S10.001	SWMH-32.2		69.530	-0.102	0.000	0.88		125.4	OK
S8.004	SWMH-30.5		69.333	0.073	0.000	1.12		316.6	SURCHARGED
S8.005	SWMH-30.6		69.155	0.035	0.000	1.93		316.1	SURCHARGED
S8.006	SWMH-30.7		69.104	0.054	0.000	1.35		315.0	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S11.000	SWMH-40.1		69.922	-0.062	0.000	0.28		14.5	OK
S11.001	SWMH-40.2		69.911	0.009	0.000	0.80		77.3	SURCHARGED
S11.002	SWMH-40.3		69.872	0.161	0.000	0.87		122.4	SURCHARGED
S11.003	SWMH-40.4		69.818	0.249	0.000	1.29		108.5	SURCHARGED
S12.000	SWMH-44.1		69.829	0.129	0.000	0.52		30.6	SURCHARGED
S12.001	SWMH-44.2		69.806	0.214	0.000	0.43		21.6	SURCHARGED
S11.004	SWMH-40.5		69.794	0.246	0.000	1.04		136.0	SURCHARGED
S13.000	SWMH-41.1		69.877	0.057	0.000	0.70		139.6	SURCHARGED
S13.001	SWMH-41.2		69.835	0.182	0.000	0.88		176.8	SURCHARGED
S11.005	SWMH-40.6		69.730	0.252	0.000	1.25		318.6	SURCHARGED
S14.000	SWMH-42.1		69.674	-0.081	0.000	0.59		57.6	OK
S14.001	SWMH-42.2		69.633	0.078	0.000	0.86		83.9	SURCHARGED
S11.006	SWMH-40.7		69.536	0.181	0.000	2.88		403.8	SURCHARGED
S15.000	SWMH-43.1		69.687	-0.158	0.000	0.49		48.9	OK
S15.001	SWMH-43.2		69.631	-0.056	0.000	0.96		96.4	OK
S15.002	SWMH-43.3		69.490	-0.014	0.000	0.91		90.2	OK
S11.007	SWMH-40.8		69.378	0.048	0.000	1.31		484.7	SURCHARGED
S11.008	SWMH-40.9		69.271	0.000	0.000	1.71		478.1	OK
S11.009	SWMH-40.10		69.199	-0.001	0.000	1.01		474.2	OK
S3.008	SWMH-OUTFALL		68.803	-0.297	0.000	0.07		24.2	OK

PN	US/MH Name	Level Exceeded
S8.000	SWMH-30.1	
S8.001	SWMH-30.2	
S8.002	SWMH-30.3	
S9.000	SWMH-31.1	
S9.001	SWMH-31.2	
S8.003	SWMH-30.4	
S10.000	SWMH-32.1	
S10.001	SWMH-32.2	
S8.004	SWMH-30.5	
S8.005	SWMH-30.6	
S8.006	SWMH-30.7	
S11.000	SWMH-40.1	
S11.001	SWMH-40.2	
S11.002	SWMH-40.3	
S11.003	SWMH-40.4	
S12.000	SWMH-44.1	
S12.001	SWMH-44.2	
S11.004	SWMH-40.5	
S13.000	SWMH-41.1	
S13.001	SWMH-41.2	
S11.005	SWMH-40.6	
S14.000	SWMH-42.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S14.001	SWMH-42.2	
S11.006	SWMH-40.7	
S15.000	SWMH-43.1	
S15.001	SWMH-43.2	
S15.002	SWMH-43.3	
S11.007	SWMH-40.8	
S11.008	SWMH-40.9	
S11.009	SWMH-40.10	
S3.008	SWMH-OUTFALL	

100 year Return Period 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 2.000
            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 Storage Structures 1
         Number of Online Controls 1 Number of Time/Area Diagrams 0
        Number of Offline Controls 0 Number of Real Time Controls 0
```

Synthetic Rainfall Details

```
     Rainfall Model                 FSR      Ratio R 0.323
             Region Scotland and Ireland Cv (Summer) 0.750
       M5-60 (mm)                 17.800 Cv (Winter) 0.840

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


                 Profile(s)                           Summer and Winter
           Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
        Return Period(s) (years)                               5, 30, 100
           Climate Change (%)                                  10, 10, 10
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.000	SWMH-20.1	15 Winter	100	+10%	30/15 Summer			
S3.001	SWMH-20.2	15 Winter	100	+10%	30/15 Summer			
S4.000	SWMH-21.1	15 Winter	100	+10%	30/15 Summer			
S5.000	SWMH-22.1	15 Winter	100	+10%	30/15 Winter			
S4.001	SWMH-21.2	15 Winter	100	+10%	30/15 Summer			
S4.002	SWMH-21.3	15 Winter	100	+10%	30/15 Summer			
S3.002	SWMH-20.3	15 Winter	100	+10%	30/15 Summer			
S3.003	SWMH-20.4	15 Winter	100	+10%	30/15 Summer			
S3.004	SWMH-20.5	30 Winter	100	+10%	30/15 Summer			
S3.005	SWMH-20.6	30 Winter	100	+10%	30/15 Summer			
S3.006	SWMH-20.7	30 Winter	100	+10%	30/15 Summer			
S3.007	SWMH-20.8	1440 Winter	100	+10%	100/15 Winter			
S6.000	SWMH-10.1	15 Winter	100	+10%	30/15 Summer			
S6.001	SWMH-10.2	15 Winter	100	+10%	30/15 Summer			
S6.002	SWMH-10.3	30 Winter	100	+10%	30/15 Summer			
S6.003	SWMH-10.4	30 Winter	100	+10%	30/15 Summer			
S6.004	SWMH-10.5	30 Winter	100	+10%	30/15 Summer			
S6.005	SWMH-10.6	30 Winter	100	+10%	30/15 Summer			
S7.000	SWMH-11.1	30 Winter	100	+10%	100/15 Summer			
S6.006	SWMH-10.7	30 Winter	100	+10%	30/15 Summer			
S6.007	SWMH-10.8	30 Winter	100	+10%	5/30 Winter			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH-20.1	70.662	0.917	0.000	1.41		84.9	FLOOD RISK	
S3.001	SWMH-20.2	70.396	0.823	0.000	1.66		94.8	SURCHARGED	
S4.000	SWMH-21.1	70.608	0.608	0.000	0.16		8.9	SURCHARGED	
S5.000	SWMH-22.1	70.642	0.592	0.000	0.63		37.0	SURCHARGED	
S4.001	SWMH-21.2	70.601	0.669	0.000	0.96		55.4	SURCHARGED	
S4.002	SWMH-21.3	70.532	0.691	0.000	1.44		87.0	SURCHARGED	
S3.002	SWMH-20.3	70.187	0.697	0.000	1.54		196.4	SURCHARGED	
S3.003	SWMH-20.4	70.068	0.634	0.000	1.49		212.6	SURCHARGED	
S3.004	SWMH-20.5	69.728	0.478	0.000	1.45		208.1	SURCHARGED	
S3.005	SWMH-20.6	69.305	0.250	0.000	1.60		214.9	SURCHARGED	
S3.006	SWMH-20.7	69.083	0.113	0.000	2.75		215.2	SURCHARGED	
S3.007	SWMH-20.8	68.924	0.024	0.000	0.13		22.6	SURCHARGED	
S6.000	SWMH-10.1	70.624	0.907	0.000	1.10		155.6	FLOOD RISK	
S6.001	SWMH-10.2	70.505	0.959	0.000	1.64		170.5	SURCHARGED	
S6.002	SWMH-10.3	70.455	0.947	0.000	1.40		189.9	FLOOD RISK	
S6.003	SWMH-10.4	70.283	0.874	0.000	1.62		222.1	SURCHARGED	
S6.004	SWMH-10.5	70.009	0.710	0.000	1.19		247.8	SURCHARGED	
S6.005	SWMH-10.6	69.801	0.624	0.000	1.37		268.9	SURCHARGED	
S7.000	SWMH-11.1	69.590	0.290	0.000	0.54		50.1	SURCHARGED	
S6.006	SWMH-10.7	69.565	0.512	0.000	2.61		301.2	SURCHARGED	
S6.007	SWMH-10.8	69.410	0.435	0.000	1.95		282.2	SURCHARGED	

100 year Return Period 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
S8.000	SWMH-30.1	15 Winter	100	+10%	100/15 Summer		
S8.001	SWMH-30.2	15 Winter	100	+10%	30/15 Summer		
S8.002	SWMH-30.3	15 Winter	100	+10%	30/15 Summer		
S9.000	SWMH-31.1	15 Winter	100	+10%	30/15 Summer		
S9.001	SWMH-31.2	15 Winter	100	+10%	30/15 Summer		
S8.003	SWMH-30.4	15 Winter	100	+10%	30/15 Summer		
S10.000	SWMH-32.1	15 Winter	100	+10%			
S10.001	SWMH-32.2	15 Winter	100	+10%	100/15 Summer		
S8.004	SWMH-30.5	15 Winter	100	+10%	30/15 Summer		
S8.005	SWMH-30.6	15 Winter	100	+10%	30/15 Summer		
S8.006	SWMH-30.7	15 Winter	100	+10%	30/15 Summer		
S11.000	SWMH-40.1	15 Winter	100	+10%	100/15 Summer		
S11.001	SWMH-40.2	15 Winter	100	+10%	30/15 Winter		
S11.002	SWMH-40.3	15 Winter	100	+10%	30/15 Summer		
S11.003	SWMH-40.4	15 Winter	100	+10%	30/15 Summer		
S12.000	SWMH-44.1	15 Winter	100	+10%	30/15 Summer		
S12.001	SWMH-44.2	15 Winter	100	+10%	30/15 Summer		
S11.004	SWMH-40.5	15 Winter	100	+10%	30/15 Summer		
S13.000	SWMH-41.1	15 Winter	100	+10%	30/15 Winter		
S13.001	SWMH-41.2	15 Winter	100	+10%	30/15 Summer		
S11.005	SWMH-40.6	15 Winter	100	+10%	30/15 Summer		
S14.000	SWMH-42.1	15 Winter	100	+10%	100/15 Summer		
S14.001	SWMH-42.2	15 Winter	100	+10%	30/15 Summer		
S11.006	SWMH-40.7	15 Winter	100	+10%	30/15 Summer		
S15.000	SWMH-43.1	15 Winter	100	+10%	100/15 Winter		
S15.001	SWMH-43.2	15 Winter	100	+10%	100/15 Summer		
S15.002	SWMH-43.3	15 Winter	100	+10%	100/15 Summer		
S11.007	SWMH-40.8	15 Winter	100	+10%	30/15 Summer		
S11.008	SWMH-40.9	15 Winter	100	+10%	100/15 Summer		
S11.009	SWMH-40.10	15 Winter	100	+10%	100/15 Summer		
S3.008	SWMH-OUTFALL	1440 Winter	100	+10%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S8.000	SWMH-30.1		70.395	0.510	0.000	0.69		41.9	SURCHARGED
S8.001	SWMH-30.2		70.297	0.634	0.000	1.01		100.8	SURCHARGED
S8.002	SWMH-30.3		70.138	0.654	0.000	1.39		98.8	SURCHARGED
S9.000	SWMH-31.1		70.435	0.260	0.000	1.45		137.6	SURCHARGED
S9.001	SWMH-31.2		70.195	0.157	0.000	1.91		133.5	SURCHARGED
S8.003	SWMH-30.4		70.096	0.646	0.000	1.70		255.8	SURCHARGED
S10.000	SWMH-32.1		69.755	-0.017	0.000	0.69		96.8	OK
S10.001	SWMH-32.2		69.686	0.054	0.000	1.07		152.6	SURCHARGED
S8.004	SWMH-30.5		69.638	0.378	0.000	1.39		391.2	SURCHARGED
S8.005	SWMH-30.6		69.356	0.236	0.000	2.37		388.7	SURCHARGED
S8.006	SWMH-30.7		69.203	0.153	0.000	1.66		387.6	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S11.000	SWMH-40.1		70.508	0.524	0.000	0.29		15.1	SURCHARGED
S11.001	SWMH-40.2		70.495	0.593	0.000	0.88		85.0	SURCHARGED
S11.002	SWMH-40.3		70.424	0.713	0.000	1.01		142.0	FLOOD RISK
S11.003	SWMH-40.4		70.313	0.744	0.000	1.64		138.4	SURCHARGED
S12.000	SWMH-44.1		70.328	0.628	0.000	0.61		35.4	FLOOD RISK
S12.001	SWMH-44.2		70.298	0.706	0.000	0.47		23.7	SURCHARGED
S11.004	SWMH-40.5		70.282	0.734	0.000	1.33		174.2	SURCHARGED
S13.000	SWMH-41.1		70.454	0.634	0.000	0.79		157.7	SURCHARGED
S13.001	SWMH-41.2		70.374	0.721	0.000	1.17		235.4	SURCHARGED
S11.005	SWMH-40.6		70.168	0.690	0.000	1.67		423.9	SURCHARGED
S14.000	SWMH-42.1		70.096	0.341	0.000	0.69		67.4	SURCHARGED
S14.001	SWMH-42.2		70.028	0.473	0.000	1.27		124.2	SURCHARGED
S11.006	SWMH-40.7		69.866	0.511	0.000	3.85		539.2	SURCHARGED
S15.000	SWMH-43.1		69.859	0.014	0.000	0.60		59.7	SURCHARGED
S15.001	SWMH-43.2		69.817	0.129	0.000	1.15		115.1	SURCHARGED
S15.002	SWMH-43.3		69.725	0.220	0.000	1.04		103.6	SURCHARGED
S11.007	SWMH-40.8		69.594	0.264	0.000	1.72		636.0	SURCHARGED
S11.008	SWMH-40.9		69.417	0.146	0.000	2.28		637.9	SURCHARGED
S11.009	SWMH-40.10		69.247	0.047	0.000	1.35		635.2	SURCHARGED
S3.008	SWMH-OUTFALL		68.922	-0.178	0.000	0.07		24.2	OK

PN	US/MH Name	Level Exceeded
S8.000	SWMH-30.1	
S8.001	SWMH-30.2	
S8.002	SWMH-30.3	
S9.000	SWMH-31.1	
S9.001	SWMH-31.2	
S8.003	SWMH-30.4	
S10.000	SWMH-32.1	
S10.001	SWMH-32.2	
S8.004	SWMH-30.5	
S8.005	SWMH-30.6	
S8.006	SWMH-30.7	
S11.000	SWMH-40.1	
S11.001	SWMH-40.2	
S11.002	SWMH-40.3	
S11.003	SWMH-40.4	
S12.000	SWMH-44.1	
S12.001	SWMH-44.2	
S11.004	SWMH-40.5	
S13.000	SWMH-41.1	
S13.001	SWMH-41.2	
S11.005	SWMH-40.6	
S14.000	SWMH-42.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S14.001	SWMH-42.2	
S11.006	SWMH-40.7	
S15.000	SWMH-43.1	
S15.001	SWMH-43.2	
S15.002	SWMH-43.3	
S11.007	SWMH-40.8	
S11.008	SWMH-40.9	
S11.009	SWMH-40.10	
S3.008	SWMH-OUTFALL	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.800	Add Flow / Climate Change (%)	0
Ratio R	0.323	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.750
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.306	4-8	1.995	8-12	0.848

Total Area Contributing (ha) = 3.150

Total Pipe Volume (m³) = 160.872

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	**Length (m)**	**Fall (m)**	**Slope (1:X)**	**I.Area (ha)**	**T.E. (mins)**	**Base Flow (l/s)**	**k (mm)**	**HYD SECT**	**DIA (mm)**	**Section Type**	**Auto Design**
S1.000	63.805	0.128	498.5	0.378	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S1.001	68.227	0.136	500.0	0.370	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S1.002	30.781	0.062	500.0	0.020	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S1.003	40.480	0.081	500.0	0.158	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓

Network Results Table

PN	**Rain (mm/hr)**	**T.C. (mins)**	**US/IL (m)**	**Σ I.Area (ha)**	**Σ Base Flow (l/s)**	**Foul (l/s)**	**Add Flow (l/s)**	**Vel (m/s)**	**Cap (l/s)**	**Flow (l/s)**
S1.000	50.00	6.18	68.375	0.378	0.0	0.0	0.0	0.90	143.7	51.1
S1.001	50.00	7.32	68.172	0.747	0.0	0.0	0.0	0.99	215.4	101.2
S1.002	50.00	7.84	68.036	0.767	0.0	0.0	0.0	0.99	215.4	103.9
S1.003	50.00	8.51	67.974	0.926	0.0	0.0	0.0	0.99	215.4	125.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	43.603	0.145	300.0	0.058	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S1.004	112.893	0.226	499.5	0.318	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S3.000	83.121	0.277	300.0	0.201	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S3.001	15.466	0.052	300.0	0.023	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S3.002	82.680	0.184	450.0	0.277	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.003	46.862	0.104	450.0	0.230	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.004	14.136	0.031	450.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S4.000	82.294	0.219	375.0	0.212	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S4.001	53.634	0.143	375.0	0.150	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S5.000	84.199	0.225	375.0	0.287	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S5.001	45.683	0.122	375.0	0.190	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S5.002	18.201	0.049	375.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S3.005	44.744	0.089	500.0	0.102	0.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S1.005	41.916	0.070	598.8	0.178	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S1.006	9.419	0.022	428.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S1.007	15.052	0.100	150.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	50.00	5.81	68.288	0.058	0.0	0.0	0.0	0.90	63.8	7.8
S1.004	50.00	10.40	67.893	1.301	0.0	0.0	0.0	1.00	215.5	176.2
S3.000	50.00	6.53	68.770	0.201	0.0	0.0	0.0	0.90	63.8	27.2
S3.001	50.00	6.78	68.418	0.224	0.0	0.0	0.0	1.04	115.0	30.3
S3.002	50.00	8.23	68.291	0.501	0.0	0.0	0.0	0.95	151.4	67.8
S3.003	50.00	9.05	68.108	0.731	0.0	0.0	0.0	0.95	151.4	99.0
S3.004	50.00	9.30	68.004	0.731	0.0	0.0	0.0	0.95	151.4	99.0
S4.000	50.00	6.48	68.425	0.212	0.0	0.0	0.0	0.93	102.7	28.8
S4.001	50.00	7.44	68.206	0.362	0.0	0.0	0.0	0.93	102.7	49.0
S5.000	50.00	6.51	68.475	0.287	0.0	0.0	0.0	0.93	102.7	38.9
S5.001	50.00	7.33	68.250	0.477	0.0	0.0	0.0	0.93	102.7	64.5
S5.002	50.00	7.65	68.129	0.477	0.0	0.0	0.0	0.93	102.7	64.5
S3.005	50.00	10.05	67.861	1.671	0.0	0.0	0.0	0.99	215.4«	226.3
S1.005	50.00	11.11	67.592	3.150	0.0	0.0	0.0	0.99	279.3«	426.6
S1.006	50.00	11.25	67.472	3.150	0.0	0.0	0.0	1.17	331.0«	426.6
S1.007	50.00	11.37	67.450	3.150	0.0	0.0	0.0	1.98	560.6	426.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.008	24.885	0.050	497.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.008	50.00	11.89	67.350	3.150	0.0	0.0	0.0	0.81	89.0«	426.6

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdro (mm)
S60.1	69.600	1.225	Open Manhole	1350	S1.000	68.375	450				
S60.2	69.600	1.428	Open Manhole	1500	S1.001	68.172	525	S1.000	68.247	450	
S60.3	69.600	1.564	Open Manhole	1500	S1.002	68.036	525	S1.001	68.036	525	
S60.4	69.495	1.521	Open Manhole	1500	S1.003	67.974	525	S1.002	67.974	525	
S64.1	69.600	1.312	Open Manhole	1200	S2.000	68.288	300				
S60.5	69.300	1.407	Open Manhole	1500	S1.004	67.893	525	S1.003	67.893	525	
								S2.000	68.143	300	2
S61.1	70.320	1.550	Open Manhole	1200	S3.000	68.770	300				
S61.2	69.600	1.182	Open Manhole	1350	S3.001	68.418	375	S3.000	68.493	300	
S61.3	69.600	1.309	Open Manhole	1350	S3.002	68.291	450	S3.001	68.366	375	
S61.4	69.600	1.492	Open Manhole	1350	S3.003	68.108	450	S3.002	68.108	450	
S61.5	69.600	1.596	Open Manhole	1350	S3.004	68.004	450	S3.003	68.004	450	
S62.1	69.550	1.125	Open Manhole	1350	S4.000	68.425	375				
S62.2	69.530	1.325	Open Manhole	1350	S4.001	68.206	375	S4.000	68.206	375	
S63.1	69.600	1.125	Open Manhole	1350	S5.000	68.475	375				
S63.2	69.600	1.350	Open Manhole	1350	S5.001	68.250	375	S5.000	68.250	375	
S63.4	69.600	1.471	Open Manhole	1350	S5.002	68.129	375	S5.001	68.129	375	
S61.6	69.400	1.539	Open Manhole	1500	S3.005	67.861	525	S3.004	67.972	450	3
								S4.001	68.063	375	5
								S5.002	68.080	375	6
S60.6	69.176	1.584	Open Manhole	1500	S1.005	67.592	600	S1.004	67.667	525	
								S3.005	67.772	525	10
S60.7	69.477	2.005	Open Manhole	1500	S1.006	67.472	600	S1.005	67.522	600	5
SOUTFALL	69.000	1.550	Open Manhole	1500	S1.007	67.450	600	S1.006	67.450	600	
S21	68.733	1.383	Open Manhole	1500	S1.008	67.350	375	S1.007	67.350	600	
S	68.436	1.136	Open Manhole	0		OUTFALL		S1.008	67.300	375	

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	450	S60.1	69.600	68.375	0.775	Open Manhole	1350
S1.001	o	525	S60.2	69.600	68.172	0.903	Open Manhole	1500
S1.002	o	525	S60.3	69.600	68.036	1.039	Open Manhole	1500
S1.003	o	525	S60.4	69.495	67.974	0.996	Open Manhole	1500
S2.000	o	300	S64.1	69.600	68.288	1.012	Open Manhole	1200
S1.004	o	525	S60.5	69.300	67.893	0.882	Open Manhole	1500
S3.000	o	300	S61.1	70.320	68.770	1.250	Open Manhole	1200
S3.001	o	375	S61.2	69.600	68.418	0.807	Open Manhole	1350
S3.002	o	450	S61.3	69.600	68.291	0.859	Open Manhole	1350
S3.003	o	450	S61.4	69.600	68.108	1.042	Open Manhole	1350
S3.004	o	450	S61.5	69.600	68.004	1.146	Open Manhole	1350
S4.000	o	375	S62.1	69.550	68.425	0.750	Open Manhole	1350
S4.001	o	375	S62.2	69.530	68.206	0.949	Open Manhole	1350
S5.000	o	375	S63.1	69.600	68.475	0.750	Open Manhole	1350
S5.001	o	375	S63.2	69.600	68.250	0.975	Open Manhole	1350
S5.002	o	375	S63.4	69.600	68.129	1.096	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)
S1.000	63.805	498.5	S60.2	69.600	68.247	0.903	Open Manhole	1500
S1.001	68.227	500.0	S60.3	69.600	68.036	1.039	Open Manhole	1500
S1.002	30.781	500.0	S60.4	69.495	67.974	0.996	Open Manhole	1500
S1.003	40.480	500.0	S60.5	69.300	67.893	0.882	Open Manhole	1500
S2.000	43.603	300.0	S60.5	69.300	68.143	0.857	Open Manhole	1500
S1.004	112.893	499.5	S60.6	69.176	67.667	0.984	Open Manhole	1500
S3.000	83.121	300.0	S61.2	69.600	68.493	0.807	Open Manhole	1350
S3.001	15.466	300.0	S61.3	69.600	68.366	0.859	Open Manhole	1350
S3.002	82.680	450.0	S61.4	69.600	68.108	1.042	Open Manhole	1350
S3.003	46.862	450.0	S61.5	69.600	68.004	1.146	Open Manhole	1350
S3.004	14.136	450.0	S61.6	69.400	67.972	0.978	Open Manhole	1500
S4.000	82.294	375.0	S62.2	69.530	68.206	0.950	Open Manhole	1350
S4.001	53.634	375.0	S61.6	69.400	68.063	0.962	Open Manhole	1500
S5.000	84.199	375.0	S63.2	69.600	68.250	0.975	Open Manhole	1350
S5.001	45.683	375.0	S63.4	69.600	68.129	1.096	Open Manhole	1350
S5.002	18.201	375.0	S61.6	69.400	68.080	0.945	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)
S3.005	o	525	S61.6	69.400	67.861	1.014	Open Manhole	1500
S1.005	o	600	S60.6	69.176	67.592	0.984	Open Manhole	1500
S1.006	o	600	S60.7	69.477	67.472	1.405	Open Manhole	1500
S1.007	o	600	SOUTFALL	69.000	67.450	0.950	Open Manhole	1500
S1.008	o	375	S21	68.733	67.350	1.008	Open Manhole	1500

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)
S3.005	44.744	500.0	S60.6	69.176	67.772	0.879	Open Manhole	1500
S1.005	41.916	598.8	S60.7	69.477	67.522	1.355	Open Manhole	1500
S1.006	9.419	428.1	SOUTFALL	69.000	67.450	0.950	Open Manhole	1500
S1.007	15.052	150.5	S21	68.733	67.350	0.783	Open Manhole	1500
S1.008	24.885	497.7	S	68.436	67.300	0.761	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Gravel	75	0.234	0.175	0.175
	Classification	Roof	100	0.202	0.202	0.378
1.001	Classification	Gravel	75	0.215	0.161	0.161
	Classification	Roof	100	0.209	0.209	0.370
1.002	Classification	Grass	30	0.067	0.020	0.020
1.003	Classification	Road	100	0.158	0.158	0.158
2.000	Classification	Road	100	0.058	0.058	0.058
1.004	Classification	Roof	100	0.189	0.189	0.189
	Classification	Road	100	0.129	0.129	0.318
3.000	Classification	Grass	30	0.391	0.117	0.117
	Classification	Road	100	0.083	0.083	0.201
3.001	Classification	Grass	30	0.078	0.023	0.023
3.002	Classification	Roof	100	0.252	0.252	0.252
	Classification	Grass	30	0.083	0.025	0.277
3.003	Classification	Roof	100	0.205	0.205	0.205
	Classification	Grass	30	0.084	0.025	0.230
3.004	-	-	100	0.000	0.000	0.000
4.000	Classification	Road	100	0.212	0.212	0.212
4.001	Classification	Road	100	0.150	0.150	0.150
5.000	Classification	Roof	100	0.262	0.262	0.262
	Classification	Grass	30	0.082	0.024	0.287
5.001	Classification	Roof	100	0.171	0.171	0.171
	Classification	Grass	30	0.062	0.019	0.190
5.002	-	-	100	0.000	0.000	0.000
3.005	Classification	Road	100	0.096	0.096	0.096
	Classification	Grass	30	0.021	0.006	0.102
1.005	Classification	Roof	100	0.127	0.127	0.127
	Classification	Road	100	0.051	0.051	0.178
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.869	3.150	3.150

Network Classifications for Storm

PN	**USMH Name**	**Pipe Dia (mm)**	**Min Cover Depth (m)**	**Max Cover Depth (m)**	**Pipe Type**	**MH Dia (mm)**	**MH Width (mm)**	**MH Ring Depth (m)**	**MH Type**
S1.000	S60.1	450	0.775	0.903	Unclassified	1350	0	0.775	Unclassified
S1.001	S60.2	525	0.903	1.050	Unclassified	1500	0	0.903	Unclassified
S1.002	S60.3	525	0.996	1.047	Unclassified	1500	0	1.039	Unclassified
S1.003	S60.4	525	0.882	0.996	Unclassified	1500	0	0.996	Unclassified
S2.000	S64.1	300	0.857	1.025	Unclassified	1200	0	1.012	Unclassified
S1.004	S60.5	525	0.882	1.055	Unclassified	1500	0	0.882	Unclassified
S3.000	S61.1	300	0.807	1.250	Unclassified	1200	0	1.250	Unclassified
S3.001	S61.2	375	0.807	0.859	Unclassified	1350	0	0.807	Unclassified
S3.002	S61.3	450	0.859	1.042	Unclassified	1350	0	0.859	Unclassified
S3.003	S61.4	450	1.011	1.146	Unclassified	1350	0	1.042	Unclassified
S3.004	S61.5	450	0.978	1.146	Unclassified	1350	0	1.146	Unclassified
S4.000	S62.1	375	0.750	0.950	Unclassified	1350	0	0.750	Unclassified
S4.001	S62.2	375	0.949	1.024	Unclassified	1350	0	0.949	Unclassified
S5.000	S63.1	375	0.750	0.975	Unclassified	1350	0	0.750	Unclassified
S5.001	S63.2	375	0.975	1.096	Unclassified	1350	0	0.975	Unclassified
S5.002	S63.4	375	0.945	1.096	Unclassified	1350	0	1.096	Unclassified
S3.005	S61.6	525	0.879	1.014	Unclassified	1500	0	1.014	Unclassified
S1.005	S60.6	600	0.984	1.355	Unclassified	1500	0	0.984	Unclassified
S1.006	S60.7	600	0.950	1.405	Unclassified	1500	0	1.405	Unclassified
S1.007	SOUTFALL	600	0.783	0.950	Unclassified	1500	0	0.950	Unclassified
S1.008	S21	375	0.761	1.008	Unclassified	1500	0	1.008	Unclassified

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)**
S1.008	S	68.436	67.300	0.000	0	0

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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	Scotland and Ireland
Return Period (years)	100	M5-60 (mm)	17.800

Synthetic Rainfall Details

Ratio R	0.323	Cv (Winter)	0.840
Profile Type	Summer	Storm Duration (mins)	30
Cv (Summer)	0.750		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SOUTFALL, DS/PN: S1.007, Volume (m³): 5.0

Unit Reference	MD-SHE-0196-1940-1000-1940
Design Head (m)	1.000
Design Flow (l/s)	19.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	196
Invert Level (m)	67.450
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	19.4
Flush-Flo™	0.340	19.4
Kick-Flo®	0.720	16.6
Mean Flow over Head Range	-	16.3

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)**
0.100	6.8	1.200	21.2	3.000	32.8	7.000	49.4
0.200	18.3	1.400	22.8	3.500	35.3	7.500	51.1
0.300	19.3	1.600	24.3	4.000	37.7	8.000	52.7
0.400	19.3	1.800	25.7	4.500	39.9	8.500	54.3
0.500	19.0	2.000	27.0	5.000	42.0	9.000	55.8
0.600	18.4	2.200	28.3	5.500	44.0	9.500	57.3
0.800	17.5	2.400	29.5	6.000	45.9		
1.000	19.4	2.600	30.6	6.500	47.7		

Storage Structures for Storm

Tank or Pond Manhole: SOUTFALL, DS/PN: S1.007

Invert Level (m) 67.450

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	1582.0	1.550	3178.0

Manhole Headloss for Storm

PN	**US/MH Name**	**US/MH Headloss**
S1.000	S60.1	0.500
S1.001	S60.2	0.500
S1.002	S60.3	0.500
S1.003	S60.4	0.500
S2.000	S64.1	0.500
S1.004	S60.5	0.500
S3.000	S61.1	0.500
S3.001	S61.2	0.500
S3.002	S61.3	0.500
S3.003	S61.4	0.500
S3.004	S61.5	0.500
S4.000	S62.1	0.500
S4.001	S62.2	0.500
S5.000	S63.1	0.500
S5.001	S63.2	0.500
S5.002	S63.4	0.500
S3.005	S61.6	0.500
S1.005	S60.6	0.500
S1.006	S60.7	0.500
S1.007	SOUTFALL	0.500
S1.008	S21	0.500

5 year Return Period 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	2.000
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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.323
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.800	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	5, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S60.1	15 Winter	5	+10%	30/15 Winter			
S1.001	S60.2	15 Winter	5	+10%	30/15 Summer			
S1.002	S60.3	15 Winter	5	+10%	30/15 Summer			
S1.003	S60.4	15 Winter	5	+10%	30/15 Summer			
S2.000	S64.1	15 Winter	5	+10%	30/15 Summer			
S1.004	S60.5	30 Winter	5	+10%	30/15 Summer			
S3.000	S61.1	15 Winter	5	+10%	100/15 Summer			
S3.001	S61.2	15 Winter	5	+10%	30/15 Winter			
S3.002	S61.3	15 Winter	5	+10%	30/15 Winter			
S3.003	S61.4	15 Winter	5	+10%	30/15 Summer			
S3.004	S61.5	15 Winter	5	+10%	30/15 Summer			
S4.000	S62.1	15 Winter	5	+10%	100/15 Summer			
S4.001	S62.2	15 Winter	5	+10%	30/15 Summer			
S5.000	S63.1	15 Winter	5	+10%	30/15 Winter			
S5.001	S63.2	15 Winter	5	+10%	30/15 Summer			
S5.002	S63.4	15 Winter	5	+10%	30/15 Summer			
S3.005	S61.6	15 Winter	5	+10%	5/15 Winter			
S1.005	S60.6	15 Winter	5	+10%	5/15 Summer			
S1.006	S60.7	15 Winter	5	+10%	5/15 Summer			
S1.007	SOUTFALL	480 Winter	5	+10%	100/240 Summer			
S1.008	S21	480 Winter	5	+10%				

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S60.1	68.628	-0.197	0.000	0.56		74.1	OK	
S1.001	S60.2	68.496	-0.201	0.000	0.63		123.9	OK	
S1.002	S60.3	68.432	-0.129	0.000	0.62		112.8	OK	
S1.003	S60.4	68.401	-0.098	0.000	0.65		122.8	OK	
S2.000	S64.1	68.380	-0.208	0.000	0.20		12.0	OK	
S1.004	S60.5	68.363	-0.056	0.000	0.68		139.2	OK	
S3.000	S61.1	68.955	-0.115	0.000	0.62		38.3	OK	
S3.001	S61.2	68.600	-0.193	0.000	0.46		42.6	OK	
S3.002	S61.3	68.551	-0.190	0.000	0.58		82.4	OK	
S3.003	S61.4	68.488	-0.070	0.000	0.71		97.1	OK	
S3.004	S61.5	68.440	-0.014	0.000	0.99		92.5	OK	
S4.000	S62.1	68.605	-0.195	0.000	0.41		40.5	OK	
S4.001	S62.2	68.437	-0.144	0.000	0.64		61.0	OK	
S5.000	S63.1	68.691	-0.159	0.000	0.56		54.6	OK	
S5.001	S63.2	68.524	-0.102	0.000	0.86		81.0	OK	
S5.002	S63.4	68.441	-0.063	0.000	0.88		73.6	OK	
S3.005	S61.6	68.394	0.008	0.000	1.14		216.6	SURCHARGED	
S1.005	S60.6	68.263	0.071	0.000	1.47		352.7	SURCHARGED	
S1.006	S60.7	68.112	0.040	0.000	2.03		347.1	SURCHARGED	
S1.007	SOUTFALL	67.840	-0.210	0.000	0.06		19.3	OK	
S1.008	S21	67.477	-0.248	0.000	0.25		19.3	OK	

30 year Return Period 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 2.000
               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 Storage Structures 1
             Number of Online Controls 1 Number of Time/Area Diagrams 0
            Number of Offline Controls 0 Number of Real Time Controls 0
```

Synthetic Rainfall Details

```
              Rainfall Model                FSR      Ratio R 0.323
                      Region Scotland and Ireland Cv (Summer) 0.750
                  M5-60 (mm)               17.800 Cv (Winter) 0.840

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


                       Profile(s)                          Summer and Winter
                  Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
               Return Period(s) (years)                                5, 30, 100
                  Climate Change (%)                                  10, 10, 10
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S60.1	15 Winter	30	+10%	30/15 Winter			
S1.001	S60.2	15 Winter	30	+10%	30/15 Summer			
S1.002	S60.3	15 Winter	30	+10%	30/15 Summer			
S1.003	S60.4	15 Winter	30	+10%	30/15 Summer			
S2.000	S64.1	15 Winter	30	+10%	30/15 Summer			
S1.004	S60.5	15 Winter	30	+10%	30/15 Summer			
S3.000	S61.1	15 Winter	30	+10%	100/15 Summer			
S3.001	S61.2	15 Winter	30	+10%	30/15 Winter			
S3.002	S61.3	15 Winter	30	+10%	30/15 Winter			
S3.003	S61.4	15 Winter	30	+10%	30/15 Summer			
S3.004	S61.5	15 Winter	30	+10%	30/15 Summer			
S4.000	S62.1	15 Winter	30	+10%	100/15 Summer			
S4.001	S62.2	15 Winter	30	+10%	30/15 Summer			
S5.000	S63.1	15 Winter	30	+10%	30/15 Winter			
S5.001	S63.2	15 Winter	30	+10%	30/15 Summer			
S5.002	S63.4	15 Winter	30	+10%	30/15 Summer			
S3.005	S61.6	15 Winter	30	+10%	5/15 Winter			
S1.005	S60.6	15 Winter	30	+10%	5/15 Summer			
S1.006	S60.7	15 Winter	30	+10%	5/15 Summer			
S1.007	SOUTFALL	480 Winter	30	+10%	100/240 Summer			
S1.008	S21	1440 Winter	30	+10%				

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S60.1	68.918	0.093	0.000	0.80		107.1	SURCHARGED	
S1.001	S60.2	68.886	0.189	0.000	0.91		179.5	SURCHARGED	
S1.002	S60.3	68.839	0.278	0.000	0.81		146.3	SURCHARGED	
S1.003	S60.4	68.798	0.299	0.000	0.84		158.3	SURCHARGED	
S2.000	S64.1	68.752	0.164	0.000	0.28		16.7	SURCHARGED	
S1.004	S60.5	68.741	0.323	0.000	0.92		188.7	SURCHARGED	
S3.000	S61.1	69.036	-0.034	0.000	0.92		56.6	OK	
S3.001	S61.2	68.893	0.100	0.000	0.55		50.8	SURCHARGED	
S3.002	S61.3	68.871	0.130	0.000	0.80		114.6	SURCHARGED	
S3.003	S61.4	68.827	0.269	0.000	1.01		138.7	SURCHARGED	
S3.004	S61.5	68.749	0.296	0.000	1.40		131.0	SURCHARGED	
S4.000	S62.1	68.800	0.000	0.000	0.61		59.7	OK	
S4.001	S62.2	68.764	0.183	0.000	0.82		78.5	SURCHARGED	
S5.000	S63.1	68.900	0.050	0.000	0.78		76.1	SURCHARGED	
S5.001	S63.2	68.851	0.226	0.000	1.09		103.3	SURCHARGED	
S5.002	S63.4	68.757	0.253	0.000	1.09		91.2	SURCHARGED	
S3.005	S61.6	68.708	0.322	0.000	1.50		285.0	SURCHARGED	
S1.005	S60.6	68.525	0.333	0.000	1.98		473.0	SURCHARGED	
S1.006	S60.7	68.245	0.173	0.000	2.77		473.7	SURCHARGED	
S1.007	SOUTFALL	68.014	-0.036	0.000	0.06		19.3	OK	
S1.008	S21	67.477	-0.248	0.000	0.25		19.3	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0
Number of Online Controls 1
Number of Offline Controls 0
Number of Storage Structures 1
Number of Time/Area Diagrams 0
Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR
Region Scotland and Ireland
M5-60 (mm) 17.800
Ratio R 0.323
Cv (Summer) 0.750
Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 5, 30, 100
Climate Change (%) 10, 10, 10

PN	**US/MH Name**	**Storm**	**Return Period**	**Climate Change**	**First (X) Surcharge**	**First (Y) Flood**	**First (Z) Overflow**	**Overflow Act.**
S1.000	S60.1	15 Winter	100	+10%	30/15 Winter			
S1.001	S60.2	15 Winter	100	+10%	30/15 Summer			
S1.002	S60.3	15 Winter	100	+10%	30/15 Summer			
S1.003	S60.4	15 Winter	100	+10%	30/15 Summer			
S2.000	S64.1	30 Winter	100	+10%	30/15 Summer			
S1.004	S60.5	30 Winter	100	+10%	30/15 Summer			
S3.000	S61.1	15 Winter	100	+10%	100/15 Summer			
S3.001	S61.2	15 Winter	100	+10%	30/15 Winter			
S3.002	S61.3	15 Winter	100	+10%	30/15 Winter			
S3.003	S61.4	15 Winter	100	+10%	30/15 Summer			
S3.004	S61.5	15 Winter	100	+10%	30/15 Summer			
S4.000	S62.1	15 Winter	100	+10%	100/15 Summer			
S4.001	S62.2	15 Winter	100	+10%	30/15 Summer			
S5.000	S63.1	15 Winter	100	+10%	30/15 Winter			
S5.001	S63.2	15 Winter	100	+10%	30/15 Summer			
S5.002	S63.4	15 Winter	100	+10%	30/15 Summer			
S3.005	S61.6	15 Winter	100	+10%	5/15 Winter			
S1.005	S60.6	30 Winter	100	+10%	5/15 Summer			
S1.006	S60.7	30 Winter	100	+10%	5/15 Summer			
S1.007	SOUTFALL	480 Winter	100	+10%	100/240 Summer			
S1.008	S21	960 Winter	100	+10%				

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S60.1	69.564	0.739	0.000	0.89		119.0	FLOOD RISK	
S1.001	S60.2	69.515	0.818	0.000	1.07		210.7	FLOOD RISK	
S1.002	S60.3	69.435	0.875	0.000	1.07		194.2	FLOOD RISK	
S1.003	S60.4	69.380	0.881	0.000	1.13		211.8	FLOOD RISK	
S2.000	S64.1	69.301	0.713	0.000	0.24		14.5	FLOOD RISK	
S1.004	S60.5	69.285	0.867	0.000	1.27		258.5	FLOOD RISK	
S3.000	S61.1	69.666	0.596	0.000	1.07		65.8	SURCHARGED	
S3.001	S61.2	69.511	0.718	0.000	0.64		59.6	FLOOD RISK	
S3.002	S61.3	69.480	0.739	0.000	0.85		121.7	FLOOD RISK	
S3.003	S61.4	69.382	0.825	0.000	1.24		170.0	FLOOD RISK	
S3.004	S61.5	69.259	0.806	0.000	1.71		159.6	SURCHARGED	
S4.000	S62.1	69.339	0.539	0.000	0.71		69.8	FLOOD RISK	
S4.001	S62.2	69.290	0.709	0.000	0.89		85.4	FLOOD RISK	
S5.000	S63.1	69.523	0.673	0.000	0.89		87.5	FLOOD RISK	
S5.001	S63.2	69.427	0.801	0.000	1.32		125.0	FLOOD RISK	
S5.002	S63.4	69.282	0.778	0.000	1.37		114.9	SURCHARGED	
S3.005	S61.6	69.204	0.818	0.000	1.90		360.2	FLOOD RISK	
S1.005	S60.6	68.901	0.709	0.000	2.62		627.0	FLOOD RISK	
S1.006	S60.7	68.413	0.341	0.000	3.66		627.3	SURCHARGED	
S1.007	SOUTFALL	68.167	0.117	0.000	0.06		19.3	SURCHARGED	
S1.008	S21	67.477	-0.248	0.000	0.25		19.3	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.800	Add Flow / Climate Change (%)	0
Ratio R	0.323	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.750
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.285	4-8	2.022	8-12	1.164	12-16	0.081

Total Area Contributing (ha) = 3.552

Total Pipe Volume (m^3) = 240.280

Network Design Table for Storm

PN	**Length (m)**	**Fall (m)**	**Slope (1:X)**	**I.Area (ha)**	**T.E. (mins)**	**Base Flow (l/s)**	**k (mm)**	**HYD SECT**	**DIA (mm)**	**Section Type**	**Auto Design**
S1.000	94.286	0.210	450.0	0.201	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S1.001	26.441	0.059	450.0	0.063	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S1.002	60.877	0.135	450.0	0.466	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S1.003	60.861	0.122	500.0	0.438	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S2.000	63.437	0.169	375.0	0.190	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S2.001	70.831	0.189	375.0	0.204	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓

Network Results Table

PN	**Rain (mm/hr)**	**T.C. (mins)**	**US/IL (m)**	**Σ I.Area (ha)**	**Σ Base Flow (l/s)**	**Foul (l/s)**	**Add Flow (l/s)**	**Vel (m/s)**	**Cap (l/s)**	**Flow (l/s)**
S1.000	50.00	6.65	67.660	0.201	0.0	0.0	0.0	0.95	151.4	27.2
S1.001	50.00	7.11	67.450	0.264	0.0	0.0	0.0	0.95	151.4	35.8
S1.002	50.00	8.18	67.392	0.730	0.0	0.0	0.0	0.95	151.4	98.9
S1.003	50.00	9.20	67.181	1.169	0.0	0.0	0.0	0.99	215.4	158.3
S2.000	50.00	6.14	67.900	0.190	0.0	0.0	0.0	0.93	102.7	25.7
S2.001	50.00	7.41	67.731	0.394	0.0	0.0	0.0	0.93	102.7	53.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.002	37.059	0.099	375.0	0.056	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S1.004	38.370	0.096	400.0	0.110	0.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S3.000	49.714	0.199	249.8	0.223	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S1.005	67.593	0.135	500.0	0.164	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S1.006	56.340	0.129	436.7	0.155	0.00	0.0	0.600	o	750	Pipe/Conduit	🔓
S1.007	32.646	0.046	714.4	0.255	0.00	0.0	0.600	o	750	Pipe/Conduit	🔓
S4.000	73.541	0.147	500.0	0.214	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.001	52.670	0.132	400.0	0.197	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S4.002	14.591	0.036	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S5.000	66.291	0.166	400.0	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S5.001	56.817	0.142	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S4.003	9.541	0.024	400.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S1.008	8.670	0.012	750.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔓
S1.009	78.996	0.100	790.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.002	50.00	8.07	67.542	0.450	0.0	0.0	0.0	0.93	102.7	60.9
S1.004	50.00	9.77	67.060	1.728	0.0	0.0	0.0	1.11	241.1	234.0
S3.000	50.00	5.84	67.550	0.223	0.0	0.0	0.0	0.99	70.0	30.2
S1.005	50.00	10.81	66.889	2.115	0.0	0.0	0.0	1.08	306.0	286.4
S1.006	50.00	11.52	66.604	2.270	0.0	0.0	0.0	1.33	588.7	307.4
S1.007	50.00	12.04	66.475	2.525	0.0	0.0	0.0	1.04	459.1	341.9
S4.000	50.00	6.76	67.250	0.214	0.0	0.0	0.0	0.70	49.2	29.0
S4.001	50.00	7.74	67.028	0.411	0.0	0.0	0.0	0.90	99.4	55.7
S4.002	50.00	8.01	66.896	0.411	0.0	0.0	0.0	0.90	99.4	55.7
S5.000	50.00	6.23	67.018	0.000	0.0	0.0	0.0	0.90	99.4	0.0
S5.001	50.00	7.28	66.852	0.000	0.0	0.0	0.0	0.90	99.4	0.0
S4.003	50.00	8.18	66.710	0.411	0.0	0.0	0.0	0.90	99.4	55.7
S1.008	50.00	12.19	66.311	2.937	0.0	0.0	0.0	1.01	448.0	397.7
S1.009	50.00	13.52	66.250	2.937	0.0	0.0	0.0	0.99	436.4	397.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.000	65.003	0.173	375.7	0.215	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S6.001	69.797	0.186	375.0	0.221	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S6.002	80.052	0.178	450.0	0.179	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.003	16.895	0.088	192.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.004	57.261	0.100	572.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S1.010	8.226	0.050	164.5	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	50.00	6.17	66.950	0.215	0.0	0.0	0.0	0.93	102.6	29.1
S6.001	50.00	7.42	66.777	0.436	0.0	0.0	0.0	0.93	102.7	59.0
S6.002	50.00	8.82	66.516	0.615	0.0	0.0	0.0	0.95	151.4	83.3
S6.003	50.00	9.01	66.338	0.615	0.0	0.0	0.0	1.46	232.8	83.3
S6.004	50.00	10.14	66.250	0.615	0.0	0.0	0.0	0.84	134.0	83.3
S1.010	50.00	13.58	66.150	3.552	0.0	0.0	0.0	2.18	962.7	481.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Back (m
70.1	69.450	1.790	Open Manhole	1350	S1.000	67.660	450				
70.2	69.450	2.000	Open Manhole	1350	S1.001	67.450	450	S1.000	67.450	450	
70.3	69.331	1.939	Open Manhole	1350	S1.002	67.392	450	S1.001	67.392	450	
70.4	68.821	1.640	Open Manhole	1500	S1.003	67.181	525	S1.002	67.256	450	
71.1	69.600	1.700	Open Manhole	1350	S2.000	67.900	375				
71.2	69.600	1.869	Open Manhole	1350	S2.001	67.731	375	S2.000	67.731	375	
71.3	69.600	2.058	Open Manhole	1350	S2.002	67.542	375	S2.001	67.542	375	
70.5	68.550	1.490	Open Manhole	1500	S1.004	67.060	525	S1.003	67.060	525	
								S2.002	67.443	375	
72.1	69.307	1.757	Open Manhole	1200	S3.000	67.550	300				
70.6	68.500	1.611	Open Manhole	1500	S1.005	66.889	600	S1.004	66.964	525	
								S3.000	67.351	300	
70.7	68.181	1.577	Open Manhole	1800	S1.006	66.604	750	S1.005	66.754	600	
70.8	68.150	1.675	Open Manhole	1800	S1.007	66.475	750	S1.006	66.475	750	
73.1	68.450	1.200	Open Manhole	1200	S4.000	67.250	300				
73.2	68.450	1.422	Open Manhole	1350	S4.001	67.028	375	S4.000	67.103	300	
73.3	68.450	1.554	Open Manhole	1350	S4.002	66.896	375	S4.001	66.896	375	
16	68.136	1.118	Open Manhole	1350	S5.000	67.018	375				
17	68.590	1.738	Open Manhole	1350	S5.001	66.852	375	S5.000	66.852	375	
73.4	68.100	1.390	Open Manhole	1350	S4.003	66.710	375	S4.002	66.860	375	
								S5.001	66.710	375	
70.9	68.300	1.989	Open Manhole	1800	S1.008	66.311	750	S1.007	66.429	750	
								S4.003	66.686	375	
20	68.350	2.100	Open Manhole	1800	S1.009	66.250	750	S1.008	66.300	750	
80.1	68.450	1.500	Open Manhole	1350	S6.000	66.950	375				
80.2	68.450	1.673	Open Manhole	1350	S6.001	66.777	375	S6.000	66.777	375	
80.3	68.400	1.884	Open Manhole	1350	S6.002	66.516	450	S6.001	66.591	375	
80.4	68.200	1.862	Open Manhole	1350	S6.003	66.338	450	S6.002	66.338	450	
80.5	68.350	2.100	Open Manhole	1350	S6.004	66.250	450	S6.003	66.250	450	
OUTFALL MH	68.350	2.200	Open Manhole	1800	S1.010	66.150	750	S1.009	66.150	750	
								S6.004	66.150	450	
	68.370	2.270	Open Manhole	0		OUTFALL		S1.010	66.100	750	

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	450	70.1	69.450	67.660	1.340	Open Manhole	1350
S1.001	o	450	70.2	69.450	67.450	1.550	Open Manhole	1350
S1.002	o	450	70.3	69.331	67.392	1.489	Open Manhole	1350
S1.003	o	525	70.4	68.821	67.181	1.115	Open Manhole	1500
S2.000	o	375	71.1	69.600	67.900	1.325	Open Manhole	1350
S2.001	o	375	71.2	69.600	67.731	1.494	Open Manhole	1350
S2.002	o	375	71.3	69.600	67.542	1.683	Open Manhole	1350
S1.004	o	525	70.5	68.550	67.060	0.965	Open Manhole	1500
S3.000	o	300	72.1	69.307	67.550	1.457	Open Manhole	1200
S1.005	o	600	70.6	68.500	66.889	1.011	Open Manhole	1500
S1.006	o	750	70.7	68.181	66.604	0.827	Open Manhole	1800
S1.007	o	750	70.8	68.150	66.475	0.925	Open Manhole	1800
S4.000	o	300	73.1	68.450	67.250	0.900	Open Manhole	1200
S4.001	o	375	73.2	68.450	67.028	1.047	Open Manhole	1350
S4.002	o	375	73.3	68.450	66.896	1.179	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)
S1.000	94.286	450.0	70.2	69.450	67.450	1.550	Open Manhole	1350
S1.001	26.441	450.0	70.3	69.331	67.392	1.489	Open Manhole	1350
S1.002	60.877	450.0	70.4	68.821	67.256	1.115	Open Manhole	1500
S1.003	60.861	500.0	70.5	68.550	67.060	0.965	Open Manhole	1500
S2.000	63.437	375.0	71.2	69.600	67.731	1.494	Open Manhole	1350
S2.001	70.831	375.0	71.3	69.600	67.542	1.683	Open Manhole	1350
S2.002	37.059	375.0	70.5	68.550	67.443	0.732	Open Manhole	1500
S1.004	38.370	400.0	70.6	68.500	66.964	1.011	Open Manhole	1500
S3.000	49.714	249.8	70.6	68.500	67.351	0.849	Open Manhole	1500
S1.005	67.593	500.0	70.7	68.181	66.754	0.827	Open Manhole	1800
S1.006	56.340	436.7	70.8	68.150	66.475	0.925	Open Manhole	1800
S1.007	32.646	714.4	70.9	68.300	66.429	1.121	Open Manhole	1800
S4.000	73.541	500.0	73.2	68.450	67.103	1.047	Open Manhole	1350
S4.001	52.670	400.0	73.3	68.450	66.896	1.179	Open Manhole	1350
S4.002	14.591	400.0	73.4	68.100	66.860	0.865	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)**
S5.000	o	375	16	68.136	67.018	0.743	Open Manhole	1350
S5.001	o	375	17	68.590	66.852	1.363	Open Manhole	1350
S4.003	o	375	73.4	68.100	66.710	1.015	Open Manhole	1350
S1.008	o	750	70.9	68.300	66.311	1.239	Open Manhole	1800
S1.009	o	750	20	68.350	66.250	1.350	Open Manhole	1800
S6.000	o	375	80.1	68.450	66.950	1.125	Open Manhole	1350
S6.001	o	375	80.2	68.450	66.777	1.298	Open Manhole	1350
S6.002	o	450	80.3	68.400	66.516	1.434	Open Manhole	1350
S6.003	o	450	80.4	68.200	66.338	1.412	Open Manhole	1350
S6.004	o	450	80.5	68.350	66.250	1.650	Open Manhole	1350
S1.010	o	750	OUTFALL MH	68.350	66.150	1.450	Open Manhole	1800

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)**
S5.000	66.291	400.0	17	68.590	66.852	1.363	Open Manhole	1350
S5.001	56.817	400.0	73.4	68.100	66.710	1.015	Open Manhole	1350
S4.003	9.541	400.0	70.9	68.300	66.686	1.239	Open Manhole	1800
S1.008	8.670	750.0	20	68.350	66.300	1.300	Open Manhole	1800
S1.009	78.996	790.0	OUTFALL MH	68.350	66.150	1.450	Open Manhole	1800
S6.000	65.003	375.7	80.2	68.450	66.777	1.298	Open Manhole	1350
S6.001	69.797	375.0	80.3	68.400	66.591	1.434	Open Manhole	1350
S6.002	80.052	450.0	80.4	68.200	66.338	1.412	Open Manhole	1350
S6.003	16.895	192.0	80.5	68.350	66.250	1.650	Open Manhole	1350
S6.004	57.261	572.6	OUTFALL MH	68.350	66.150	1.750	Open Manhole	1800
S1.010	8.226	164.5		68.370	66.100	1.520	Open Manhole	0

Area Summary for Storm

Pipe Number	**PIMP Type**	**PIMP Name**	**PIMP (%)**	**Gross Area (ha)**	**Imp. Area (ha)**	**Pipe Total (ha)**
1.000	Classification	Grass	30	0.389	0.117	0.117
	Classification	Road	100	0.084	0.084	0.201
1.001	Classification	Road	100	0.063	0.063	0.063
1.002	Classification	Road	100	0.166	0.166	0.166
	Classification	Gravel	75	0.205	0.154	0.320
	Classification	Gravel	75	0.195	0.146	0.466
1.003	Classification	Road	100	0.183	0.183	0.183
	Classification	Gravel	75	0.190	0.142	0.325
	Classification	Gravel	75	0.151	0.113	0.438
2.000	Classification	Roof	100	0.190	0.190	0.190
2.001	Classification	Roof	100	0.204	0.204	0.204
2.002	Classification	Road	100	0.056	0.056	0.056
1.004	Classification	Road	100	0.110	0.110	0.110
3.000	Classification	Road	100	0.056	0.056	0.056
	Classification	Road	100	0.071	0.071	0.127
	Classification	Roof	100	0.096	0.096	0.223
1.005	Classification	Road	100	0.072	0.072	0.072
	Classification	Roof	100	0.092	0.092	0.164
1.006	Classification	Road	100	0.065	0.065	0.065
	Classification	Roof	100	0.089	0.089	0.155
1.007	Classification	Road	100	0.169	0.169	0.169
	Classification	Road	100	0.086	0.086	0.255
4.000	Classification	Roof	100	0.214	0.214	0.214
4.001	Classification	Roof	100	0.197	0.197	0.197
4.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.000	0.000	0.000
5.001	-	-	100	0.000	0.000	0.000
4.003	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
6.000	Classification	Roof	100	0.215	0.215	0.215
6.001	Classification	Roof	100	0.221	0.221	0.221
6.002	Classification	Grass	30	0.251	0.075	0.075
	Classification	Road	100	0.104	0.104	0.179
6.003	-	-	100	0.000	0.000	0.000
6.004	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				4.185	3.552	3.552

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	70.1	450	1.340	1.616	Unclassified	1350	0	1.340	Unclassified
S1.001	70.2	450	1.489	1.739	Unclassified	1350	0	1.550	Unclassified
S1.002	70.3	450	1.115	1.848	Unclassified	1350	0	1.489	Unclassified
S1.003	70.4	525	0.965	1.584	Unclassified	1500	0	1.115	Unclassified
S2.000	71.1	375	1.325	1.494	Unclassified	1350	0	1.325	Unclassified
S2.001	71.2	375	1.494	1.683	Unclassified	1350	0	1.494	Unclassified
S2.002	71.3	375	0.732	1.683	Unclassified	1350	0	1.683	Unclassified
S1.004	70.5	525	0.965	1.011	Unclassified	1500	0	0.965	Unclassified
S3.000	72.1	300	0.683	1.457	Unclassified	1200	0	1.457	Unclassified
S1.005	70.6	600	0.827	1.011	Unclassified	1500	0	1.011	Unclassified
S1.006	70.7	750	0.827	0.996	Unclassified	1800	0	0.827	Unclassified
S1.007	70.8	750	0.925	1.121	Unclassified	1800	0	0.925	Unclassified
S4.000	73.1	300	0.900	1.047	Unclassified	1200	0	0.900	Unclassified
S4.001	73.2	375	1.047	1.902	Unclassified	1350	0	1.047	Unclassified
S4.002	73.3	375	0.865	1.924	Unclassified	1350	0	1.179	Unclassified
S5.000	16	375	0.743	1.363	Unclassified	1350	0	0.743	Unclassified
S5.001	17	375	1.015	1.363	Unclassified	1350	0	1.363	Unclassified
S4.003	73.4	375	1.015	1.256	Unclassified	1350	0	1.015	Unclassified
S1.008	70.9	750	1.239	1.300	Unclassified	1800	0	1.239	Unclassified
S1.009	20	750	1.350	1.491	Unclassified	1800	0	1.350	Unclassified
S6.000	80.1	375	1.125	1.298	Unclassified	1350	0	1.125	Unclassified
S6.001	80.2	375	1.298	1.434	Unclassified	1350	0	1.298	Unclassified
S6.002	80.3	450	1.412	1.434	Unclassified	1350	0	1.434	Unclassified
S6.003	80.4	450	1.412	1.650	Unclassified	1350	0	1.412	Unclassified
S6.004	80.5	450	1.650	1.750	Unclassified	1350	0	1.650	Unclassified
S1.010	OUTFALL MH	750	1.450	1.520	Unclassified	1800	0	1.450	Unclassified

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)
S1.010		68.370	66.100	0.000	0	0

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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Simulation Criteria for Storm

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.800	Storm Duration (mins)	30
Ratio R	0.323		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: OUTFALL MH, DS/PN: S1.010, Volume (m³): 48.6

Unit Reference	MD-SHE-0210-2280-1000-2280
Design Head (m)	1.000
Design Flow (l/s)	22.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	210
Invert Level (m)	66.150
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	22.8
Flush-Flo™	0.352	22.8
Kick-Flo®	0.728	19.6
Mean Flow over Head Range	-	19.1

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)**
0.100	7.2	1.200	24.9	3.000	38.6	7.000	58.2
0.200	20.3	1.400	26.8	3.500	41.6	7.500	60.2
0.300	22.7	1.600	28.5	4.000	44.4	8.000	62.1
0.400	22.7	1.800	30.2	4.500	47.0	8.500	63.9
0.500	22.3	2.000	31.8	5.000	49.4	9.000	65.8
0.600	21.7	2.200	33.3	5.500	51.8	9.500	67.5
0.800	20.5	2.400	34.7	6.000	54.0		
1.000	22.8	2.600	36.0	6.500	56.1		

Storage Structures for Storm

Tank or Pond Manhole: OUTFALL MH, DS/PN: S1.010

Invert Level (m) 66.150

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	2405.0	1.500	3934.0	2.100	4582.0

Manhole Headloss for Storm

PN	**US/MH Name**	**US/MH Headloss**
S1.000	70.1	0.500
S1.001	70.2	0.500
S1.002	70.3	0.500
S1.003	70.4	0.500
S2.000	71.1	0.500
S2.001	71.2	0.500
S2.002	71.3	0.500
S1.004	70.5	0.500
S3.000	72.1	0.500
S1.005	70.6	0.500
S1.006	70.7	0.500
S1.007	70.8	0.500
S4.000	73.1	0.500
S4.001	73.2	0.500
S4.002	73.3	0.500
S5.000	16	0.500
S5.001	17	0.500
S4.003	73.4	0.500
S1.008	70.9	0.500
S1.009	20	0.500
S6.000	80.1	0.500
S6.001	80.2	0.500
S6.002	80.3	0.500
S6.003	80.4	0.500
S6.004	80.5	0.500
S1.010	OUTFALL MH	0.500

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0
Number of Online Controls 1
Number of Offline Controls 0
Number of Storage Structures 1
Number of Time/Area Diagrams 0
Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR
Region Scotland and Ireland
M5-60 (mm) 17.800
Ratio R 0.323
Cv (Summer) 0.750
Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 360, 480, 960, 1440
Return Period(s) (years) 5, 30, 100
Climate Change (%) 10, 10, 10

PN	**US/MH Name**	**Storm**	**Return Period**	**Climate Change**	**First (X) Surcharge**	**First (Y) Flood**	**First (Z) Overflow**	**Overflow Act.**	**Water Level (m)**
S1.000	70.1	15 Winter	5	+10%	30/15 Winter				67.831
S1.001	70.2	15 Winter	5	+10%	30/15 Summer				67.725
S1.002	70.3	15 Winter	5	+10%	30/15 Summer				67.713
S1.003	70.4	15 Winter	5	+10%	30/15 Summer				67.653
S2.000	71.1	15 Winter	5	+10%	100/15 Summer				68.069
S2.001	71.2	15 Winter	5	+10%	30/15 Winter				67.971
S2.002	71.3	15 Winter	5	+10%	30/15 Winter				67.795
S1.004	70.5	15 Winter	5	+10%	30/15 Summer				67.585
S3.000	72.1	15 Winter	5	+10%	30/15 Winter				67.740
S1.005	70.6	15 Winter	5	+10%	30/15 Summer				67.354
S1.006	70.7	30 Winter	5	+10%	100/15 Winter				67.092
S1.007	70.8	30 Winter	5	+10%	100/15 Summer				67.020
S4.000	73.1	15 Winter	5	+10%	30/15 Summer				67.485
S4.001	73.2	15 Winter	5	+10%	30/15 Summer				67.279
S4.002	73.3	15 Winter	5	+10%	30/15 Winter				67.193
S5.000	16	60 Winter	5	+10%					67.018
S5.001	17	15 Winter	5	+10%	100/30 Winter				66.998
S4.003	73.4	15 Winter	5	+10%	30/15 Summer				67.001
S1.008	70.9	30 Winter	5	+10%	30/15 Winter				66.934
S1.009	20	30 Winter	5	+10%	30/30 Winter				66.773
S6.000	80.1	15 Winter	5	+10%	100/15 Summer				67.132

5 year Return Period 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
S1.000	70.1	-0.279	0.000	0.26		37.3	OK	
S1.001	70.2	-0.175	0.000	0.35		44.3	OK	
S1.002	70.3	-0.129	0.000	0.78		109.5	OK	
S1.003	70.4	-0.054	0.000	0.79		154.5	OK	
S2.000	71.1	-0.206	0.000	0.39		37.6	OK	
S2.001	71.2	-0.135	0.000	0.69		67.4	OK	
S2.002	71.3	-0.122	0.000	0.78		72.2	OK	
S1.004	70.5	0.000	0.000	1.07		223.7	OK	
S3.000	72.1	-0.110	0.000	0.72		47.6	OK	
S1.005	70.6	-0.135	0.000	0.93		256.8	OK	
S1.006	70.7	-0.262	0.000	0.52		261.3	OK	
S1.007	70.8	-0.205	0.000	0.79		274.4	OK	
S4.000	73.1	-0.065	0.000	0.86		40.7	OK	
S4.001	73.2	-0.124	0.000	0.76		70.0	OK	
S4.002	73.3	-0.078	0.000	0.98		67.3	OK	
S5.000	16	-0.375	0.000	0.00		0.0	OK	
S5.001	17	-0.230	0.000	0.04		4.1	OK	
S4.003	73.4	-0.084	0.000	0.95		59.9	OK	
S1.008	70.9	-0.128	0.000	1.20		323.9	OK	
S1.009	20	-0.227	0.000	0.83		323.8	OK	
S6.000	80.1	-0.193	0.000	0.44		42.4	OK	

5 year Return Period 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.
S6.001	80.2	15 Winter	5	+10%	30/15 Summer			
S6.002	80.3	15 Winter	5	+10%	100/15 Summer			
S6.003	80.4	15 Winter	5	+10%	100/15 Winter			
S6.004	80.5	15 Winter	5	+10%	100/15 Summer			
S1.010	OUTFALL MH	960 Winter	5	+10%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S6.001	80.2	67.033	-0.119	0.000	0.76		74.1	OK	
S6.002	80.3	66.793	-0.173	0.000	0.66		94.5	OK	
S6.003	80.4	66.586	-0.202	0.000	0.54		90.8	OK	
S6.004	80.5	66.539	-0.161	0.000	0.73		90.5	OK	
S1.010	OUTFALL MH	66.471	-0.429	0.000	0.04		22.6	OK	

30 year Return Period 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 2.000
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 Storage Structures 1
Number of Online Controls 1
Number of Time/Area Diagrams 0
Number of Offline Controls 0
Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR
Ratio R 0.323
Region Scotland and Ireland
Cv (Summer) 0.750
M5-60 (mm) 17.800
Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 360, 480, 960, 1440
Return Period(s) (years) 5, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	70.1	15 Winter	30	+10%	30/15 Winter				68.209
S1.001	70.2	15 Winter	30	+10%	30/15 Summer				68.177
S1.002	70.3	15 Winter	30	+10%	30/15 Summer				68.152
S1.003	70.4	15 Winter	30	+10%	30/15 Summer				68.005
S2.000	71.1	15 Winter	30	+10%	100/15 Summer				68.177
S2.001	71.2	15 Winter	30	+10%	30/15 Winter				68.122
S2.002	71.3	15 Winter	30	+10%	30/15 Winter				67.957
S1.004	70.5	15 Winter	30	+10%	30/15 Summer				67.849
S3.000	72.1	15 Winter	30	+10%	30/15 Winter				67.857
S1.005	70.6	15 Winter	30	+10%	30/15 Summer				67.618
S1.006	70.7	30 Winter	30	+10%	100/15 Winter				67.325
S1.007	70.8	30 Summer	30	+10%	100/15 Summer				67.225
S4.000	73.1	15 Winter	30	+10%	30/15 Summer				67.688
S4.001	73.2	15 Winter	30	+10%	30/15 Summer				67.437
S4.002	73.3	15 Winter	30	+10%	30/15 Winter				67.273
S5.000	16	30 Winter	30	+10%					67.097
S5.001	17	30 Winter	30	+10%	100/30 Winter				67.097
S4.003	73.4	30 Winter	30	+10%	30/15 Summer				67.099
S1.008	70.9	30 Winter	30	+10%	30/15 Winter				67.072
S1.009	20	30 Winter	30	+10%	30/30 Winter				67.009
S6.000	80.1	15 Winter	30	+10%	100/15 Summer				67.292

30 year Return Period 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
S1.000	70.1	0.099	0.000	0.35		49.9	SURCHARGED	
S1.001	70.2	0.276	0.000	0.57		72.3	SURCHARGED	
S1.002	70.3	0.310	0.000	0.98		137.1	SURCHARGED	
S1.003	70.4	0.299	0.000	1.15		224.3	SURCHARGED	
S2.000	71.1	-0.098	0.000	0.56		53.9	OK	
S2.001	71.2	0.016	0.000	1.00		97.3	SURCHARGED	
S2.002	71.3	0.040	0.000	1.07		99.1	SURCHARGED	
S1.004	70.5	0.264	0.000	1.55		323.2	SURCHARGED	
S3.000	72.1	0.007	0.000	1.02		67.0	SURCHARGED	
S1.005	70.6	0.129	0.000	1.40		388.1	SURCHARGED	
S1.006	70.7	-0.029	0.000	0.76		382.2	OK	
S1.007	70.8	0.000	0.000	1.05		361.3	OK	
S4.000	73.1	0.138	0.000	1.24		58.4	SURCHARGED	
S4.001	73.2	0.035	0.000	1.07		98.6	SURCHARGED	
S4.002	73.3	0.002	0.000	1.44		98.7	SURCHARGED	
S5.000	16	-0.296	0.000	0.00		0.4	OK	
S5.001	17	-0.131	0.000	0.11		9.9	OK	
S4.003	73.4	0.013	0.000	1.20		75.0	SURCHARGED	
S1.008	70.9	0.011	0.000	1.76		473.6	SURCHARGED	
S1.009	20	0.009	0.000	1.18		461.0	SURCHARGED	
S6.000	80.1	-0.033	0.000	0.62		59.5	OK	

30 year Return Period 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.
S6.001	80.2	15 Winter	30	+10%	30/15 Summer			
S6.002	80.3	15 Winter	30	+10%	100/15 Summer			
S6.003	80.4	15 Winter	30	+10%	100/15 Winter			
S6.004	80.5	15 Winter	30	+10%	100/15 Summer			
S1.010	OUTFALL MH	960 Winter	30	+10%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S6.001	80.2	67.221	0.069	0.000	1.12		108.2	SURCHARGED	
S6.002	80.3	66.892	-0.074	0.000	0.97		137.7	OK	
S6.003	80.4	66.692	-0.096	0.000	0.74		125.9	OK	
S6.004	80.5	66.647	-0.053	0.000	1.00		123.1	OK	
S1.010	OUTFALL MH	66.610	-0.290	0.000	0.04		22.7	OK	

100 year Return Period 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 2.000
               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 Storage Structures 1
              Number of Online Controls 1 Number of Time/Area Diagrams 0
             Number of Offline Controls 0 Number of Real Time Controls 0

                           Synthetic Rainfall Details
                Rainfall Model                  FSR      Ratio R 0.323
                       Region Scotland and Ireland Cv (Summer) 0.750
                    M5-60 (mm)               17.800 Cv (Winter) 0.840

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


                          Profile(s)                       Summer and Winter
                  Duration(s) (mins) 15, 30, 60, 120, 360, 480, 960, 1440
              Return Period(s) (years)                           5, 30, 100
                  Climate Change (%)                             10, 10, 10
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	70.1	15 Winter	100	+10%	30/15 Winter				68.869
S1.001	70.2	15 Winter	100	+10%	30/15 Summer				68.828
S1.002	70.3	15 Winter	100	+10%	30/15 Summer				68.798
S1.003	70.4	15 Winter	100	+10%	30/15 Summer				68.559
S2.000	71.1	15 Winter	100	+10%	100/15 Summer				68.737
S2.001	71.2	15 Winter	100	+10%	30/15 Winter				68.683
S2.002	71.3	15 Winter	100	+10%	30/15 Winter				68.460
S1.004	70.5	15 Winter	100	+10%	30/15 Summer				68.288
S3.000	72.1	15 Winter	100	+10%	30/15 Winter				68.069
S1.005	70.6	15 Winter	100	+10%	30/15 Summer				67.868
S1.006	70.7	30 Winter	100	+10%	100/15 Winter				67.447
S1.007	70.8	30 Winter	100	+10%	100/15 Summer				67.328
S4.000	73.1	15 Winter	100	+10%	30/15 Summer				68.022
S4.001	73.2	15 Winter	100	+10%	30/15 Summer				67.624
S4.002	73.3	15 Winter	100	+10%	30/15 Winter				67.326
S5.000	16	30 Winter	100	+10%					67.249
S5.001	17	30 Winter	100	+10%	100/30 Winter				67.249
S4.003	73.4	30 Winter	100	+10%	30/15 Summer				67.260
S1.008	70.9	30 Winter	100	+10%	30/15 Winter				67.230
S1.009	20	30 Winter	100	+10%	30/30 Winter				67.104
S6.000	80.1	15 Winter	100	+10%	100/15 Summer				67.624

100 year Return Period 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
S1.000	70.1	0.759	0.000	0.41		58.3	SURCHARGED	
S1.001	70.2	0.928	0.000	0.61		78.0	SURCHARGED	
S1.002	70.3	0.956	0.000	1.36		190.0	SURCHARGED	
S1.003	70.4	0.853	0.000	1.50		294.5	FLOOD RISK	
S2.000	71.1	0.462	0.000	0.63		61.1	SURCHARGED	
S2.001	71.2	0.577	0.000	1.16		113.1	SURCHARGED	
S2.002	71.3	0.543	0.000	1.30		120.3	SURCHARGED	
S1.004	70.5	0.703	0.000	2.06		429.8	FLOOD RISK	
S3.000	72.1	0.219	0.000	1.29		85.0	SURCHARGED	
S1.005	70.6	0.379	0.000	1.84		508.8	SURCHARGED	
S1.006	70.7	0.093	0.000	0.99		498.3	SURCHARGED	
S1.007	70.8	0.103	0.000	1.53		528.6	SURCHARGED	
S4.000	73.1	0.472	0.000	1.54		72.8	SURCHARGED	
S4.001	73.2	0.221	0.000	1.41		130.6	SURCHARGED	
S4.002	73.3	0.055	0.000	1.88		128.6	SURCHARGED	
S5.000	16	-0.144	0.000	0.01		0.6	OK	
S5.001	17	0.022	0.000	0.12		11.2	SURCHARGED	
S4.003	73.4	0.175	0.000	1.46		91.9	SURCHARGED	
S1.008	70.9	0.169	0.000	2.25		606.4	SURCHARGED	
S1.009	20	0.104	0.000	1.55		602.7	SURCHARGED	
S6.000	80.1	0.299	0.000	0.78		74.9	SURCHARGED	

100 year Return Period 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.
S6.001	80.2	15 Winter	100	+10%	30/15 Summer			
S6.002	80.3	15 Winter	100	+10%	100/15 Summer			
S6.003	80.4	15 Winter	100	+10%	100/15 Winter			
S6.004	80.5	15 Winter	100	+10%	100/15 Summer			
S1.010	OUTFALL MH	960 Winter	100	+10%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S6.001	80.2	67.519	0.367	0.000	1.43		138.6	SURCHARGED	
S6.002	80.3	67.084	0.118	0.000	1.23		174.3	SURCHARGED	
S6.003	80.4	66.808	0.020	0.000	0.94		158.5	SURCHARGED	
S6.004	80.5	66.743	0.043	0.000	1.25		153.4	SURCHARGED	
S1.010	OUTFALL MH	66.738	-0.162	0.000	0.04		22.7	OK	

Appendix G –Swale Design Calculations

CLIFTON SCANNELL EMERSON ASSOCIATES		Job No.	18_086
Project	Engine Node	Rev	1
Location		Date	08/07/2019
Element	SW Attenuation Catchment 3	Sh	1 of 3
CALC BY	CD	Checked By	PF

Clifton Scannell Emerson
Associates

Storm Return Period	100	Years
Total Site Area	0.16	Hectares (Ha)
PIMP	100	%

Total Impermeable Area 0.16 Hectares

Allowable Outflow (QBAR) = 0.00108 (AREA$^{\wedge 0.89}$)*(SAAR$^{\wedge 0.89}$)*(SOIL$^{\wedge 2.17}$)

AREA	50	Hectares		
AREA	0.5	Km^2		
SAAR	815	see Met Eireann DATA		
SOIL	0.45	Sandy / Silty Gravels / Clays (SOIL TYPE 3) - See Table D1 of Appendix D of Volume 2 of GDSDS		
QBAR	0.26	m^3/s	for 50 hectares	
QBAR	0.005	m^3/s/ha	5.25	l/s/ha
QBAR	0.001	m^3/s	for Total Catchment Area	
QBAR	0.84	l/s	for Total Catchment Area	

Duration	**Rainfall**	**Climate**	**Intensity**	**Area**	**Discharge**	**Runoff**	**Allowable**	**Storage**
	100m Year	**Change**	**I**	**A**	**Q = 2.78*C*I*A)**	**Volume**	**Outflow**	**Required**
	(mm)	**10%**	**(mm/hr)**	**(Ha)**	**(l/s)**	**(m^3)**	**(m^3)**	**(m^3)**
5	13	1.1	156.00	0.16	76.33	22.898	0.252	22.646
10	18.1	1.1	108.60	0.16	53.14	31.881	0.504	31.378
15	21.3	1.1	85.20	0.16	41.69	37.518	0.756	36.762
30	26.4	1.1	52.80	0.16	25.83	46.501	1.512	44.990
60	32.6	1.1	32.60	0.16	15.95	57.422	3.023	54.399
120	40.3	1.1	20.15	0.16	9.86	70.985	6.047	64.938
180	45.6	1.1	15.20	0.16	7.44	80.320	9.070	71.250
240	49.8	1.1	12.45	0.16	6.09	87.718	12.093	75.625
360	56.4	1.1	9.40	0.16	4.60	99.343	18.140	81.203
540	63.9	1.1	7.10	0.16	3.47	112.554	27.210	85.344
720	**69.8**	**1.1**	**5.82**	**0.16**	**2.85**	**122.946**	**36.280**	**86.666**
1080	79	1.1	4.39	0.16	2.15	139.151	54.420	84.731
1440	86.2	1.1	3.59	0.16	1.76	151.833	72.560	79.274
2880	98.3	1.1	2.05	0.16	1.00	173.146	145.120	28.027

Swale Volume Available	**89.65**	**m^3**	See Sheet 3
Volume Required	**86.67**	**m^3**	
Capacity	**Okay**		

CLIFTON SCANNELL EMERSON ASSOCIATES		Job No.	18_086
Project	Engine Node	Rev	1
Location		Date	08/07/2019
Element	SW Attenuation Catchment 3	Sh	2 of 3
CALC BY	CD	Checked By	PF

Clifton Scannell Emerson
Associates

Swale Calcualtions (Section 1 - 4m wide Swale)

Mannings Equation Q = 1/n*A*(R^2/3)*(S^1/2)

Where

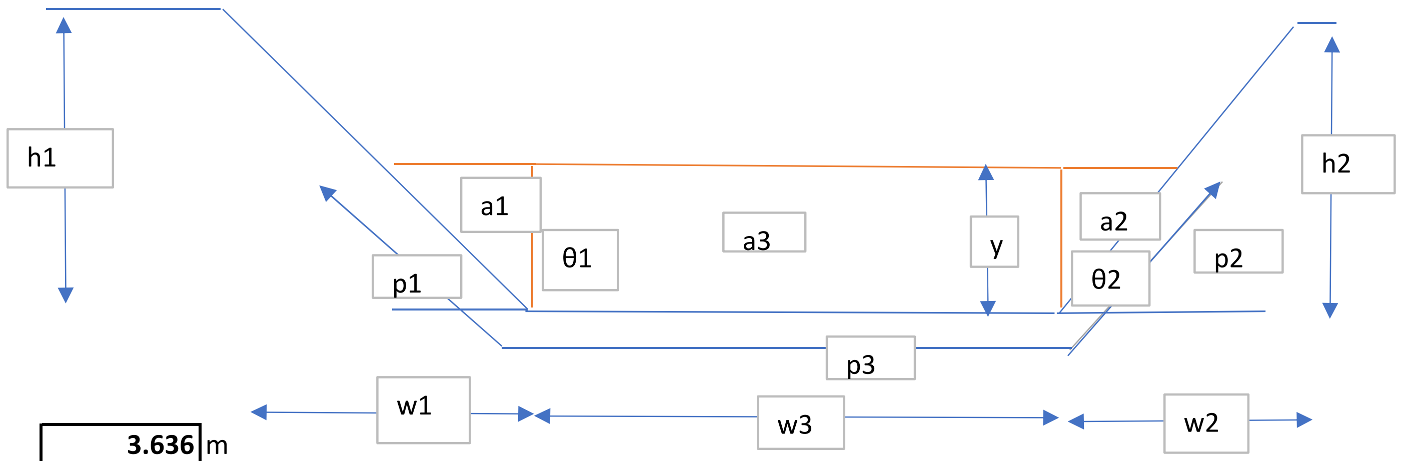
n = Mannings Co-efficient = 0.030

A = AREA (m2)

R = Hydraulic Radius (A/P)

P = Wetted Permitted (m)

S = Longitudinal Slope (Based on adjacent Bed Levels (BL1 and BL2)



n	**0.030**					
y	0.500	m				
w	1.400	m				
h1	0.650	m				
h2	0.650	m				
w1	1.300	m				
w2	1.300	m				
θ1	63.435					
θ2	63.435					
Tan θ1	2.000					
Tan θ2	2.000		**P**	**3.636**	m	
a1	0.250	m^2	R	0.330		
a2	0.250	m^2	BL1	70.425	@	35
a3	0.700	m^2	BL2	70.188	@	82
A	**1.200**	m^2	L	47.000	m	
p1	1.118	m	**S**	**0.005**		
p2	1.118	m	**Q**	**1.356**		
p3	1.400	m	**V**	**1.130**	m/s	
Volume Section 1	**56.4**	**m3**				

CLIFTON SCANNELL EMERSON ASSOCIATES		Job No.	18_086
Project	Engine Node	Rev	1
Location		Date	08/07/2019
Element	SW Attenuation Catchment 3	Sh	3 of 3
CALC BY	CD	Checked By	PF

Clifton Scannell Emerson
Associates

Swale Calcualtions (Section 2 - 3.5m wide swale (average))

Mannings Equation Q = 1/n*A*(R^2/3)*(S^1/2)

Where

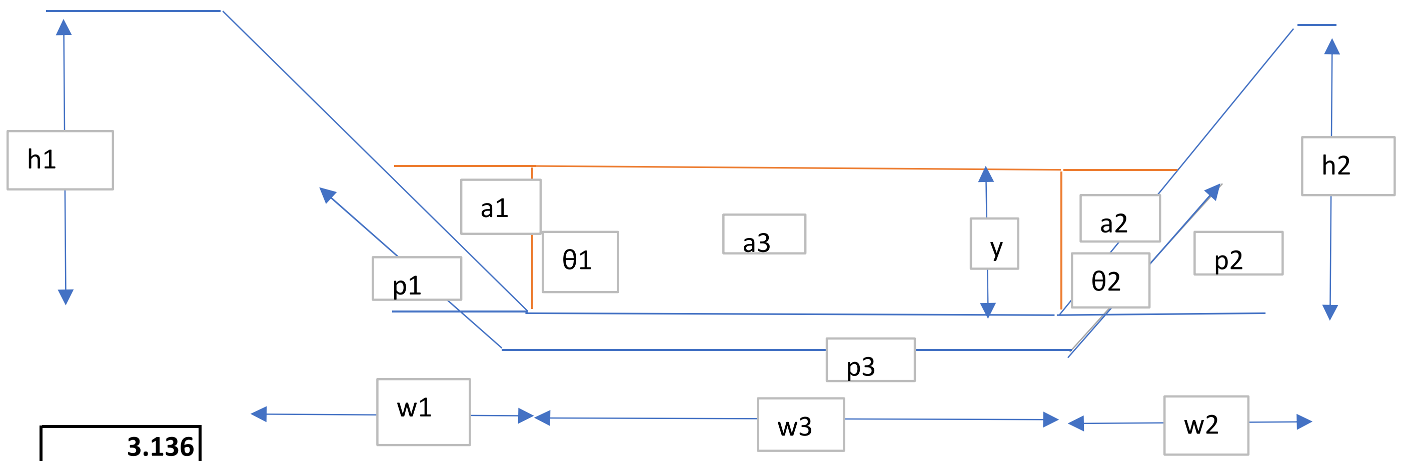
n = Mannings Co-efficient = 0.03

A = AREA (m2)

R = Hydraulic Radius (A/P)

P = Wetted Permitted (m)

S = Longitudinal Slope (Based on adjacent Bed Levels (BL1 and BL2)



n	**0.030**					
y	0.500	m				
w	0.900	m				
h1	0.650	m				
h2	0.650	m				
w1	1.300	m				
w2	1.300	m				
θ1	63.435					
θ2	63.435					
Tan θ1	2.000					
Tan θ2	2.000		**P**	**3.136**		
a1	0.250	m^2	R	0.303		
a2	0.250	m^2	BL1	70.718	@	0
a3	0.450	m^2	BL2	70.425	@	35
A	**0.950**	m^2	L	35.000	m	
p1	1.118	m	**S**	**0.008**		
p2	1.118	m	**Q**	**1.307**		
p3	0.900	m	**V**	**1.376**	m/s	
Volume Section 2	**33.25**	**m^3**				
Total Volume =	**89.65**	**m^3**				

Appendix H – Foul Water Drainage Calculations

CLIENT	EngineNode		**Project No.**	18_086		**Date:**	Revision
PROJECT	EngineNode					02/09/2019	PL
Description	Sanitary Water Flow Rate Calculation						
Reference	BS EN 12056-2:2000: "Gravity Drainage Systems Inside Buildings"						

Pipe No	**Location**	**WC (6L cistern)***	**WHB**	**Shower**	**Urinal**	**Sink**	**Dish Wash**	**Commercial Wash**	**Floor Drains (DN100)**	**Sub Total DU**	**Total DU**	**Cummulative Q l/s**
FF Office(k_{DU}) = 0.5**	**0.5**	**2**	**0.5**	**0.6**	**0.8**	**0.8**	**0.8**	**1.5**	**2**		**Discharge Units (DU)**	**Volume**
1.000	FMH1.0 to FMH1.3	11	13	2	2	2	1		12	57.7	57.7	3.8
1.003	FMH1.3 to FMH1.8	4	5	1	1	1	1		4	21.5	79.2	4.45
1.008	FMH1.8 to FMH1.11	8	9	2	2	2	1		8	41.7	120.9	5.5
7.000	FMH7.0 - FMH7.5	11	13	2	2	2	1		12	57.7	57.7	3.8
7.005	FMH7.5 - FMH7.6	11	13	2	2	2	1		12	57.7	115.4	5.38
7.006	FMH7.6 - FMH1.11	11	13	2	2	2	1		12	57.7	173.1	6.58
1.009	FMH1.12 - PS	0	0	0	0	0	0		0	0	294	8.58
	∑	56	66	11	11	11	6	0	60			

TITLE		Project Number	**_Revision_**	Date
Project	EngineNode	18_086	PL	02/09/2019
SUBJECT				

Sanitary Sewer Pipe Sizing Calculations

EN 12056 - 2 :2000 "Gravity Drainage Systems Inside Buildings"

Note:

k_s = 0.0015 m

Pipe Section	Dist (m)	Slope (1/X)	Piezo Gradient	Pipe Dia (mm)	Pipe Dia (m)	Flow (l/s)	Full Cap (l/s)	Adequate Capacity?	Full Vel (m/s)	Prop Discharge <0.8	Prop Vel (m/s)	Actual Vel (m/s)	Self Cleansing >0.75m/s? **	Notes
1.000	90.0	82.0	0.012	150.0	0.150	3.8	17.095	✓	0.97	0.22	0.77	0.75	✓	
1.003	90.0	96.0	0.010	150.0	0.150	4.5	15.791	✓	0.89	0.28	0.84	0.75	✓	
1.008	90.0	110.0	0.009	150.0	0.150	5.5	14.745	✓	0.83	0.37	0.90	0.75	✓	
7.000	90.0	82.0	0.012	150.0	0.150	3.8	17.095	✓	0.97	0.22	0.77	0.75	✓	
7.005	90.0	110.0	0.009	150.0	0.150	5.4	14.745	✓	0.83	0.36	0.90	0.75	✓	
7.006	90.0	125.0	0.008	150.0	0.150	6.6	13.826	✓	0.78	0.48	0.95	0.75	✓	
1.009	90.0	150.0	0.007	150.0	0.150	8.6	12.612	✓	0.71	0.68	1.07	0.77	✓	

Notes:

Proportional Discharge = Actual Discharge/Full Bore Discharge

Proportional Velocity = Actual Velocity/Full Bore Velocity

k_s = Pipe Roughness Factor

** BS EN 752 (9.6.3.1 Page 61)

CLIFTON SCANNELL EMERSON ASSOCIATES		Job No.	18_086
Project	Engine Node	Rev	1
Location	Co. Meath	Date	31/07/2019
Element	Foul Peak Flow Calculation		
CALC BY	CD	Checked By	PF

Calcualtion based in EN 12056-2:2000

Waste Water Flow Rate = Q_{ww} = K x SQRT(ΣDU)

K = Frequency Factor 0.5 (Office Use - Table 3 EN 12056)

ΣDU = Sum of Discharge Units

DU flow rate based on System I

Appliance	**Total No.**	**DU (l/s)**	**Total DU (l/s)**
WC (6l cistern*)	56	2	112
WHB	66	0.5	33
Shower	11	0.6	6.6
Urinal	11	0.8	8.8
Sink	11	0.8	8.8
Dishwasher	6	0.8	4.8
Floor Drains (DN 100)	60	2	120
		ΣDU	**294**
		Q_{ww}	**8.57** l/s

*Check cistern size with Building Services Designers

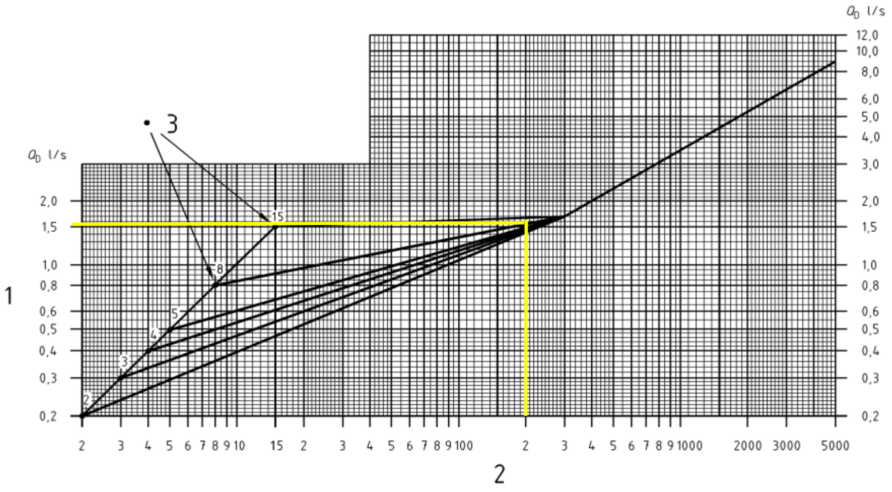
Appendix I –Water Supply Calculations

Project	**18-054 ENGINE NODE DATA CENTRE**
Title	Domestic Water Usage
Rev	Rev B
Date	25/07/2019
Author	SN

Callaghan Engineering
Consulting Engineers Project Managers

Item	**Quantity of items**	**EN 806 Loading Units**	**Total**
WHB	66	1.0	66.0
WC	56	1.0	56.0
Urinal	11	3.0	33.0
Sink	11	2.0	22.0
Shower	11	2.0	22.0
Dishwasher	6	1.0	6.0
Total LU			205.0
Flow rate (from EN 806 graph) (l/s)			1.5

EN 806-3:2006 (E)



Appendix J – IW PCE Form

Pre-connection enquiry form

Business developments, mixed use developments, housing developments

This form is to be filled out by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure. If completing this form by hand, please use BLOCK CAPITALS and black ink.

Please refer to the **Guide to completing the pre-connection enquiry form** on page 13 of this document when completing the form.

*** Denotes mandatory/ required field. Please note, if mandatory fields are not completed the application will be returned.**

Section A | Applicant details

1 *Applicant details:

Registered company name (if applicable): EngineNode Limited

Trading name (if applicable):

Company registration number (if applicable): 622594

If you are not a registered company/business, please provide the applicant's name:

*Contact name: Jason O'Connaill

*Postal address: 6-9 Trinity Street
Dublin 2

*Eircode: D02EY47

*Telephone: 0851746057

Mobile:

*Email: jason@enginenode.com

2 Agent details (if applicable):

Contact name: Conor Doherty

Company name (if applicable): CSEA

Postal address: Seafort Lodge,
Castledawson Ave. Blackrock
Co. Dublin

Eircode: A94P768

Telephone: 012885006

Email: conor.doherty@csea.ie

3 ***Please indicate whether it is the applicant or agent who should receive future correspondence in relation to the enquiry:**

Applicant ☐ Agent ☒

Section B | Site details

4 ***Site address:** Bracetown, Clonee
Co. Meath

5 ***Irish Grid co-ordinates of site:** Eastings (X) 302899 Northings (Y) 243141

Eg. co-ordinates of GPO, O'Connell St., Dublin: E(X) 315,878 N(Y) 234,619

6 ***Local Authority:**

Local Authority that granted planning permission (if applicable):

Meath County Council

7 ***Has full planning permission been granted?** Yes ☐ No ☒

If 'Yes', please provide the current or previous planning reference number:

Section C | Development details

8 **Please outline the domestic and/or industry/business use proposed:**

Property type	Number of units	Property type	Number of units	Property type	Number of units
House		Apartments		Agricultural	
Office	1	School		Retail unit	
Residential care home		Institution		Industrial unit	4
Hotel		Factory		Other	1
Other (please specify type)	Energy Centre				

9 ***Approximate start date of proposed development:** 01/11/2020

10 ***Is the development multi-phased?** Yes ☐ No ☒

If 'Yes', application must include a master-plan identifying the development phases and the current phase number.

If 'Yes', please provide details of variations in water demand volumes and wastewater discharge loads due to phasing requirements.

11 ***Please indicate the type of connection required by ticking the appropriate box below:**

Water ☐ Please go to Section D

Wastewater ☐ Please go to Section E

Both ☒ Please complete both Sections D and E

Section D | Water connection and demand details

12 ***Is there an existing connection to public water mains at the site?** Yes ☐ No ☒

12.1 If yes, is this enquiry for an additional connection to one already installed? Yes ☐ No ☐

12.2 If yes, is this enquiry to increase the size of an existing connection? Yes ☐ No ☐

13 **Approximate date water connection is required:** 01/11/2020

14 ***What diameter of water connection is required to service the development?** 250 mm

15 ***Is more than one connection required to the public infrastructure to service this development?** Yes ☒ No ☐

If 'Yes', how many? 2

16 **Please indicate the business water demand (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak hour water demand	1.5	**l/s**
Post-development average hour water demand	0.12	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

17 **Please indicate the industrial water demand (industry-specific water requirements):**

Post-development peak hour water demand	97.21	**l/s**
Post-development average hour water demand	16.5	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

18 **What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?**

71.25 m

19 **What is the highest finished floor level of the proposed development above Malin Head Ordnance Datum?**

71.10 m

20 **Is on-site water storage being provided?** Yes ☒ No ☐

Please include calculations on the attached sheet provided.

21 **Are there fire flow requirements?** Yes ☐ No ☒

Additional fire flow requirements over and above those identified in Q16-17	fire water will be a pumped hydrant main and sprinkler mains with storage onsit	**l/s**

Please include calculations on the attached sheet provided, and include confirmation of requirements from the Fire Authority.

22 **Do you propose to supplement your potable water supply from other sources?** Yes ☐ No ☒

If 'Yes', please indicate how you propose to supplement your potable water supply from other sources (see **Guide to completing the application form** on page 12 of this document for further details):

Section E | Wastewater connection and discharge details

23 ***Is there an existing connection to a public sewer at the site?** Yes ☐ No ☒

23.1 If yes, is this enquiry for an additional connection to the one already installed? Yes ☐ No ☐

23.2 If yes, is this enquiry to increase the size of an existing connection? Yes ☐ No ☐

24 ***Approximate date that wastewater connection is required:** 01/11/2020

25 ***What diameter of wastewater connection is required to service the development?** 80 mm

26 ***Is more than one connection required to the public infrastructure to service this development?** Yes ☐ No ☒

If 'Yes', how many?

27 **Please indicate the commercial wastewater hydraulic load (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak discharge	8.57	**l/s**
Post-development average discharge	0.14	**l/s**

Please include calculations on the attached sheet provided.

28 **Please indicate the industrial wastewater hydraulic load (industry-specific discharge requirements):**

Post-development peak discharge	0	**l/s**
Post-development average discharge	0	**l/s**

Please include calculations on the attached sheet provided.

29 **Wastewater organic load:**

Characteristic	Max concentration (mg/l)	Average concentration (mg/l)	Maximum daily load (kg/day)
Biochemical oxygen demand (BOD)	925	470	11.61
Chemical oxygen demand (COD)	1748	888	21.85
Suspended solids (SS)	531	293	6.64
Total nitrogen (N)	95.7	55	1.19
Total phosphorus (P)	13.16	8.21	0.17
Other			

Temperature range	10-15 deg C
pH range	6.73 - 8.01

30 ***Storm water run-off will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer. In the case of such brownfield sites, please indicate if the development intends discharging surface water to the combined wastewater collection system:**

Yes ☐ No ☒

If 'Yes', please give reason for discharge and comment on adequacy of SUDS/attenuation measures proposed.

31 ***Do you propose to pump the wastewater?** Yes ☒ No ☐

If 'Yes', please include justification for your pumped solution with this application.

32 **What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?**

71.25 m

33 **What is the lowest finished floor level on site above Malin Head Ordnance Datum?** 68.60 m

34 **What is the proposed invert level of the pipe exiting the property to the public road?**

69.90 m

Section F | Supporting documentation

Please provide the following additional information (all mandatory):

- \> Site location map: A site location map to a scale of 1:1000, which clearly identifies the land or structure to which the enquiry relates. The map shall include the following details: ☒
  - i. The scale shall be clearly indicated on the map.
  - ii. The boundaries shall be delineated in red.
  - iii. The site co-ordinates shall be marked on the site location map.
- \> Details of planning and development exemptions (if applicable). ☒
- \> Calculations (calculation sheets provided below). ☒
- \> Site layout map to a scale of 1:500 showing layout of proposed development, water network and wastewater network layouts, additional water/wastewater infrastructure if proposed, connection points to Irish Water infrastructure. ☒
- \> Conceptual design of the connection asset from the proposed development to the existing Irish Water infrastructure, including service conflicts, gradients, pipe sizes and invert levels. ☒
- \> Any other information that might help Irish Water assess this pre-connection enquiry. ☒

Section G | Declaration

I/We hereby make this application to Irish Water for a water and/or wastewater connection as detailed on this form.

I/We understand that any alterations made to this application must be declared to Irish Water.

The details that I/we have given with this application are accurate.

I/We have enclosed all the necessary supporting documentation.

Any personal data you provide will be stored and processed by Irish Water and may be transferred to third parties for the purposes of the water and/or wastewater connection process. I hereby give consent to Irish Water to store and process my personal data and to transfer my personal data to third parties, if required, for the purposes of the connection process.

If you wish to revoke consent at any time or wish to see Irish Water's full Data Protection Notice, please see **https://www.water.ie/privacy-notice/**

Signature:

Date: 31 / 07 / 2019

Your full name (in BLOCK CAPITALS):

CONOR DOHERTY

Irish Water will carry out a formal assessment based on the information provided on this form.
Any future connection offer made by Irish Water will be based on the information that has been provided here.

Please submit the completed form to **newconnections@water.ie** or alternatively, post to:

Irish Water
PO Box 860
South City Delivery Office
Cork City

Please note that if you are sending us your application form and any associated documentation by email, the maximum file size that we can receive in any one email is 35MB.

Please note, if mandatory fields are not completed the application will be returned.

Irish Water is subject to the provisions of the Freedom of Information Act 2014 (“FOIA”) and the codes of practice issued under FOIA as may be amended, updated or replaced from time to time. The FOIA enables members of the public to obtain access to records held by public bodies subject to certain exemptions such as where the requested records may not be released, for example to protect another individual’s privacy rights or to protect commercially sensitive information. Please clearly label any document or part thereof which contains commercially sensitive information. Irish Water accepts no responsibility for any loss or damage arising as a result of its processing of freedom of information requests.

Calculations

Water demand

DOMESTIC WATER

The peak domestic water calculation is based on a the calculation method in EN 806 based on loading units for the site draw off points.

Detailed calculation sheets provided separately.

The average flow rate is calculated based on the average daily water consumption divided by the number of seconds in the day.

Consumption is based on a population of 245 persons on site and a demand of 45 litres per person per day (Based on Office Factory as per Section 3.28 IW-CDS-5020-03) over a 24 hour period.

Average Demand = 245 x 45 / 24 x 60 x 60 = 0.12 l/s

INDUSTRIAL WATER

The industrial water peak flow rate occurs when all evaporative coolers in AHUs and CRAH units call for cooling on a hot summers day when the temperature is above 25 degress Celsius. This peak flow rate will occur for an estimated time of 20 minutes and then drop off to an estimated for rate of 60.52 l/s. On a peak day it is estimated that the system will operate at 60.52 l/s for 6 hours.

Detailed calculation sheets provided separately.

On-site storage

Each building will have a domestic water storage tank based on an occupancy of 45 people. 24 hour storage will be provided based on a water usage rate of 45 l/s/person. This equates to 2,025 litres storage per building. (4 No. data centre, 1 No. Energy centre)

Each data centre will have an evaporative cooling water storage tank sized to cater for peak 24 hour period. This will equate to 350m³ of storage per building.

Fire flow requirements

Fire water will be stored and pumped on site and consist of:

1 no. site wide pumped hydrant main also serving the spinkler for the energy centre.

Each data centre (4 No. in total) building will have a dedicated fire water storage a pumped sprinkler main.

Foul wastewater discharge

The peak domestic foul wastewater calculation is based on a the calculation method in EN 12056-2 based on loading units for the site discharge points.

Detailed calculation sheets provided separately.

Average wastewater flow is based on a population of 245 persons on site and a wastewater flow rate of 50 litres per person per day (Based on Office Factory without Canteen as per Appendix D of IW-CDS-5030-03) over a 24 hour period.

Average Flow = 245 x 50 / 24 x 60 x 60 = 0.14 l/s

Following consultation with Meath County Council the following is proposed in relation to the wastewater outfall from the site:-

- Divert existing 140mm dia foul rising main which connects the Takeda Biologics (Shire) plant at Pace, Dunboyne Co. Meath with the 9C Trunk Sewer at Damastown, Dublin 15 to a new intermediate pumping station on the Engine Node Site.
-Provide storage with capacity for Takeda Biologics (Shire), the existing Bracetown Business Park (currently served by on-site treatment), Engine Node and the existing Hub Logistics park to the north of the Engine Node site. See drawing ENGNE-CSE-00-XX-DR-C-1020 for overview.
- Connect rising main from site to existing 140mm dia foul rising main.

The preliminary assessment of required 24 hour storage volume is as follows:-

-Takeda Biologics (Shire) = 461 m3 (Based on EPA Licence)
-Engine Node = 12.25 m3 (Based on 245 person @50 litres/head/day)
-Bracetown Business Park = 10m3 (Based on existing WWTP on site with 10% allowance for future expansion)
-The HUB Logistics Park (Estimate) = 12.5m3 (Based on 0.15 l/s/ha for a Gross Site Area of 2.4 ha with 10% allowance for infiltration and 10% allowance for future expansion (0.15 litres x 2.4 ha x 1.1 x 1.1 x 24/3 x 60 x 60 /1000 =>12.5m3 (24 hour storage divided by factor of 3 as per Section 3.6 of IW-CDS-5030-03)).
Total = 461+12.25+10+12.5 => 495.75 ~ 500 m3

Flow Rate
-Takeda Biologics = Max 20m3/hour (Based on EPA Licence)
-Engine Node = 1 DWF = 0.5m3/hour => 3 DWF = 1.5m3/hour
-Bracetown Business Park = 1 DWF = 0.42m3 /hour => 3 DWF = 1.25m3/hour
-The HUB Logistics Park (Estimate) = 1 DWF = 0.5m3 /hour => 3 DWF = 1.5m3/hour
-Total = 24.25m3/hour ~ 7 litres / sec

Guide to completing the pre-connection enquiry form

This form should be completed by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure.

The Irish Water Codes of Practice are available at **www.water.ie** for reference.

Section A | Applicant Details

Question 1: This question requires the applicant or company enquiring about the feasibility of a connection to identify themselves, their postal address, and to provide their contact details.

Question 2: If the applicant has employed a consulting engineer or an agent to manage the enquiry on their behalf, the agent's address and contact details should be recorded here.

Question 3: Please indicate whether it is the applicant or the agent who should receive future correspondence in relation to the enquiry.

Section B | Site details

Question 4: This is the address of the site requiring the water/wastewater service connection and for which this enquiry is being made.

Question 5: Please provide the Irish Grid co-ordinates of the proposed site. Irish grid positions on maps are expressed in two dimensions as Eastings (E or X) and Northings (N or Y) relative to an origin. You will find these coordinates on your Ordnance Survey map which is required to be submitted with an application.

Question 6: Please identify the Local Authority that is or will be dealing with your planning application, for example Cork City Council.

Question 7: Please indicate if planning permission has been granted for this application, and if so, please provide the planning permission reference number.

Section C | Development details

Question 8: Please specify the number of different property/premises types by filling in the tables provided.

Question 9: Please indicate the approximate commencement date of works on the development.

Question 10: Please indicate if a phased building approach is to be adopted when developing the site. If so, please provide details of the phase master-plan and the proposed variation in water demand/wastewater discharge as a result of the phasing of the development.

Question 11: Please indicate the type of connection required by ticking the appropriate box and proceed to complete the appropriate section or sections.

Section D | Water connection and demand details

Question 12: Please indicate if a water connection already exists for this site.

Question 12.1: Please indicate if this enquiry concerns an additional connection to one already installed on the site.

Question 12.2: Please indicate if you are proposing to upgrade the water connection to facilitate an increase in water demand. Irish Water will determine what impact this will have on our infrastructure.

Question 13: Please indicate the approximate date that the proposed connection to the water infrastructure will be required.

Question 14: Please indicate what diameter of water connection is required to service this development.

Question 15: Please indicate if more than one connection is required to service this development. Please note that the connection size provided may be used to determine the connection charge.

Question 16: If this connection enquiry concerns a business premises, please provide calculations for the water demand and include your calculations on the calculation sheet provided. Business premises include shops, offices, hotels, schools, etc. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 17: If this connection enquiry is for an industrial premises, please calculate the water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak demand for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 18: Please specify the ground level at the location where connection to the public water mains will be made. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 19: Please specify the highest finished floor level on site. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 20: If storage is required, water storage capacity of 24-hour water demand must usually be provided at the proposed site. In some cases, 24-hour storage capacity may not be required, for example 24-hour storage for a domestic house would be provided in an attic storage tank. Please calculate the 24-hour water storage requirements and include your calculations on the attached sheet provided. Please also confirm that on-site storage is being provided by ticking the appropriate box.

Question 21: The water supply system shall be designed and constructed to reliably convey the water flows that are required of the development including fire flow requirements by the Fire Authority. The Fire Authority will provide the requirement for fire flow rates that the water supply system will have to carry. Please note that while flows in excess of your required demand may be achieved in the Irish Water network and could be utilised in the event of a fire, Irish Water cannot guarantee a flow rate to meet your fire flow requirement. To guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development. Please include your calculations on the attached sheet provided, and further provide confirmation of the Fire Authority requirements.

Question 22: Please identify proposed additional water supply sources, that is, do you intend to connect to the public water mains or the public mains and supplement from other sources? If supplementing public water supply with a supply from another source, please provide details as to how the potable water supply is to be protected from cross contamination at the premises.

Section E | Wastewater connection and discharge details

Question 23: Please indicate if a wastewater connection to a public sewer already exists for this site.

Question 23.1: Please indicate if this enquiry relates to an additional wastewater connection to one already installed.

Question 23.2: Please indicate if you are proposing to upgrade the wastewater connection to facilitate an increased discharge. Irish Water will determine what impact this will have on our infrastructure.

Question 24: Please specify the approximate date that the proposed connection to the wastewater infrastructure will be required.

Question 25: Please indicate what diameter of wastewater connection is required to service this development.

Question 26: Please indicate if more than one connection is required to service this development. Please indicate number required.

Question 27: If this enquiry relates to a business premises, please provide calculations for the wastewater discharge and include your calculations on the attached sheet provided. Business premises include shops, offices, hotels, schools, etc. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 28: If this enquiry relates to an industrial premises, please provide calculations for the wastewater discharge and include your calculations on the calculation sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak discharge for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 29: Please specify the maximum and average concentrations and the maximum daily load of each of the wastewater characteristics listed in the wastewater organic load table (if not domestic effluent), and also specify if any other significant concentrations are expected in the effluent. Please complete the table and provide additional supporting documentation if relevant. Note that the concentration shall be in mg/l and the load shall be in kg/day. Note that for business premises (shops, offices, schools, hotels, etc.) for which only domestic effluent will be discharged (excluding discharge from canteens/ restaurants which would require a Trade Effluent Discharge licence), there is no need to complete this question.

Question 30: In exceptional circumstances, such as brownfield sites, where the only practical outlet for storm/ surface water is to a combined sewer, Irish Water will consider permitting a restricted attenuated flow to the combined sewer. Storm/surface water will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer and the applicant must demonstrate how the storm/surface water flow from the proposed site is minimised using sustainable urban drainage system (SUDS). This type of connection will only be considered on a case by case basis. Please advise if the proposed development intends discharging surface water to the combined wastewater collection system.

Question 31: Please specify if the development needs to pump its wastewater discharge to gain access to Irish Water infrastructure.

Question 32: Please specify the ground level at the location where connection to the public sewer will be made. This is required to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 33: Please specify the lowest floor level of the proposed development. This is required in order to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 34: Please specify the proposed invert level of the pipe exiting the property to the public road.

Section F | Supporting documentation

Please provide additional information as listed.

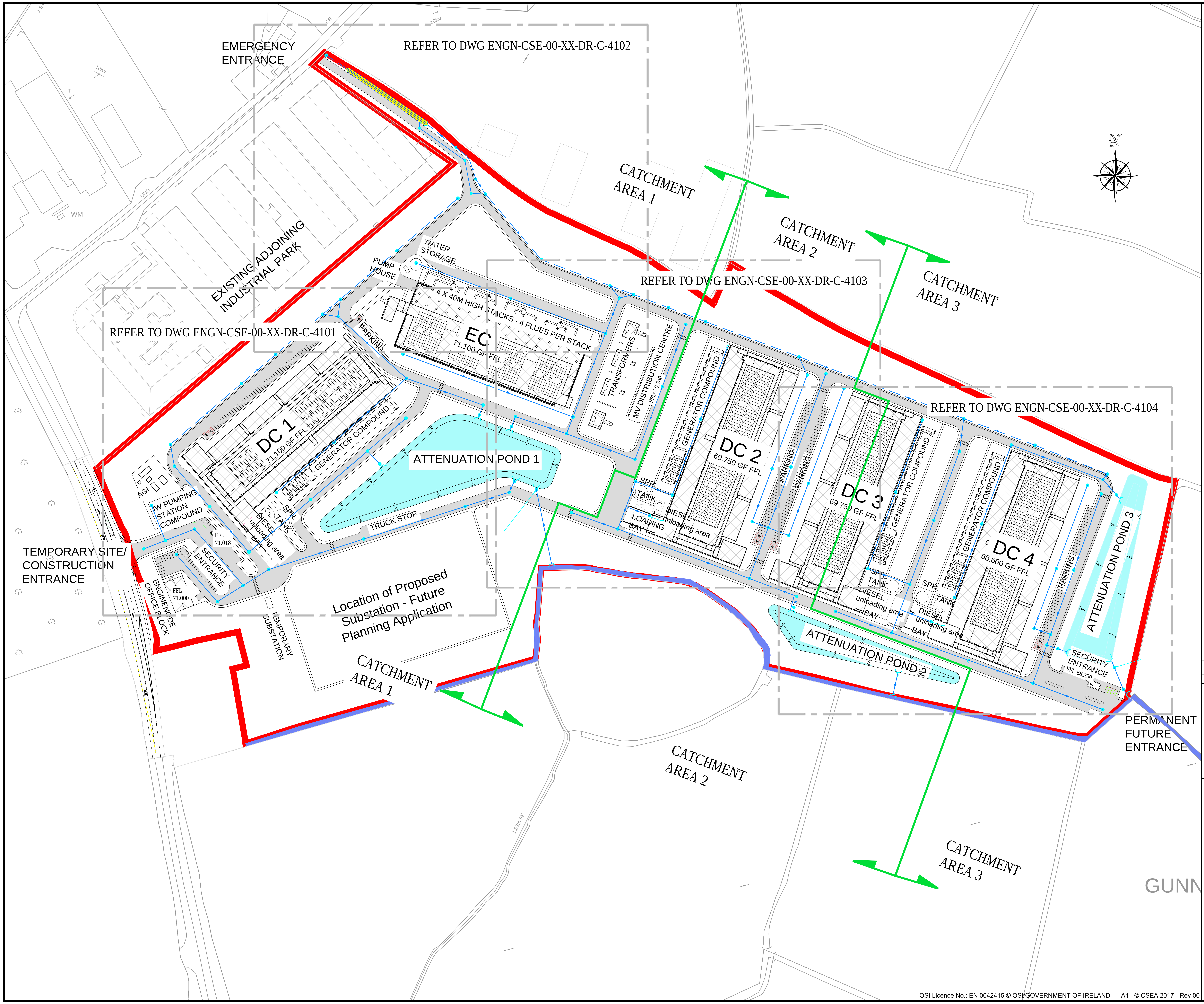
Section G | Declaration

Please review the declaration, sign, and return the completed application form to Irish Water by email or by post using the contact details provided in Section G.

Clifton Scannell Emerson Associates Limited, Civil & Structural Consulting Engineers
Seafort Lodge, Castledawson Avenue, Blackrock, Co. Dublin, Ireland.

T. +353 1 288 5006 F. +353 1 283 3466 E. info@csea.ie W. www.csea.ie

Appendix B – Proposed Site Drawings (subject to concurrent planning application)



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A1

LEGEND

PROPOSED ROAD LAYOUTS	▭
PROPOSED BUILDINGS	▨
PROPOSED ATTENUATION POND	🟦
PROPOSED SITE BOUNDARY	🟥
EXISTING WATERCOURSE	━
PROPOSED SW CARRIER DRAIN	→
PROPOSED SW FILTER DRAIN	- - →
PROPOSED SWALE	🟨
PROPOSED SW MANHOLE	●
PROPOSED SW HEADWALL	⟨

NOTE:

1. STORM DRAINAGE PIPES TO BE HDPE TWINWALL IN ACCORDANCE WITH EN13476. FOR PIPEWORK UP TO AND INCLUDING 375 mm dia.
2. PIPEWORK GREATER THAN 375 mm dia SHALL BE CONCRETE IN ACCORDANCE WITH IS 6:2004 AND EN 1916:2004.
3. ALL RAINWATER PIPES ARE 150 mm WELDED HDPE WITH 90° SLOW RADIUS BENDS SADDLED INTO MAIN SURFACE DRAIN.
4. ALL PIPEWORK FROM GULLIES TO PROPOSED STORM NETWORK ARE OMITTED FOR CLARITY. CONTRACTOR TO ALLOW FOR CONNECTIONS.
5. ALL PIPEWORK TO HAVE WARNING TAPE LAID 300mm ABOVE TOP OF PIPE.
6. PROPRIETARY FLOOR GULLIES TO FORM SEALED DRAINAGE CONNECTIONS TO AHU'S. DETAILS TO BE SUBMITTED FOR APPROVAL.
7. FOR ALL MANHOLE DETAILS, PIPELINE DETAILS, BEDDING HAUNCHING & SURROUND DETAILS, MANHOLE COVERS & FRAMES, ROAD GULLIES, TESTING & CLEANING OF DRAINS AND SEWER DIVERSIONS, REFER TO THE GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS. (AS OF FEBRUARY 2018) ALL PRECAST SURFACE WATER MANHOLES SHALL HAVE A MINIMUM THICKNESS SURROUND OF 150m CONCRETE CLASS B.

Revision	Description	Drw'n	Chk'd	Date
P01	ISSUED FOR PLANNING	ZS	CD	14/10/2019

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates Limited
Consulting Engineers,
Seafort Lodge,
Castledawson Avenue,
Blackrock, Co. Dublin,
Ireland.

T. +353 1 288 5006
F. +353 1 283 3466
E. info@csea.ie
W. www.csea.ie

ENGINENODE

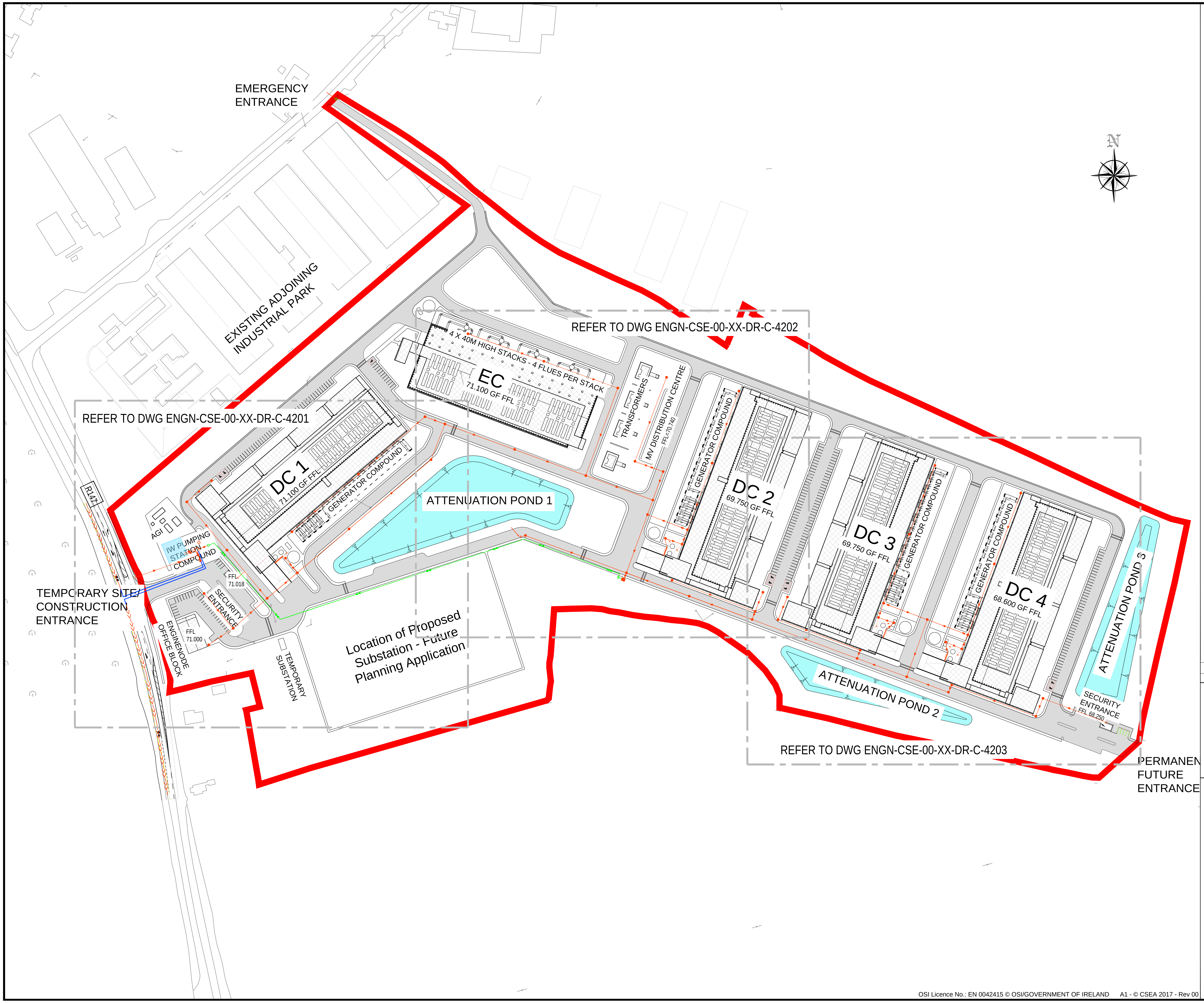
Project: ENGINENODE
CLONEE

Dwg. Title: OVERALL PROPOSED SURFACE WATER DRAINAGE LAYOUT

Drawn By: ZS
Date: 15/07/2019
Checked by: COD
Scale: 1:1500 @ A1

Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
ENGN	CSE	00	XX	DR	C	4100

Status Code: S2
Suitability Description: ISSUED FOR INFORMATION
Revision: PL01
Project Status: PLANNING
CSEA Job No.: 18_086



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LEGEND

PROPOSED ROAD LAYOUTS	▒
PROPOSED BUILDINGS	▨
PROPOSED SITE BOUNDARY	━
PROPOSED ATTENUATION POND	▒
PROPOSED FOUL SEWER LINE	─▶─
PROPOSED FOUL MANHOLE	─●─
PROPOSED FOUL PETROL INTERCEPTOR MANHOLE	─▥─
PROPOSED ACO DRAIN	ACO DRAIN
PROPOSED FOUL GULLY	RG
PROPOSED 80mmØ FOUL RISING MAIN	─▶▶─
PROPOSED STAND OFF MANHOLE.	▶▶─○
PROPOSED 140mmØ FOUL RISING MAIN CONNECTION	━
EXISTING 140mmØ FOUL RISING MAIN	–>>–>>–>>–>>–>>–>>–
PROPOSED ATTENUATION POND	▒
PROPOSED ATTENUATION POND	▨

NOTE:

1. WASTEWATER PIPEWORK SHALL COMPLY WITH SECTION 3.13 OF THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE (IW-C05-5030-03)
2. REFER TO DRAWING NO. ENGN-CSE-00-ZZ-DR-C-4940 FOR PUMPING STATION DETAILS
3. REFER TO DRAWING NO. ENGN-CSE-00-ZZ-DR-C-4912 FOR STANDARD TRENCH DETAILS

Revision	Description	Drw'n	Chk'd	Date
P01	ISSUED FOR PLANNING	ZS	CD	14/10/2019

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates Limited
Consulting Engineers,
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T. +353 1 288 5006
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E. info@csea.ie
W. www.csea.ie

ENGINENODE

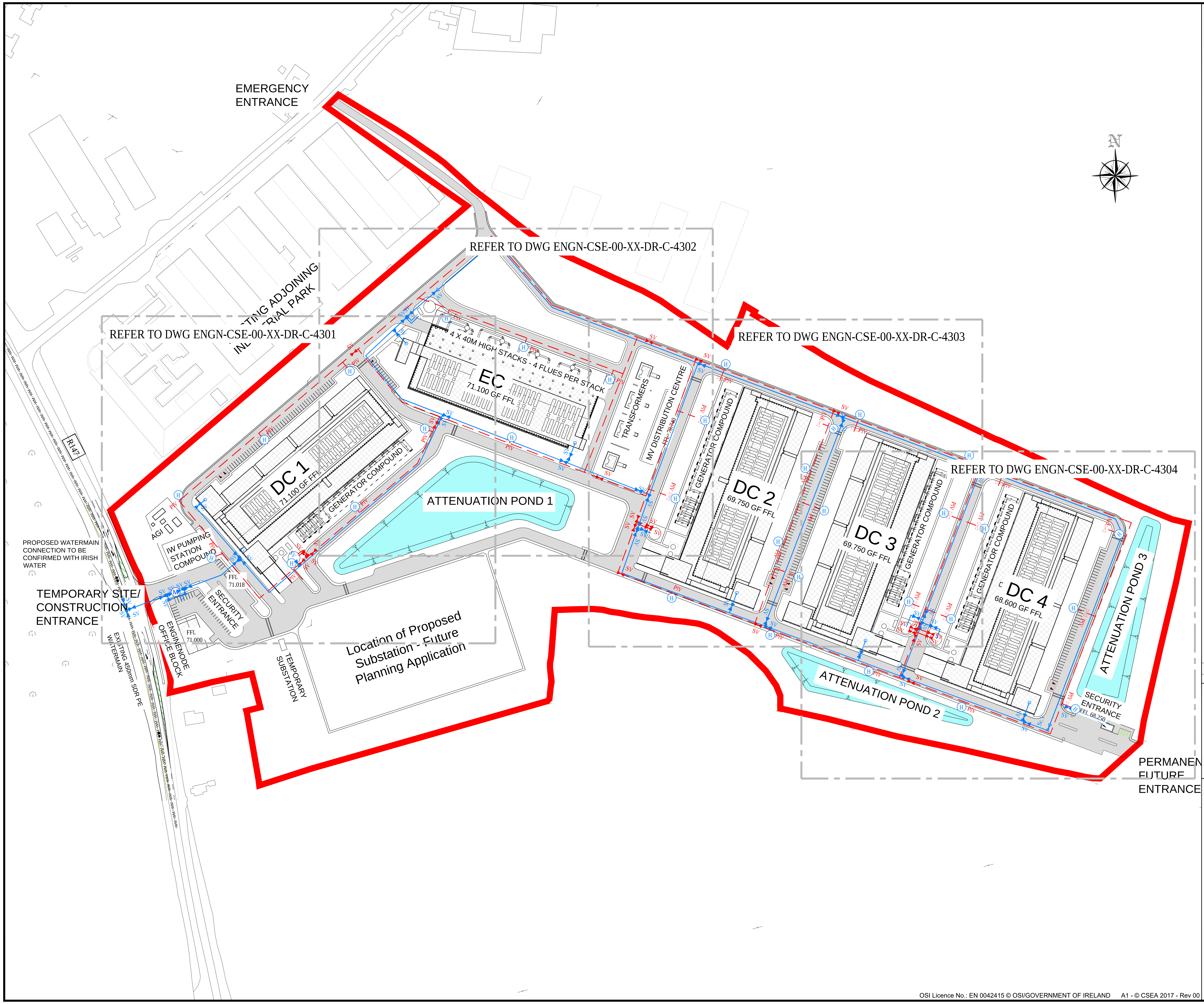
Project: ENGINENODE
CLONEE

Dwg. Title: OVERALL PROPOSED FOUL WATER
LAYOUT

Drawn By: ZS
Date: 15/07/2019
Checked by: COD
Scale: 1:1500 @ A1

Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
ENGN	- CSE -	00 -	XX -	DR -	C -	4200

Status Code: S2
Suitability Description: ISSUED FOR INFORMATION
Revision: P01
Project Status: PLANNING
CSEA Job No.: 18_086



A1

LEGEND

PROPOSED ROADS LAYOUT	▒
PROPOSED BUILDINGS	▨
PROPOSED SITE BOUNDARY	🟥
PROPOSED ATTENUATION POND	▭

NOTE:

1. Sprinkler pipes below ground to be to Fire Protection Designers Specification.

2. Above ground pipework to be non alloy steel tubes suitable for welding or threading. Painted Red RAL 3000. Work to EN 10255:2004.

3. All watermains shall be laid in accordance with Code of Practice for Water Infrastructure

4. All watermains shall comply with PAS 27:1999

5. Concrete thrust blocks to be installed at all bends, tees and cap end locations.

6. All New Watermains Supplies to be HDPE or MDPE (PE-80) Pipelines.

7. All pipework to have warning tape laid 300mm above top of pipe.

8. Drawing to be read in conjunction with M&E layouts. Any discrepancies to be notified to C.S.E.A for clarification prior to proceeding with works.

9. Refer to Drawing ENGN-CSE-00-XX-DR-C-4905 for typical Watermain Details.

10..Refer to Drawing ENGN-CSE-00-XX-DR-C-4904 for typical Trench Backfill Details.

Revision	Description	Drw'n	Chk'd	Date
P01	ISSUED FOR PLANNING	ZS	CD	14/10/2019

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ENGINENODE

Project: ENGINENODE
CLONEE

Dwg. Title: OVERALL PROPOSED WATERMAIN
LAYOUT

Drawn By: ZS
Date: 15/07/2019
Checked by: COD
Scale: 1:1500 @ A1

Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
ENGN	CSE	00	XX	DR	C	4300

Status Code: S2
Suitability Description: ISSUED FOR INFORMATION
Revision: P01
Project Status: PLANNING
CSEA Job No.: 18_086

Appendix C – Irish Water CoF

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

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Conor Doherty

Seafort Lodge
Castledawson Ave. Blackrock
Dublin
A94P768

29 May 2020

Re: CDS19006045 pre-connection enquiry - Subject to contract | Contract denied

Connection for Business Connection of 6 unit(s) at Bracetown, Clonee, Meath

Dear Sir/Madam,

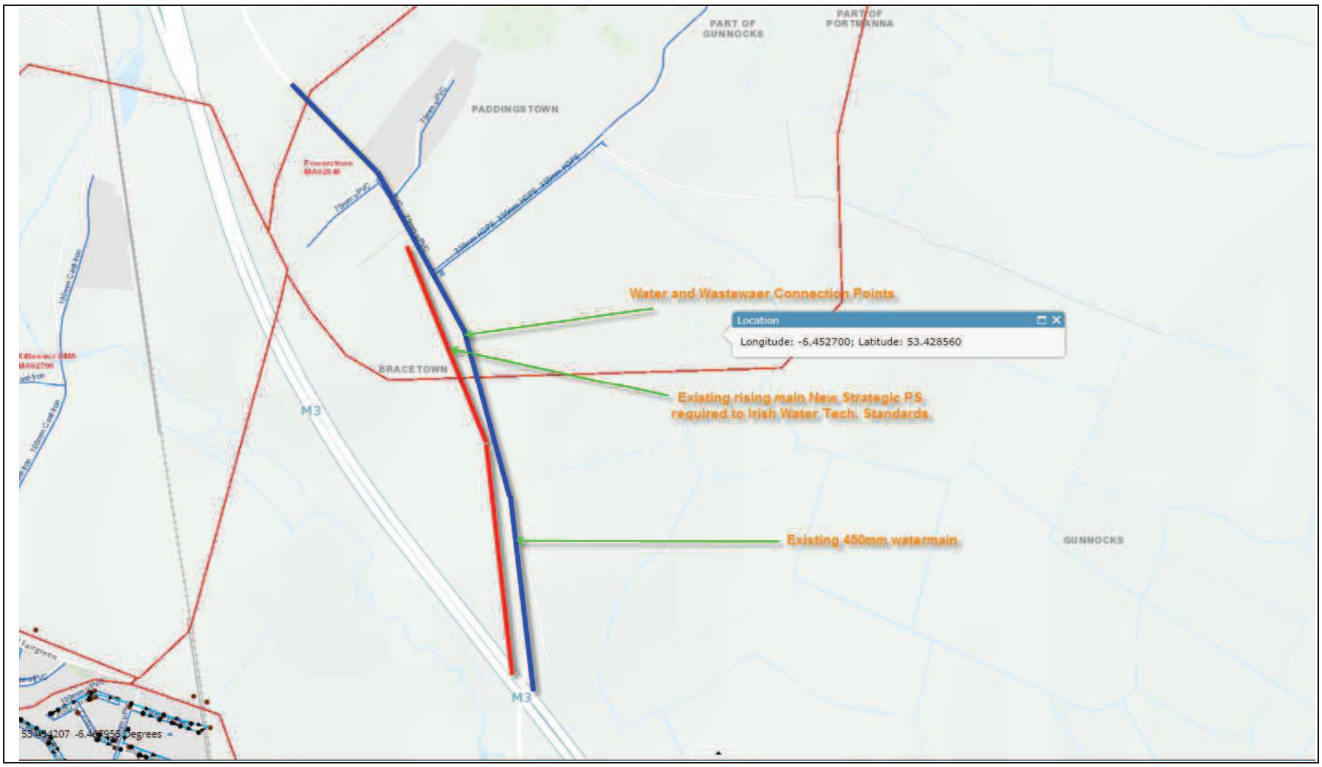
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Bracetown, Clonee, Meath (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrades by Irish Water
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	The connection offer for the entire 5 No. Building proposed development will be made limiting peak flow to 15.56l/s with an annual limit of 7673 m3 . Annual demand should not exceed 7673 m3 without consultation with Irish Water. 7673 m3 allows for: • Domestic Demand (3696 m3) • Industrial Demand (3977 m3) If the customer requires to refill their storage during a summer period or needs to go over their annual allowance, they should in the first instance contact Irish Water. It will be a requirement that a meter that can be hooked up to our telemetry system and a flow control valve are installed as part of the connection.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363
IW-HP-BUS
REV012

<table>
<tr><td>Wastewater Connection</td><td>A strategic pump station is required to serve the proposed development and catchment subject to an Agreement with Irish Water to be outlined prior to the connection application stage. Irish Water does not currently have any plans to carry out the works required.</td></tr>
<tr><td colspan="2">The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.</td></tr>
</table>

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

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

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Paul Fuller from the design team on 018230382 or email PFuller@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

M O'Dwyer

Maria O’Dwyer

Connections and Developer Services

Appendix D – Surface Water Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	17.800	Add Flow / Climate Change (%)	0
Ratio R	0.323	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.750
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.122	4-8	3.569	8-12	4.205	12-16	0.629

Total Area Contributing (ha) = 8.524

Total Pipe Volume (m³) = 530.762

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	51.577	0.172	299.9	0.276	5.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S3.001	25.093	0.084	298.7	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S4.000	19.881	0.066	300.0	0.032	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	44.46	5.95	69.445	0.276	0.0	0.0	0.0	0.90	63.8	33.2
S3.001	43.09	6.41	69.273	0.327	0.0	0.0	0.0	0.90	63.9	38.1
S4.000	46.34	5.37	69.700	0.032	0.0	0.0	0.0	0.90	63.8	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.000	35.356	0.118	300.0	0.115	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.001	27.383	0.091	300.9	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S4.002	60.062	0.200	300.3	0.124	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S3.002	25.151	0.056	450.0	0.083	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.003	82.609	0.184	450.0	0.152	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S6.000	86.037	0.191	450.0	0.230	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S6.001	30.330	0.067	452.7	0.105	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S7.000	86.165	0.191	451.1	0.144	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S6.002	17.094	0.038	450.0	0.120	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S8.000	88.659	0.197	450.0	0.227	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S6.003	8.806	0.020	450.0	0.216	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.004	87.772	0.146	600.0	0.099	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S9.000	38.102	0.102	373.5	0.129	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S5.000	45.40	5.65	69.750	0.115	0.0	0.0	0.0	0.90	63.8	14.1
S4.001	43.83	6.16	69.632	0.192	0.0	0.0	0.0	0.90	63.7	22.8
S4.002	40.82	7.27	69.541	0.316	0.0	0.0	0.0	0.90	63.8	34.9
S3.002	39.76	7.71	69.039	0.725	0.0	0.0	0.0	0.95	151.4	78.1
S3.003	36.71	9.16	68.983	0.877	0.0	0.0	0.0	0.95	151.4	87.2
S6.000	42.83	6.51	69.117	0.230	0.0	0.0	0.0	0.95	151.4	26.7
S6.001	41.41	7.04	68.926	0.335	0.0	0.0	0.0	0.95	150.9	37.6
S7.000	42.82	6.51	69.049	0.144	0.0	0.0	0.0	0.95	151.2	16.7
S6.002	40.65	7.34	68.858	0.599	0.0	0.0	0.0	0.95	151.4	66.0
S8.000	42.71	6.55	69.017	0.227	0.0	0.0	0.0	0.95	151.4	26.3
S6.003	40.28	7.49	68.820	1.043	0.0	0.0	0.0	0.95	151.4	113.8
S3.004	34.11	10.64	68.650	2.019	0.0	0.0	0.0	0.99	279.0	186.5
S9.000	45.30	5.68	69.159	0.129	0.0	0.0	0.0	0.93	102.9	15.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.001	38.959	0.104	375.0	0.123	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S9.002	40.673	0.108	375.0	0.047	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S10.000	38.187	0.102	374.4	0.141	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S9.003	11.969	0.032	375.0	0.160	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S9.004	10.878	0.029	375.0	0.034	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S3.005	38.209	0.076	500.0	0.065	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S3.006	9.872	0.020	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S3.007	16.960	0.034	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S11.000	76.899	0.171	450.0	0.521	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S11.001	17.089	0.038	450.0	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S11.002	44.455	0.099	450.0	0.210	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S11.003	49.696	0.110	450.0	0.172	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S11.004	66.906	0.149	450.0	0.156	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S11.005	62.002	0.124	500.0	0.143	0.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S12.000	41.629	0.111	375.0	0.162	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S11.006	14.829	0.028	529.6	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S9.001	43.19	6.38	69.057	0.252	0.0	0.0	0.0	0.93	102.7	29.5
S9.002	41.23	7.11	68.953	0.299	0.0	0.0	0.0	0.93	102.7	33.4
S10.000	45.30	5.68	68.947	0.141	0.0	0.0	0.0	0.93	102.8	17.3
S9.003	40.69	7.32	68.845	0.601	0.0	0.0	0.0	0.93	102.7	66.2
S9.004	40.21	7.52	68.813	0.635	0.0	0.0	0.0	0.93	102.7	69.2
S3.005	33.20	11.23	68.504	2.719	0.0	0.0	0.0	1.08	306.0	244.5
S3.006	32.98	11.38	68.428	2.719	0.0	0.0	0.0	1.08	306.0	244.5
S3.007	32.60	11.64	68.408	2.719	0.0	0.0	0.0	1.08	306.0	244.5
S11.000	43.29	6.35	69.267	0.521	0.0	0.0	0.0	0.95	151.4	61.1
S11.001	42.45	6.65	69.096	0.590	0.0	0.0	0.0	0.95	151.4	67.9
S11.002	40.44	7.42	69.058	0.800	0.0	0.0	0.0	0.95	151.4	87.6
S11.003	38.46	8.29	68.959	0.972	0.0	0.0	0.0	0.95	151.4	101.2
S11.004	36.33	9.36	68.774	1.128	0.0	0.0	0.0	1.05	227.2	111.0
S11.005	34.51	10.40	68.652	1.270	0.0	0.0	0.0	0.99	215.4	118.7
S12.000	45.10	5.75	68.925	0.162	0.0	0.0	0.0	0.93	102.7	19.8
S11.006	34.09	10.65	68.528	1.433	0.0	0.0	0.0	0.97	209.2	132.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.007	128.614	0.100	1286.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S13.000	66.564	0.222	299.8	0.136	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S13.001	62.672	0.179	350.1	0.215	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S13.002	12.828	0.034	377.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S14.000	51.225	0.137	373.9	0.379	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S14.001	11.430	0.030	375.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S13.003	76.069	0.190	400.4	0.171	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S15.000	63.020	0.140	450.0	0.266	5.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S15.001	79.775	0.112	712.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S13.004	67.190	0.140	479.9	0.420	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S13.005	8.730	0.020	436.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔓
S13.006	70.784	0.100	707.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S16.000	30.634	0.082	373.6	0.048	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S16.001	71.701	0.191	375.4	0.224	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S16.002	64.030	0.142	450.9	0.272	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S16.003	9.527	0.021	453.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.007	29.45	14.13	68.450	1.433	0.0	0.0	0.0	0.62	133.3	132.3
S13.000	43.63	6.23	69.585	0.136	0.0	0.0	0.0	0.90	63.8	16.0
S13.001	40.71	7.31	69.288	0.350	0.0	0.0	0.0	0.96	106.3	38.6
S13.002	40.15	7.54	69.109	0.350	0.0	0.0	0.0	0.93	102.4	38.6
S14.000	44.56	5.92	69.800	0.379	0.0	0.0	0.0	0.93	102.8	45.7
S14.001	43.94	6.12	69.663	0.379	0.0	0.0	0.0	0.93	102.7	45.7
S13.003	37.10	8.95	69.075	0.900	0.0	0.0	0.0	0.90	99.3	90.4
S15.000	44.00	6.10	69.322	0.266	0.0	0.0	0.0	0.95	151.4	31.7
S15.001	39.40	7.87	69.182	0.266	0.0	0.0	0.0	0.75	119.9	31.7
S13.004	35.23	9.97	68.660	1.585	0.0	0.0	0.0	1.10	312.4	151.2
S13.005	35.01	10.09	68.520	1.585	0.0	0.0	0.0	1.16	327.7	151.2
S13.006	32.96	11.39	68.450	1.585	0.0	0.0	0.0	0.91	256.6	151.2
S16.000	45.46	5.63	69.684	0.048	0.0	0.0	0.0	0.81	57.1	6.0
S16.001	41.72	6.92	69.527	0.272	0.0	0.0	0.0	0.93	102.6	30.8
S16.002	39.01	8.04	69.261	0.544	0.0	0.0	0.0	0.95	151.2	57.5
S16.003	38.64	8.21	69.119	0.544	0.0	0.0	0.0	0.95	150.8	57.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S17.000	32.276	0.108	298.9	0.104	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S17.001	10.407	0.035	297.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S16.004	31.398	0.070	448.5	0.087	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S18.000	83.500	0.167	500.0	0.519	5.00	0.0	0.600	o	525	Pipe/Conduit	🔒
S18.001	83.500	0.167	500.0	0.358	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S16.005	73.956	0.123	600.0	0.220	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S19.000	74.921	0.200	374.6	0.208	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S19.001	74.921	0.200	374.6	0.217	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S16.006	14.850	0.025	594.0	0.059	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
S20.000	55.222	0.158	350.0	0.167	5.00	0.0	0.600	o	375	Pipe/Conduit	🔒
S20.001	64.122	0.183	350.4	0.188	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S20.002	60.444	0.173	350.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
S16.007	44.617	0.059	756.2	0.116	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒
S16.008	8.824	0.021	420.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S17.000	45.58	5.59	69.400	0.104	0.0	0.0	0.0	0.90	63.9	12.8
S17.001	44.97	5.79	69.292	0.104	0.0	0.0	0.0	0.91	64.1	12.8
S16.004	37.49	8.76	69.098	0.735	0.0	0.0	0.0	0.95	151.6	74.6
S18.000	43.14	6.40	69.295	0.519	0.0	0.0	0.0	0.99	215.4	60.6
S18.001	39.56	7.80	69.128	0.877	0.0	0.0	0.0	0.99	215.4	94.0
S16.005	34.98	10.12	68.953	1.832	0.0	0.0	0.0	0.91	196.4	173.5
S19.000	43.30	6.34	69.380	0.208	0.0	0.0	0.0	0.93	102.7	24.4
S19.001	39.82	7.68	69.180	0.425	0.0	0.0	0.0	0.93	102.7	45.8
S16.006	34.56	10.37	68.755	2.316	0.0	0.0	0.0	0.99	280.4	216.7
S20.000	44.44	5.96	69.470	0.167	0.0	0.0	0.0	0.96	106.3	20.0
S20.001	41.33	7.07	69.312	0.354	0.0	0.0	0.0	0.96	106.3	39.7
S20.002	38.85	8.11	69.129	0.354	0.0	0.0	0.0	0.96	106.3	39.7
S16.007	33.39	11.10	68.580	2.787	0.0	0.0	0.0	1.01	446.1	252.0
S16.008	33.23	11.21	68.521	2.787	0.0	0.0	0.0	1.36	600.3	252.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S16.009	48.419	0.100	484.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒
S3.008	70.492	0.050	1409.8	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S16.009	32.30	11.85	68.450	2.787	0.0	0.0	0.0	1.26	558.9	252.0
S3.008	27.79	15.73	68.350	8.524	0.0	0.0	0.0	0.74	325.3«	641.5

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Bac
SWMH-20.1	71.010	1.565	Open Manhole	1200	S3.000	69.445	300				
SWMH-20.2	71.000	1.727	Open Manhole	1200	S3.001	69.273	300	S3.000	69.273	300	
SWMH-21.1	71.397	1.697	Open Manhole	1200	S4.000	69.700	300				
SWMH-22.1	71.720	1.970	Open Manhole	1200	S5.000	69.750	300				
SWMH-21.2	71.567	1.935	Open Manhole	1200	S4.001	69.632	300	S4.000	69.634	300	
								S5.000	69.632	300	
SWMH-21.3	71.143	1.602	Open Manhole	1200	S4.002	69.541	300	S4.001	69.541	300	
SWMH-20.3	71.000	1.961	Open Manhole	1350	S3.002	69.039	450	S3.001	69.189	300	
								S4.002	69.341	300	
SWMH-20.4	71.000	2.017	Open Manhole	1350	S3.003	68.983	450	S3.002	68.983	450	
SWMH-1.1	70.560	1.443	Open Manhole	1350	S6.000	69.117	450				
SWMH-1.2	70.600	1.674	Open Manhole	1350	S6.001	68.926	450	S6.000	68.926	450	
SWMH-2.1	70.560	1.511	Open Manhole	1350	S7.000	69.049	450				
SWMH-1.3	70.600	1.742	Open Manhole	1350	S6.002	68.858	450	S6.001	68.859	450	
								S7.000	68.858	450	
SWMH-3.1	70.560	1.543	Open Manhole	1350	S8.000	69.017	450				
SWMH-1.4	70.600	1.780	Open Manhole	1350	S6.003	68.820	450	S6.002	68.820	450	
								S8.000	68.820	450	
SWMH-20.5	70.645	1.995	Open Manhole	1500	S3.004	68.650	600	S3.003	68.800	450	
								S6.003	68.800	450	
SWMH-4.1	70.316	1.157	Open Manhole	1350	S9.000	69.159	375				
SWMH-4.2	70.316	1.259	Open Manhole	1350	S9.001	69.057	375	S9.000	69.057	375	
SWMH-4.3	70.247	1.294	Open Manhole	1350	S9.002	68.953	375	S9.001	68.953	375	
SWMH-5.1	70.420	1.473	Open Manhole	1350	S10.000	68.947	375				
SWMH-4.4	70.450	1.605	Open Manhole	1350	S9.003	68.845	375	S9.002	68.845	375	
								S10.000	68.845	375	
SWMH-4.5	70.552	1.739	Open Manhole	1350	S9.004	68.813	375	S9.003	68.813	375	
SWMH-20.6	70.645	2.141	Open Manhole	1500	S3.005	68.504	600	S3.004	68.504	600	
								S9.004	68.784	375	
SWMH-20.7	70.645	2.217	Open Manhole	1500	S3.006	68.428	600	S3.005	68.428	600	
SWMH-20.8	70.806	2.399	Open Manhole	1500	S3.007	68.408	600	S3.006	68.408	600	
SWMH-10.1	70.778	1.511	Open Manhole	1350	S11.000	69.267	450				
SWMH-10.2	71.138	2.042	Open Manhole	1350	S11.001	69.096	450	S11.000	69.096	450	
SWMH-10.3	70.725	1.667	Open Manhole	1350	S11.002	69.058	450	S11.001	69.058	450	
SWMH-10.4	70.600	1.641	Open Manhole	1350	S11.003	68.959	450	S11.002	68.959	450	
SWMH-10.5	70.550	1.776	Open Manhole	1500	S11.004	68.774	525	S11.003	68.849	450	
SWMH-10.6	70.525	1.900	Open Manhole	1500	S11.005	68.652	525	S11.004	68.625	525	
SWMH-11.1	70.630	1.705	Open Manhole	1350	S12.000	68.925	375				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Back (
SWMH-10.7	70.200	1.672	Open Manhole	1500	S11.006	68.528	525	S11.005	68.528	525	
								S12.000	68.814	375	
SWMH-10.8	70.692	2.242	Open Manhole	1500	S11.007	68.450	525	S11.006	68.500	525	
SWMH-30.1	71.234	1.649	Open Manhole	1200	S13.000	69.585	300				
SWMH-30.2	71.156	1.868	Open Manhole	1350	S13.001	69.288	375	S13.000	69.363	300	
SWMH-30.3	71.151	2.042	Open Manhole	1350	S13.002	69.109	375	S13.001	69.109	375	
SWMH-31.1	71.000	1.200	Open Manhole	1350	S14.000	69.800	375				
SWMH-31.2	71.003	1.340	Open Manhole	1350	S14.001	69.663	375	S14.000	69.663	375	
SWMH-30.4	71.026	1.951	Open Manhole	1350	S13.003	69.075	375	S13.002	69.075	375	
								S14.001	69.633	375	
SWMH-32.1	70.939	1.617	Open Manhole	1350	S15.000	69.322	450				
SWMH-32.2	70.950	1.768	Open Manhole	1350	S15.001	69.182	450	S15.000	69.182	450	
SWMH-30.5	71.091	2.431	Open Manhole	1500	S13.004	68.660	600	S13.003	68.885	375	
								S15.001	69.070	450	
SWMH-30.6	70.443	1.923	Open Manhole	1500	S13.005	68.520	600	S13.004	68.520	600	
SWMH-30.7	70.200	1.750	Open Manhole	1500	S13.006	68.450	600	S13.005	68.500	600	
SWMH-40.1	71.060	1.376	Open Manhole	1200	S16.000	69.684	300				
SWMH-40.2	71.035	1.508	Open Manhole	1350	S16.001	69.527	375	S16.000	69.602	300	
SWMH-40.3	70.750	1.489	Open Manhole	1350	S16.002	69.261	450	S16.001	69.336	375	
SWMH-40.4	71.175	2.056	Open Manhole	1350	S16.003	69.119	450	S16.002	69.119	450	
SWMH-44.1	70.593	1.193	Open Manhole	1200	S17.000	69.400	300				
SWMH-44.2	70.931	1.639	Open Manhole	1200	S17.001	69.292	300	S17.000	69.292	300	
SWMH-40.5	71.270	2.172	Open Manhole	1350	S16.004	69.098	450	S16.003	69.098	450	
								S17.001	69.257	300	
SWMH-41.1	70.890	1.595	Open Manhole	1500	S18.000	69.295	525				
SWMH-41.2	70.831	1.703	Open Manhole	1500	S18.001	69.128	525	S18.000	69.128	525	
SWMH-40.6	70.940	1.987	Open Manhole	1500	S16.005	68.953	525	S16.004	69.028	450	
								S18.001	68.961	525	
SWMH-42.1	70.950	1.570	Open Manhole	1350	S19.000	69.380	375				
SWMH-42.2	70.950	1.770	Open Manhole	1350	S19.001	69.180	375	S19.000	69.180	375	
SWMH-40.7	70.800	2.045	Open Manhole	1500	S16.006	68.755	600	S16.005	68.830	525	
								S19.001	68.980	375	
SWMH-43.1	70.595	1.125	Open Manhole	1350	S20.000	69.470	375				
SWMH-43.2	70.440	1.128	Open Manhole	1350	S20.001	69.312	375	S20.000	69.312	375	
SWMH-43.3	70.370	1.241	Open Manhole	1350	S20.002	69.129	375	S20.001	69.129	375	
SWMH-40.8	70.840	2.260	Open Manhole	1800	S16.007	68.580	750	S16.006	68.730	600	
								S20.002	68.957	375	
SWMH-40.9	70.340	1.819	Open Manhole	1800	S16.008	68.521	750	S16.007	68.521	750	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)
SWMH-40.10	70.200	1.750	Open Manhole	1800	S16.009	68.450	750	S16.008	68.500	750
SWMH-OUTFALL	70.000	1.650	Open Manhole	1800	S3.008	68.350	750	S3.007	68.374	600
								S11.007	68.350	525
								S13.006	68.350	600
								S16.009	68.350	750
SWMH-	69.957	1.657	Open Manhole	0		OUTFALL		S3.008	68.300	750

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)
S3.000	o	300	SWMH-20.1	71.010	69.445	1.265	Open Manhole	1200
S3.001	o	300	SWMH-20.2	71.000	69.273	1.427	Open Manhole	1200
S4.000	o	300	SWMH-21.1	71.397	69.700	1.397	Open Manhole	1200
S5.000	o	300	SWMH-22.1	71.720	69.750	1.670	Open Manhole	1200
S4.001	o	300	SWMH-21.2	71.567	69.632	1.635	Open Manhole	1200
S4.002	o	300	SWMH-21.3	71.143	69.541	1.302	Open Manhole	1200
S3.002	o	450	SWMH-20.3	71.000	69.039	1.511	Open Manhole	1350
S3.003	o	450	SWMH-20.4	71.000	68.983	1.567	Open Manhole	1350
S6.000	o	450	SWMH-1.1	70.560	69.117	0.993	Open Manhole	1350
S6.001	o	450	SWMH-1.2	70.600	68.926	1.224	Open Manhole	1350
S7.000	o	450	SWMH-2.1	70.560	69.049	1.061	Open Manhole	1350
S6.002	o	450	SWMH-1.3	70.600	68.858	1.292	Open Manhole	1350
S8.000	o	450	SWMH-3.1	70.560	69.017	1.093	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)
S3.000	51.577	299.9	SWMH-20.2	71.000	69.273	1.427	Open Manhole	1200
S3.001	25.093	298.7	SWMH-20.3	71.000	69.189	1.511	Open Manhole	1350
S4.000	19.881	300.0	SWMH-21.2	71.567	69.634	1.633	Open Manhole	1200
S5.000	35.356	300.0	SWMH-21.2	71.567	69.632	1.635	Open Manhole	1200
S4.001	27.383	300.9	SWMH-21.3	71.143	69.541	1.302	Open Manhole	1200
S4.002	60.062	300.3	SWMH-20.3	71.000	69.341	1.359	Open Manhole	1350
S3.002	25.151	450.0	SWMH-20.4	71.000	68.983	1.567	Open Manhole	1350
S3.003	82.609	450.0	SWMH-20.5	70.645	68.800	1.395	Open Manhole	1500
S6.000	86.037	450.0	SWMH-1.2	70.600	68.926	1.224	Open Manhole	1350
S6.001	30.330	452.7	SWMH-1.3	70.600	68.859	1.291	Open Manhole	1350
S7.000	86.165	451.1	SWMH-1.3	70.600	68.858	1.292	Open Manhole	1350
S6.002	17.094	450.0	SWMH-1.4	70.600	68.820	1.330	Open Manhole	1350
S8.000	88.659	450.0	SWMH-1.4	70.600	68.820	1.330	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)
S6.003	o	450	SWMH-1.4	70.600	68.820	1.330	Open Manhole	1350
S3.004	o	600	SWMH-20.5	70.645	68.650	1.395	Open Manhole	1500
S9.000	o	375	SWMH-4.1	70.316	69.159	0.782	Open Manhole	1350
S9.001	o	375	SWMH-4.2	70.316	69.057	0.884	Open Manhole	1350
S9.002	o	375	SWMH-4.3	70.247	68.953	0.919	Open Manhole	1350
S10.000	o	375	SWMH-5.1	70.420	68.947	1.098	Open Manhole	1350
S9.003	o	375	SWMH-4.4	70.450	68.845	1.230	Open Manhole	1350
S9.004	o	375	SWMH-4.5	70.552	68.813	1.364	Open Manhole	1350
S3.005	o	600	SWMH-20.6	70.645	68.504	1.541	Open Manhole	1500
S3.006	o	600	SWMH-20.7	70.645	68.428	1.617	Open Manhole	1500
S3.007	o	600	SWMH-20.8	70.806	68.408	1.799	Open Manhole	1500
S11.000	o	450	SWMH-10.1	70.778	69.267	1.061	Open Manhole	1350
S11.001	o	450	SWMH-10.2	71.138	69.096	1.592	Open Manhole	1350
S11.002	o	450	SWMH-10.3	70.725	69.058	1.217	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)
S6.003	8.806	450.0	SWMH-20.5	70.645	68.800	1.395	Open Manhole	1500
S3.004	87.772	600.0	SWMH-20.6	70.645	68.504	1.541	Open Manhole	1500
S9.000	38.102	373.5	SWMH-4.2	70.316	69.057	0.884	Open Manhole	1350
S9.001	38.959	375.0	SWMH-4.3	70.247	68.953	0.919	Open Manhole	1350
S9.002	40.673	375.0	SWMH-4.4	70.450	68.845	1.230	Open Manhole	1350
S10.000	38.187	374.4	SWMH-4.4	70.450	68.845	1.230	Open Manhole	1350
S9.003	11.969	375.0	SWMH-4.5	70.552	68.813	1.364	Open Manhole	1350
S9.004	10.878	375.0	SWMH-20.6	70.645	68.784	1.486	Open Manhole	1500
S3.005	38.209	500.0	SWMH-20.7	70.645	68.428	1.617	Open Manhole	1500
S3.006	9.872	500.0	SWMH-20.8	70.806	68.408	1.799	Open Manhole	1500
S3.007	16.960	500.0	SWMH-OUTFALL	70.000	68.374	1.026	Open Manhole	1800
S11.000	76.899	450.0	SWMH-10.2	71.138	69.096	1.592	Open Manhole	1350
S11.001	17.089	450.0	SWMH-10.3	70.725	69.058	1.217	Open Manhole	1350
S11.002	44.455	450.0	SWMH-10.4	70.600	68.959	1.191	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)
S11.003	o	450	SWMH-10.4	70.600	68.959	1.191	Open Manhole	1350
S11.004	o	525	SWMH-10.5	70.550	68.774	1.251	Open Manhole	1500
S11.005	o	525	SWMH-10.6	70.525	68.652	1.348	Open Manhole	1500
S12.000	o	375	SWMH-11.1	70.630	68.925	1.330	Open Manhole	1350
S11.006	o	525	SWMH-10.7	70.200	68.528	1.147	Open Manhole	1500
S11.007	o	525	SWMH-10.8	70.692	68.450	1.717	Open Manhole	1500
S13.000	o	300	SWMH-30.1	71.234	69.585	1.349	Open Manhole	1200
S13.001	o	375	SWMH-30.2	71.156	69.288	1.493	Open Manhole	1350
S13.002	o	375	SWMH-30.3	71.151	69.109	1.667	Open Manhole	1350
S14.000	o	375	SWMH-31.1	71.000	69.800	0.825	Open Manhole	1350
S14.001	o	375	SWMH-31.2	71.003	69.663	0.965	Open Manhole	1350
S13.003	o	375	SWMH-30.4	71.026	69.075	1.576	Open Manhole	1350
S15.000	o	450	SWMH-32.1	70.939	69.322	1.167	Open Manhole	1350
S15.001	o	450	SWMH-32.2	70.950	69.182	1.318	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)
S11.003	49.696	450.0	SWMH-10.5	70.550	68.849	1.251	Open Manhole	1500
S11.004	66.906	450.0	SWMH-10.6	70.525	68.625	1.375	Open Manhole	1500
S11.005	62.002	500.0	SWMH-10.7	70.200	68.528	1.147	Open Manhole	1500
S12.000	41.629	375.0	SWMH-10.7	70.200	68.814	1.011	Open Manhole	1500
S11.006	14.829	529.6	SWMH-10.8	70.692	68.500	1.667	Open Manhole	1500
S11.007	128.614	1286.1	SWMH-OUTFALL	70.000	68.350	1.125	Open Manhole	1800
S13.000	66.564	299.8	SWMH-30.2	71.156	69.363	1.493	Open Manhole	1350
S13.001	62.672	350.1	SWMH-30.3	71.151	69.109	1.667	Open Manhole	1350
S13.002	12.828	377.3	SWMH-30.4	71.026	69.075	1.576	Open Manhole	1350
S14.000	51.225	373.9	SWMH-31.2	71.003	69.663	0.965	Open Manhole	1350
S14.001	11.430	375.0	SWMH-30.4	71.026	69.633	1.018	Open Manhole	1350
S13.003	76.069	400.4	SWMH-30.5	71.091	68.885	1.831	Open Manhole	1500
S15.000	63.020	450.0	SWMH-32.2	70.950	69.182	1.318	Open Manhole	1350
S15.001	79.775	712.8	SWMH-30.5	71.091	69.070	1.571	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)
S13.004	o	600	SWMH-30.5	71.091	68.660	1.831	Open Manhole	1500
S13.005	o	600	SWMH-30.6	70.443	68.520	1.323	Open Manhole	1500
S13.006	o	600	SWMH-30.7	70.200	68.450	1.150	Open Manhole	1500
S16.000	o	300	SWMH-40.1	71.060	69.684	1.076	Open Manhole	1200
S16.001	o	375	SWMH-40.2	71.035	69.527	1.133	Open Manhole	1350
S16.002	o	450	SWMH-40.3	70.750	69.261	1.039	Open Manhole	1350
S16.003	o	450	SWMH-40.4	71.175	69.119	1.606	Open Manhole	1350
S17.000	o	300	SWMH-44.1	70.593	69.400	0.893	Open Manhole	1200
S17.001	o	300	SWMH-44.2	70.931	69.292	1.339	Open Manhole	1200
S16.004	o	450	SWMH-40.5	71.270	69.098	1.722	Open Manhole	1350
S18.000	o	525	SWMH-41.1	70.890	69.295	1.070	Open Manhole	1500
S18.001	o	525	SWMH-41.2	70.831	69.128	1.178	Open Manhole	1500
S16.005	o	525	SWMH-40.6	70.940	68.953	1.462	Open Manhole	1500
S19.000	o	375	SWMH-42.1	70.950	69.380	1.195	Open Manhole	1350
S19.001	o	375	SWMH-42.2	70.950	69.180	1.395	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)
S13.004	67.190	479.9	SWMH-30.6	70.443	68.520	1.323	Open Manhole	1500
S13.005	8.730	436.5	SWMH-30.7	70.200	68.500	1.100	Open Manhole	1500
S13.006	70.784	707.8	SWMH-OUTFALL	70.000	68.350	1.050	Open Manhole	1800
S16.000	30.634	373.6	SWMH-40.2	71.035	69.602	1.133	Open Manhole	1350
S16.001	71.701	375.4	SWMH-40.3	70.750	69.336	1.039	Open Manhole	1350
S16.002	64.030	450.9	SWMH-40.4	71.175	69.119	1.606	Open Manhole	1350
S16.003	9.527	453.7	SWMH-40.5	71.270	69.098	1.722	Open Manhole	1350
S17.000	32.276	298.9	SWMH-44.2	70.931	69.292	1.339	Open Manhole	1200
S17.001	10.407	297.3	SWMH-40.5	71.270	69.257	1.713	Open Manhole	1350
S16.004	31.398	448.5	SWMH-40.6	70.940	69.028	1.462	Open Manhole	1500
S18.000	83.500	500.0	SWMH-41.2	70.831	69.128	1.178	Open Manhole	1500
S18.001	83.500	500.0	SWMH-40.6	70.940	68.961	1.454	Open Manhole	1500
S16.005	73.956	600.0	SWMH-40.7	70.800	68.830	1.445	Open Manhole	1500
S19.000	74.921	374.6	SWMH-42.2	70.950	69.180	1.395	Open Manhole	1350
S19.001	74.921	374.6	SWMH-40.7	70.800	68.980	1.445	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)
S16.006	o	600	SWMH-40.7	70.800	68.755	1.445	Open Manhole	1500
S20.000	o	375	SWMH-43.1	70.595	69.470	0.750	Open Manhole	1350
S20.001	o	375	SWMH-43.2	70.440	69.312	0.753	Open Manhole	1350
S20.002	o	375	SWMH-43.3	70.370	69.129	0.866	Open Manhole	1350
S16.007	o	750	SWMH-40.8	70.840	68.580	1.510	Open Manhole	1800
S16.008	o	750	SWMH-40.9	70.340	68.521	1.069	Open Manhole	1800
S16.009	o	750	SWMH-40.10	70.200	68.450	1.000	Open Manhole	1800
S3.008	o	750	SWMH-OUTFALL	70.000	68.350	0.900	Open Manhole	1800

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)
S16.006	14.850	594.0	SWMH-40.8	70.840	68.730	1.510	Open Manhole	1800
S20.000	55.222	350.0	SWMH-43.2	70.440	69.312	0.753	Open Manhole	1350
S20.001	64.122	350.4	SWMH-43.3	70.370	69.129	0.866	Open Manhole	1350
S20.002	60.444	350.0	SWMH-40.8	70.840	68.957	1.508	Open Manhole	1800
S16.007	44.617	756.2	SWMH-40.9	70.340	68.521	1.069	Open Manhole	1800
S16.008	8.824	420.2	SWMH-40.10	70.200	68.500	0.950	Open Manhole	1800
S16.009	48.419	484.2	SWMH-OUTFALL	70.000	68.350	0.900	Open Manhole	1800
S3.008	70.492	1409.8	SWMH-	69.957	68.300	0.907	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.000	Classification	Gravel	75	0.187	0.140	0.140
	Classification	Roof	100	0.048	0.048	0.188
	Classification	Road	100	0.088	0.088	0.276
3.001	Classification	Road	100	0.051	0.051	0.051
4.000	Classification	Road	100	0.032	0.032	0.032
5.000	Classification	Gravel	75	0.123	0.092	0.092
	Classification	Grass	30	0.076	0.023	0.115
4.001	Classification	Road	100	0.018	0.018	0.018
	Classification	Road	100	0.027	0.027	0.045
4.002	Classification	Road	100	0.124	0.124	0.124
3.002	Classification	Road	100	0.083	0.083	0.083
3.003	Classification	Road	100	0.152	0.152	0.152
6.000	Classification	Road	100	0.020	0.020	0.020
	Classification	Grass	30	0.100	0.030	0.050
	Classification	Roof	100	0.038	0.038	0.088
	Classification	Road	100	0.142	0.142	0.230
6.001	Classification	Roof	100	0.042	0.042	0.042
	Classification	Road	100	0.060	0.060	0.101
	Classification	Grass	30	0.013	0.004	0.105
7.000	Classification	Road	100	0.043	0.043	0.043
	Classification	Road	100	0.004	0.004	0.047
	Classification	Grass	30	0.018	0.005	0.052
	Classification	Roof	100	0.037	0.037	0.089
	Classification	Road	100	0.055	0.055	0.144
6.002	Classification	Road	100	0.067	0.067	0.067
	Classification	Roof	100	0.043	0.043	0.110
	Classification	Road	100	0.010	0.010	0.120
8.000	Classification	Grass	30	0.037	0.011	0.011
	Classification	Road	100	0.008	0.008	0.019
	Classification	Road	100	0.082	0.082	0.102
	Classification	Gravel	75	0.072	0.054	0.156
	Classification	Roof	100	0.072	0.072	0.227
6.003	Classification	Gravel	75	0.022	0.017	0.017
	Classification	Road	100	0.026	0.026	0.043
	Classification	Roof	100	0.078	0.078	0.120
	Classification	Gravel	75	0.076	0.057	0.177
	Classification	Road	100	0.039	0.039	0.216
3.004	Classification	Road	100	0.099	0.099	0.099
9.000	Classification	Grass	30	0.024	0.007	0.007
	Classification	Road	100	0.006	0.006	0.013
	Classification	Gravel	75	0.012	0.009	0.022
	Classification	Road	100	0.034	0.034	0.056
	Classification	Roof	100	0.022	0.022	0.077
	Classification	Gravel	75	0.047	0.035	0.112
	Classification	Gravel	75	0.023	0.017	0.129
9.001	Classification	Grass	30	0.067	0.020	0.020
	Classification	Road	100	0.011	0.011	0.032
	Classification	Gravel	75	0.031	0.023	0.055
	Classification	Road	100	0.035	0.035	0.090
	Classification	Gravel	75	0.014	0.010	0.100
	Classification	Roof	100	0.023	0.023	0.123

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
9.002	Classification	Gravel	75	0.013	0.010	0.010
	Classification	Road	100	0.011	0.011	0.021
	Classification	Gravel	75	0.013	0.010	0.031
	Classification	Roof	100	0.004	0.004	0.035
	Classification	Grass	30	0.041	0.012	0.047
10.000	Classification	Road	100	0.036	0.036	0.036
	Classification	Roof	100	0.043	0.043	0.079
	Classification	Gravel	75	0.031	0.023	0.103
	Classification	Road	100	0.024	0.024	0.127
	Classification	Gravel	75	0.019	0.015	0.141
9.003	Classification	Roof	100	0.035	0.035	0.035
	Classification	Gravel	75	0.033	0.024	0.059
	Classification	Road	100	0.018	0.018	0.077
	Classification	Gravel	75	0.023	0.017	0.094
	Classification	Road	100	0.006	0.006	0.100
	Classification	Grass	30	0.032	0.010	0.110
	Classification	Gravel	75	0.019	0.014	0.124
	Classification	Road	100	0.036	0.036	0.160
9.004	Classification	Road	100	0.022	0.022	0.022
	Classification	Gravel	75	0.007	0.006	0.028
	Classification	Grass	30	0.023	0.007	0.034
3.005	Classification	Road	100	0.065	0.065	0.065
3.006	-	-	100	0.000	0.000	0.000
3.007	-	-	100	0.000	0.000	0.000
11.000	Classification	Grass	30	0.273	0.082	0.082
	Classification	Road	100	0.127	0.127	0.209
	Classification	Gravel	75	0.078	0.058	0.267
	Classification	Roof	100	0.254	0.254	0.521
11.001	Classification	Grass	30	0.127	0.038	0.038
	Classification	Gravel	75	0.041	0.031	0.069
11.002	Classification	Gravel	75	0.045	0.034	0.034
	Classification	Road	100	0.084	0.084	0.119
	Classification	Grass	30	0.073	0.022	0.141
	Classification	Roof	100	0.069	0.069	0.210
11.003	Classification	Road	100	0.100	0.100	0.100
	Classification	Roof	100	0.072	0.072	0.172
11.004	Classification	Road	100	0.122	0.122	0.122
	Classification	Gravel	75	0.045	0.034	0.156
11.005	Classification	Gravel	75	0.121	0.091	0.091
	Classification	Road	100	0.052	0.052	0.143
12.000	Classification	Road	100	0.063	0.063	0.063
	Classification	Gravel	75	0.132	0.099	0.162
11.006	-	-	100	0.000	0.000	0.000
11.007	-	-	100	0.000	0.000	0.000
13.000	Classification	Grass	30	0.209	0.063	0.063
	Classification	Road	100	0.073	0.073	0.136
13.001	Classification	Grass	30	0.199	0.060	0.060
	Classification	Road	100	0.065	0.065	0.125
	Classification	Road	100	0.090	0.090	0.215
13.002	-	-	100	0.000	0.000	0.000
14.000	Classification	Grass	30	0.174	0.052	0.052

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Road	100	0.066	0.066	0.119
	Classification	Gravel	75	0.083	0.062	0.181
	Classification	Roof	100	0.198	0.198	0.379
14.001	-	-	100	0.000	0.000	0.000
13.003	Classification	Gravel	75	0.096	0.072	0.072
	Classification	Road	100	0.099	0.099	0.171
15.000	Classification	Roof	100	0.266	0.266	0.266
15.001	-	-	100	0.000	0.000	0.000
13.004	Classification	Road	100	0.211	0.211	0.211
	Classification	Roof	100	0.208	0.208	0.420
13.005	-	-	100	0.000	0.000	0.000
13.006	-	-	100	0.000	0.000	0.000
16.000	Classification	Road	100	0.036	0.036	0.036
	Classification	Grass	30	0.042	0.012	0.048
16.001	Classification	Road	100	0.040	0.040	0.040
	Classification	Grass	30	0.179	0.054	0.094
	Classification	Gravel	75	0.173	0.130	0.224
16.002	Classification	Grass	30	0.268	0.080	0.080
	Classification	Road	100	0.047	0.047	0.128
	Classification	Gravel	75	0.192	0.144	0.272
16.003	-	-	100	0.000	0.000	0.000
17.000	Classification	Grass	30	0.207	0.062	0.062
	Classification	Road	100	0.041	0.041	0.104
17.001	-	-	100	0.000	0.000	0.000
16.004	Classification	Road	100	0.034	0.034	0.034
	Classification	Gravel	75	0.071	0.053	0.087
18.000	Classification	Gravel	75	0.166	0.124	0.124
	Classification	Road	100	0.069	0.069	0.193
	Classification	Gravel	75	0.114	0.085	0.278
	Classification	Roof	100	0.240	0.240	0.519
18.001	Classification	Gravel	75	0.098	0.074	0.074
	Classification	Road	100	0.065	0.065	0.139
	Classification	Roof	100	0.219	0.219	0.358
16.005	Classification	Road	100	0.090	0.090	0.090
	Classification	Gravel	75	0.172	0.129	0.220
19.000	Classification	Roof	100	0.208	0.208	0.208
19.001	Classification	Roof	100	0.217	0.217	0.217
16.006	Classification	Road	100	0.038	0.038	0.038
	Classification	Gravel	75	0.028	0.021	0.059
20.000	Classification	Gravel	75	0.148	0.111	0.111
	Classification	Road	100	0.055	0.055	0.167
20.001	Classification	Gravel	75	0.163	0.123	0.123
	Classification	Road	100	0.065	0.065	0.188
20.002	-	-	100	0.000	0.000	0.000
16.007	Classification	Road	100	0.116	0.116	0.116
16.008	-	-	100	0.000	0.000	0.000
16.009	-	-	100	0.000	0.000	0.000
3.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				10.733	8.524	8.524

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S3.000	SWMH-20.1	300	1.265	1.427	Unclassified	1200	0	1.265	Unclassified
S3.001	SWMH-20.2	300	1.427	1.511	Unclassified	1200	0	1.427	Unclassified
S4.000	SWMH-21.1	300	1.397	1.633	Unclassified	1200	0	1.397	Unclassified
S5.000	SWMH-22.1	300	1.635	1.670	Unclassified	1200	0	1.670	Unclassified
S4.001	SWMH-21.2	300	1.302	1.635	Unclassified	1200	0	1.635	Unclassified
S4.002	SWMH-21.3	300	1.302	1.359	Unclassified	1200	0	1.302	Unclassified
S3.002	SWMH-20.3	450	1.511	1.567	Unclassified	1350	0	1.511	Unclassified
S3.003	SWMH-20.4	450	1.261	1.567	Unclassified	1350	0	1.567	Unclassified
S6.000	SWMH-1.1	450	0.993	1.224	Unclassified	1350	0	0.993	Unclassified
S6.001	SWMH-1.2	450	1.224	1.291	Unclassified	1350	0	1.224	Unclassified
S7.000	SWMH-2.1	450	1.061	1.292	Unclassified	1350	0	1.061	Unclassified
S6.002	SWMH-1.3	450	1.288	1.330	Unclassified	1350	0	1.292	Unclassified
S8.000	SWMH-3.1	450	0.921	1.330	Unclassified	1350	0	1.093	Unclassified
S6.003	SWMH-1.4	450	1.330	1.395	Unclassified	1350	0	1.330	Unclassified
S3.004	SWMH-20.5	600	1.395	1.541	Unclassified	1500	0	1.395	Unclassified
S9.000	SWMH-4.1	375	0.782	0.884	Unclassified	1350	0	0.782	Unclassified
S9.001	SWMH-4.2	375	0.508	0.919	Unclassified	1350	0	0.884	Unclassified
S9.002	SWMH-4.3	375	0.885	1.230	Unclassified	1350	0	0.919	Unclassified
S10.000	SWMH-5.1	375	0.992	1.230	Unclassified	1350	0	1.098	Unclassified
S9.003	SWMH-4.4	375	1.141	1.364	Unclassified	1350	0	1.230	Unclassified
S9.004	SWMH-4.5	375	1.364	1.486	Unclassified	1350	0	1.364	Unclassified
S3.005	SWMH-20.6	600	1.541	1.631	Unclassified	1500	0	1.541	Unclassified
S3.006	SWMH-20.7	600	1.617	1.799	Unclassified	1500	0	1.617	Unclassified
S3.007	SWMH-20.8	600	1.026	1.838	Unclassified	1500	0	1.799	Unclassified
S11.000	SWMH-10.1	450	1.061	1.592	Unclassified	1350	0	1.061	Unclassified
S11.001	SWMH-10.2	450	1.217	1.592	Unclassified	1350	0	1.592	Unclassified
S11.002	SWMH-10.3	450	1.191	1.445	Unclassified	1350	0	1.217	Unclassified
S11.003	SWMH-10.4	450	1.191	1.441	Unclassified	1350	0	1.191	Unclassified
S11.004	SWMH-10.5	525	1.251	1.548	Unclassified	1500	0	1.251	Unclassified
S11.005	SWMH-10.6	525	1.147	1.461	Unclassified	1500	0	1.348	Unclassified
S12.000	SWMH-11.1	375	1.011	1.330	Unclassified	1350	0	1.330	Unclassified
S11.006	SWMH-10.7	525	1.147	1.667	Unclassified	1500	0	1.147	Unclassified
S11.007	SWMH-10.8	525	1.125	1.906	Unclassified	1500	0	1.717	Unclassified
S13.000	SWMH-30.1	300	1.193	1.493	Unclassified	1200	0	1.349	Unclassified
S13.001	SWMH-30.2	375	1.400	1.667	Unclassified	1350	0	1.493	Unclassified
S13.002	SWMH-30.3	375	1.522	1.667	Unclassified	1350	0	1.667	Unclassified
S14.000	SWMH-31.1	375	0.825	0.965	Unclassified	1350	0	0.825	Unclassified
S14.001	SWMH-31.2	375	0.963	1.018	Unclassified	1350	0	0.965	Unclassified
S13.003	SWMH-30.4	375	1.576	1.831	Unclassified	1350	0	1.576	Unclassified
S15.000	SWMH-32.1	450	1.167	1.318	Unclassified	1350	0	1.167	Unclassified
S15.001	SWMH-32.2	450	1.318	1.571	Unclassified	1350	0	1.318	Unclassified
S13.004	SWMH-30.5	600	1.323	1.838	Unclassified	1500	0	1.831	Unclassified
S13.005	SWMH-30.6	600	1.100	1.939	Unclassified	1500	0	1.323	Unclassified
S13.006	SWMH-30.7	600	1.050	1.960	Unclassified	1500	0	1.150	Unclassified
S16.000	SWMH-40.1	300	1.076	1.133	Unclassified	1200	0	1.076	Unclassified
S16.001	SWMH-40.2	375	0.944	1.133	Unclassified	1350	0	1.133	Unclassified
S16.002	SWMH-40.3	450	0.888	1.606	Unclassified	1350	0	1.039	Unclassified
S16.003	SWMH-40.4	450	0.970	1.722	Unclassified	1350	0	1.606	Unclassified
S17.000	SWMH-44.1	300	0.893	1.339	Unclassified	1200	0	0.893	Unclassified

Network Classifications for Storm

PN	**USMH Name**	**Pipe Dia (mm)**	**Min Cover Depth (m)**	**Max Cover Depth (m)**	**Pipe Type**	**MH Dia (mm)**	**MH Width (mm)**	**MH Ring Depth (m)**	**MH Type**
S17.001	SWMH-44.2	300	0.966	1.713	Unclassified	1200	0	1.339	Unclassified
S16.004	SWMH-40.5	450	1.187	1.722	Unclassified	1350	0	1.722	Unclassified
S18.000	SWMH-41.1	525	1.042	1.178	Unclassified	1500	0	1.070	Unclassified
S18.001	SWMH-41.2	525	1.178	1.454	Unclassified	1500	0	1.178	Unclassified
S16.005	SWMH-40.6	525	0.987	1.462	Unclassified	1500	0	1.462	Unclassified
S19.000	SWMH-42.1	375	1.144	1.395	Unclassified	1350	0	1.195	Unclassified
S19.001	SWMH-42.2	375	1.234	1.458	Unclassified	1350	0	1.395	Unclassified
S16.006	SWMH-40.7	600	0.629	1.510	Unclassified	1500	0	1.445	Unclassified
S20.000	SWMH-43.1	375	0.750	0.843	Unclassified	1350	0	0.750	Unclassified
S20.001	SWMH-43.2	375	0.753	0.866	Unclassified	1350	0	0.753	Unclassified
S20.002	SWMH-43.3	375	0.693	1.508	Unclassified	1350	0	0.866	Unclassified
S16.007	SWMH-40.8	750	0.958	1.510	Unclassified	1800	0	1.510	Unclassified
S16.008	SWMH-40.9	750	0.950	1.747	Unclassified	1800	0	1.069	Unclassified
S16.009	SWMH-40.10	750	0.900	1.784	Unclassified	1800	0	1.000	Unclassified
S3.008	SWMH-OUTFALL	750	0.746	0.907	Unclassified	1800	0	0.900	Unclassified

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)**
S3.008	SWMH-	69.957	68.300	0.000	0	0

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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.800	Storm Duration (mins)	30
Ratio R	0.323		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SWMH-OUTFALL, DS/PN: S3.008, Volume (m^3): 76.2

Unit Reference	MD-SHE-0216-2440-1000-2440
Design Head (m)	1.000
Design Flow (l/s)	24.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	216
Invert Level (m)	68.350
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	24.4
Flush-Flo™	0.359	24.3
Kick-Flo®	0.733	21.0
Mean Flow over Head Range	-	20.3

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)**
0.100	7.3	1.200	26.6	3.000	41.3	7.000	62.3
0.200	21.2	1.400	28.6	3.500	44.5	7.500	64.4
0.300	24.2	1.600	30.5	4.000	47.5	8.000	66.5
0.400	24.3	1.800	32.3	4.500	50.3	8.500	68.5
0.500	23.9	2.000	34.0	5.000	52.9	9.000	70.4
0.600	23.2	2.200	35.6	5.500	55.4	9.500	72.3
0.800	21.9	2.400	37.1	6.000	57.8		
1.000	24.4	2.600	38.6	6.500	60.1		

Storage Structures for Storm

Tank or Pond Manhole: SWMH-OUTFALL, DS/PN: S3.008

Invert Level (m) 68.350

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	6242.0	1.000	7593.0	1.650	8502.0

Manhole Headloss for Storm

PN	**US/MH Name**	**US/MH Headloss**
S3.000	SWMH-20.1	0.500
S3.001	SWMH-20.2	0.500
S4.000	SWMH-21.1	0.500
S5.000	SWMH-22.1	0.500
S4.001	SWMH-21.2	0.500
S4.002	SWMH-21.3	0.500
S3.002	SWMH-20.3	0.500
S3.003	SWMH-20.4	0.500
S6.000	SWMH-1.1	0.500
S6.001	SWMH-1.2	0.500
S7.000	SWMH-2.1	0.500
S6.002	SWMH-1.3	0.500
S8.000	SWMH-3.1	0.500
S6.003	SWMH-1.4	0.500
S3.004	SWMH-20.5	0.500
S9.000	SWMH-4.1	0.500
S9.001	SWMH-4.2	0.500
S9.002	SWMH-4.3	0.500
S10.000	SWMH-5.1	0.500
S9.003	SWMH-4.4	0.500
S9.004	SWMH-4.5	0.500
S3.005	SWMH-20.6	0.500
S3.006	SWMH-20.7	0.500
S3.007	SWMH-20.8	0.500
S11.000	SWMH-10.1	0.500
S11.001	SWMH-10.2	0.500
S11.002	SWMH-10.3	0.500
S11.003	SWMH-10.4	0.500
S11.004	SWMH-10.5	0.500
S11.005	SWMH-10.6	0.500
S12.000	SWMH-11.1	0.500
S11.006	SWMH-10.7	0.500
S11.007	SWMH-10.8	0.500
S13.000	SWMH-30.1	0.500
S13.001	SWMH-30.2	0.500
S13.002	SWMH-30.3	0.500
S14.000	SWMH-31.1	0.500
S14.001	SWMH-31.2	0.500
S13.003	SWMH-30.4	0.500
S15.000	SWMH-32.1	0.500
S15.001	SWMH-32.2	0.500
S13.004	SWMH-30.5	0.500
S13.005	SWMH-30.6	0.500
S13.006	SWMH-30.7	0.500
S16.000	SWMH-40.1	0.500
S16.001	SWMH-40.2	0.500
S16.002	SWMH-40.3	0.500
S16.003	SWMH-40.4	0.500
S17.000	SWMH-44.1	0.500
S17.001	SWMH-44.2	0.500
S16.004	SWMH-40.5	0.500

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
S18.000	SWMH-41.1	0.500
S18.001	SWMH-41.2	0.500
S16.005	SWMH-40.6	0.500
S19.000	SWMH-42.1	0.500
S19.001	SWMH-42.2	0.500
S16.006	SWMH-40.7	0.500
S20.000	SWMH-43.1	0.500
S20.001	SWMH-43.2	0.500
S20.002	SWMH-43.3	0.500
S16.007	SWMH-40.8	0.500
S16.008	SWMH-40.9	0.500
S16.009	SWMH-40.10	0.500
S3.008	SWMH-OUTFALL	0.500

5 year Return Period 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	2.000
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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.323
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.800	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	5, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.000	SWMH-20.1	15 Winter	5	+10%	30/15 Summer			
S3.001	SWMH-20.2	15 Winter	5	+10%	30/15 Summer			
S4.000	SWMH-21.1	15 Winter	5	+10%	30/15 Summer			
S5.000	SWMH-22.1	15 Winter	5	+10%	30/15 Winter			
S4.001	SWMH-21.2	15 Winter	5	+10%	30/15 Summer			
S4.002	SWMH-21.3	15 Winter	5	+10%	30/15 Summer			
S3.002	SWMH-20.3	15 Winter	5	+10%	30/15 Summer			
S3.003	SWMH-20.4	15 Winter	5	+10%	30/15 Summer			
S6.000	SWMH-1.1	30 Winter	5	+10%	30/15 Winter			
S6.001	SWMH-1.2	30 Winter	5	+10%	30/15 Summer			
S7.000	SWMH-2.1	30 Winter	5	+10%	30/15 Summer			
S6.002	SWMH-1.3	30 Winter	5	+10%	30/15 Summer			
S8.000	SWMH-3.1	30 Winter	5	+10%	30/15 Summer			
S6.003	SWMH-1.4	30 Winter	5	+10%	5/15 Winter			
S3.004	SWMH-20.5	30 Winter	5	+10%	5/15 Winter			
S9.000	SWMH-4.1	15 Winter	5	+10%	30/15 Winter			
S9.001	SWMH-4.2	15 Winter	5	+10%	30/15 Summer			
S9.002	SWMH-4.3	15 Winter	5	+10%	30/15 Summer			
S10.000	SWMH-5.1	15 Winter	5	+10%	30/15 Summer			
S9.003	SWMH-4.4	15 Winter	5	+10%	5/15 Summer			
S9.004	SWMH-4.5	30 Summer	5	+10%	30/15 Summer			

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH-20.1	69.682	-0.063	0.000	0.92		55.5	OK	
S3.001	SWMH-20.2	69.560	-0.013	0.000	1.00		57.1	OK	
S4.000	SWMH-21.1	69.824	-0.176	0.000	0.12		6.4	OK	
S5.000	SWMH-22.1	69.885	-0.165	0.000	0.40		23.8	OK	
S4.001	SWMH-21.2	69.818	-0.114	0.000	0.62		35.8	OK	
S4.002	SWMH-21.3	69.766	-0.075	0.000	0.89		54.1	OK	
S3.002	SWMH-20.3	69.431	-0.058	0.000	0.95		120.9	OK	
S3.003	SWMH-20.4	69.383	-0.050	0.000	0.93		132.7	OK	
S6.000	SWMH-1.1	69.334	-0.233	0.000	0.25		35.9	OK	
S6.001	SWMH-1.2	69.321	-0.055	0.000	0.29		37.2	OK	
S7.000	SWMH-2.1	69.314	-0.185	0.000	0.15		21.8	OK	
S6.002	SWMH-1.3	69.306	-0.002	0.000	0.61		63.4	OK	
S8.000	SWMH-3.1	69.297	-0.170	0.000	0.24		34.8	OK	
S6.003	SWMH-1.4	69.284	0.014	0.000	1.31		111.7	SURCHARGED	
S3.004	SWMH-20.5	69.260	0.010	0.000	0.85		218.9	SURCHARGED	
S9.000	SWMH-4.1	69.321	-0.213	0.000	0.28		26.1	OK	
S9.001	SWMH-4.2	69.294	-0.138	0.000	0.44		41.4	OK	
S9.002	SWMH-4.3	69.263	-0.065	0.000	0.47		44.1	OK	
S10.000	SWMH-5.1	69.246	-0.076	0.000	0.28		26.3	OK	
S9.003	SWMH-4.4	69.228	0.008	0.000	1.23		86.4	SURCHARGED	
S9.004	SWMH-4.5	69.188	0.000	0.000	1.13		78.0	OK	

5 year Return Period 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
S3.005	SWMH-20.6	30 Winter	5	+10%	5/15 Summer		
S3.006	SWMH-20.7	30 Winter	5	+10%	5/15 Summer		
S3.007	SWMH-20.8	15 Summer	5	+10%	30/15 Summer		
S11.000	SWMH-10.1	15 Winter	5	+10%	30/15 Summer		
S11.001	SWMH-10.2	15 Winter	5	+10%	30/15 Summer		
S11.002	SWMH-10.3	15 Winter	5	+10%	30/15 Summer		
S11.003	SWMH-10.4	15 Winter	5	+10%	30/15 Summer		
S11.004	SWMH-10.5	30 Winter	5	+10%	30/15 Summer		
S11.005	SWMH-10.6	30 Winter	5	+10%	30/15 Summer		
S12.000	SWMH-11.1	15 Winter	5	+10%	100/15 Summer		
S11.006	SWMH-10.7	15 Summer	5	+10%	30/15 Summer		
S11.007	SWMH-10.8	30 Winter	5	+10%	5/30 Winter		
S13.000	SWMH-30.1	15 Winter	5	+10%	30/15 Summer		
S13.001	SWMH-30.2	15 Winter	5	+10%	5/15 Winter		
S13.002	SWMH-30.3	15 Winter	5	+10%	5/15 Summer		
S14.000	SWMH-31.1	15 Winter	5	+10%	30/15 Summer		
S14.001	SWMH-31.2	15 Winter	5	+10%	30/15 Summer		
S13.003	SWMH-30.4	15 Winter	5	+10%	5/15 Summer		
S15.000	SWMH-32.1	15 Winter	5	+10%			
S15.001	SWMH-32.2	15 Winter	5	+10%			
S13.004	SWMH-30.5	15 Winter	5	+10%	30/15 Winter		
S13.005	SWMH-30.6	15 Winter	5	+10%	30/15 Winter	100/1440 Winter	
S13.006	SWMH-30.7	15 Winter	5	+10%	30/15 Summer	100/1440 Summer	
S16.000	SWMH-40.1	15 Winter	5	+10%	30/15 Winter		
S16.001	SWMH-40.2	15 Winter	5	+10%	30/15 Summer		
S16.002	SWMH-40.3	15 Winter	5	+10%	30/15 Summer		
S16.003	SWMH-40.4	15 Winter	5	+10%	30/15 Summer		
S17.000	SWMH-44.1	30 Winter	5	+10%	30/15 Summer		
S17.001	SWMH-44.2	30 Winter	5	+10%	30/15 Summer		
S16.004	SWMH-40.5	15 Winter	5	+10%	5/15 Winter		
S18.000	SWMH-41.1	30 Winter	5	+10%	30/15 Summer		
S18.001	SWMH-41.2	15 Winter	5	+10%	30/15 Summer		
S16.005	SWMH-40.6	15 Winter	5	+10%	5/15 Summer		
S19.000	SWMH-42.1	15 Winter	5	+10%	100/15 Summer		
S19.001	SWMH-42.2	15 Winter	5	+10%	30/15 Summer		
S16.006	SWMH-40.7	60 Winter	5	+10%	30/15 Summer		
S20.000	SWMH-43.1	15 Winter	5	+10%	100/15 Winter		
S20.001	SWMH-43.2	15 Winter	5	+10%	100/15 Summer		
S20.002	SWMH-43.3	15 Winter	5	+10%	100/15 Summer		
S16.007	SWMH-40.8	30 Winter	5	+10%	30/15 Summer		
S16.008	SWMH-40.9	30 Winter	5	+10%	100/15 Summer		
S16.009	SWMH-40.10	30 Winter	5	+10%	100/15 Summer		
S3.008	SWMH-OUTFALL	1440 Winter	5	+10%			

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S3.005	SWMH-20.6		69.149	0.045	0.000	1.12		289.0	SURCHARGED
S3.006	SWMH-20.7		69.053	0.025	0.000	1.92		289.2	SURCHARGED
S3.007	SWMH-20.8		69.008	0.000	0.000	1.39		254.0	OK
S11.000	SWMH-10.1		69.569	-0.148	0.000	0.70		100.0	OK
S11.001	SWMH-10.2		69.478	-0.068	0.000	0.94		97.7	OK
S11.002	SWMH-10.3		69.438	-0.071	0.000	0.91		123.8	OK
S11.003	SWMH-10.4		69.370	-0.039	0.000	1.00		136.9	OK
S11.004	SWMH-10.5		69.197	-0.101	0.000	0.68		141.0	OK
S11.005	SWMH-10.6		69.128	-0.049	0.000	0.76		148.4	OK
S12.000	SWMH-11.1		69.083	-0.217	0.000	0.37		34.4	OK
S11.006	SWMH-10.7		69.053	0.000	0.000	1.02		117.1	OK
S11.007	SWMH-10.8		69.003	0.028	0.000	1.01		146.1	SURCHARGED
S13.000	SWMH-30.1		69.731	-0.154	0.000	0.44		26.7	OK
S13.001	SWMH-30.2		69.693	0.030	0.000	0.50		50.0	SURCHARGED
S13.002	SWMH-30.3		69.650	0.166	0.000	0.85		60.6	SURCHARGED
S14.000	SWMH-31.1		70.066	-0.109	0.000	0.80		76.2	OK
S14.001	SWMH-31.2		69.985	-0.053	0.000	1.00		69.7	OK
S13.003	SWMH-30.4		69.629	0.179	0.000	1.35		127.6	SURCHARGED
S15.000	SWMH-32.1		69.521	-0.251	0.000	0.38		52.7	OK
S15.001	SWMH-32.2		69.393	-0.239	0.000	0.43		49.0	OK
S13.004	SWMH-30.5		69.151	-0.109	0.000	0.73		206.7	OK
S13.005	SWMH-30.6		69.089	-0.031	0.000	1.19		195.1	OK
S13.006	SWMH-30.7		68.871	-0.179	0.000	0.84		195.0	OK
S16.000	SWMH-40.1		69.777	-0.207	0.000	0.19		10.0	OK
S16.001	SWMH-40.2		69.719	-0.183	0.000	0.48		46.9	OK
S16.002	SWMH-40.3		69.608	-0.103	0.000	0.58		80.7	OK
S16.003	SWMH-40.4		69.569	0.000	0.000	0.79		66.8	OK
S17.000	SWMH-44.1		69.570	-0.130	0.000	0.29		17.2	OK
S17.001	SWMH-44.2		69.557	-0.035	0.000	0.30		15.2	OK
S16.004	SWMH-40.5		69.551	0.003	0.000	0.62		81.9	SURCHARGED
S18.000	SWMH-41.1		69.589	-0.231	0.000	0.41		81.5	OK
S18.001	SWMH-41.2		69.561	-0.092	0.000	0.61		122.3	OK
S16.005	SWMH-40.6		69.515	0.037	0.000	1.10		199.1	SURCHARGED
S19.000	SWMH-42.1		69.558	-0.197	0.000	0.41		40.2	OK
S19.001	SWMH-42.2		69.432	-0.123	0.000	0.71		69.2	OK
S16.006	SWMH-40.7		69.355	0.000	0.000	1.48		207.7	OK
S20.000	SWMH-43.1		69.625	-0.220	0.000	0.34		33.6	OK
S20.001	SWMH-43.2		69.533	-0.154	0.000	0.62		61.8	OK
S20.002	SWMH-43.3		69.342	-0.162	0.000	0.60		59.4	OK
S16.007	SWMH-40.8		69.198	-0.132	0.000	0.83		308.1	OK
S16.008	SWMH-40.9		69.094	-0.177	0.000	1.10		307.5	OK
S16.009	SWMH-40.10		68.893	-0.307	0.000	0.65		307.7	OK
S3.008	SWMH-OUTFALL		68.752	-0.348	0.000	0.07		24.2	OK

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S3.005	SWMH-20.6	
S3.006	SWMH-20.7	
S3.007	SWMH-20.8	
S11.000	SWMH-10.1	
S11.001	SWMH-10.2	
S11.002	SWMH-10.3	
S11.003	SWMH-10.4	
S11.004	SWMH-10.5	
S11.005	SWMH-10.6	
S12.000	SWMH-11.1	
S11.006	SWMH-10.7	
S11.007	SWMH-10.8	
S13.000	SWMH-30.1	
S13.001	SWMH-30.2	
S13.002	SWMH-30.3	
S14.000	SWMH-31.1	
S14.001	SWMH-31.2	
S13.003	SWMH-30.4	
S15.000	SWMH-32.1	
S15.001	SWMH-32.2	
S13.004	SWMH-30.5	
S13.005	SWMH-30.6	
S13.006	SWMH-30.7	
S16.000	SWMH-40.1	
S16.001	SWMH-40.2	
S16.002	SWMH-40.3	
S16.003	SWMH-40.4	
S17.000	SWMH-44.1	
S17.001	SWMH-44.2	
S16.004	SWMH-40.5	
S18.000	SWMH-41.1	
S18.001	SWMH-41.2	
S16.005	SWMH-40.6	
S19.000	SWMH-42.1	
S19.001	SWMH-42.2	
S16.006	SWMH-40.7	
S20.000	SWMH-43.1	
S20.001	SWMH-43.2	
S20.002	SWMH-43.3	
S16.007	SWMH-40.8	
S16.008	SWMH-40.9	
S16.009	SWMH-40.10	
S3.008	SWMH-OUTFALL	

30 year Return Period 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 2.000
              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 Storage Structures 1
             Number of Online Controls 1 Number of Time/Area Diagrams 0
            Number of Offline Controls 0 Number of Real Time Controls 0
```

Synthetic Rainfall Details

```
            Rainfall Model                  FSR      Ratio R 0.323
                    Region Scotland and Ireland Cv (Summer) 0.750
                M5-60 (mm)                17.800 Cv (Winter) 0.840

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


                    Profile(s)                             Summer and Winter
             Duration(s) (mins)  15, 30, 60, 120, 240, 360, 480, 960, 1440
          Return Period(s) (years)                                  5, 30, 100
             Climate Change (%)                                   10, 10, 10
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.000	SWMH-20.1	15 Winter	30	+10%	30/15 Summer			
S3.001	SWMH-20.2	15 Winter	30	+10%	30/15 Summer			
S4.000	SWMH-21.1	15 Winter	30	+10%	30/15 Summer			
S5.000	SWMH-22.1	15 Winter	30	+10%	30/15 Winter			
S4.001	SWMH-21.2	15 Winter	30	+10%	30/15 Summer			
S4.002	SWMH-21.3	15 Winter	30	+10%	30/15 Summer			
S3.002	SWMH-20.3	15 Winter	30	+10%	30/15 Summer			
S3.003	SWMH-20.4	15 Winter	30	+10%	30/15 Summer			
S6.000	SWMH-1.1	30 Winter	30	+10%	30/15 Winter			
S6.001	SWMH-1.2	30 Winter	30	+10%	30/15 Summer			
S7.000	SWMH-2.1	30 Winter	30	+10%	30/15 Summer			
S6.002	SWMH-1.3	30 Winter	30	+10%	30/15 Summer			
S8.000	SWMH-3.1	30 Winter	30	+10%	30/15 Summer			
S6.003	SWMH-1.4	30 Winter	30	+10%	5/15 Winter			
S3.004	SWMH-20.5	30 Winter	30	+10%	5/15 Winter			
S9.000	SWMH-4.1	30 Winter	30	+10%	30/15 Winter			
S9.001	SWMH-4.2	30 Winter	30	+10%	30/15 Summer			
S9.002	SWMH-4.3	30 Winter	30	+10%	30/15 Summer			
S10.000	SWMH-5.1	30 Winter	30	+10%	30/15 Summer			
S9.003	SWMH-4.4	30 Winter	30	+10%	5/15 Summer			
S9.004	SWMH-4.5	30 Winter	30	+10%	30/15 Summer			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH-20.1	70.119	0.374	0.000	1.21		73.2	SURCHARGED	
S3.001	SWMH-20.2	70.031	0.458	0.000	1.41		80.6	SURCHARGED	
S4.000	SWMH-21.1	70.113	0.113	0.000	0.15		8.1	SURCHARGED	
S5.000	SWMH-22.1	70.132	0.082	0.000	0.55		32.3	SURCHARGED	
S4.001	SWMH-21.2	70.109	0.177	0.000	0.83		47.4	SURCHARGED	
S4.002	SWMH-21.3	70.073	0.232	0.000	1.19		72.3	SURCHARGED	
S3.002	SWMH-20.3	69.940	0.451	0.000	1.14		145.1	SURCHARGED	
S3.003	SWMH-20.4	69.877	0.444	0.000	1.11		158.6	SURCHARGED	
S6.000	SWMH-1.1	69.820	0.253	0.000	0.35		50.5	SURCHARGED	
S6.001	SWMH-1.2	69.795	0.419	0.000	0.41		53.4	SURCHARGED	
S7.000	SWMH-2.1	69.787	0.288	0.000	0.21		30.5	SURCHARGED	
S6.002	SWMH-1.3	69.771	0.463	0.000	0.90		93.2	SURCHARGED	
S8.000	SWMH-3.1	69.762	0.295	0.000	0.34		49.0	SURCHARGED	
S6.003	SWMH-1.4	69.736	0.466	0.000	1.93		164.5	SURCHARGED	
S3.004	SWMH-20.5	69.685	0.435	0.000	1.20		308.2	SURCHARGED	
S9.000	SWMH-4.1	69.635	0.101	0.000	0.30		28.4	SURCHARGED	
S9.001	SWMH-4.2	69.619	0.187	0.000	0.48		44.9	SURCHARGED	
S9.002	SWMH-4.3	69.588	0.260	0.000	0.55		51.0	SURCHARGED	
S10.000	SWMH-5.1	69.569	0.247	0.000	0.34		31.6	SURCHARGED	
S9.003	SWMH-4.4	69.552	0.332	0.000	1.60		112.8	SURCHARGED	
S9.004	SWMH-4.5	69.512	0.324	0.000	1.72		118.4	SURCHARGED	

30 year Return Period 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
S3.005	SWMH-20.6	30 Winter	30	+10%	5/15 Summer		
S3.006	SWMH-20.7	30 Winter	30	+10%	5/15 Summer		
S3.007	SWMH-20.8	30 Winter	30	+10%	30/15 Summer		
S11.000	SWMH-10.1	15 Winter	30	+10%	30/15 Summer		
S11.001	SWMH-10.2	15 Winter	30	+10%	30/15 Summer		
S11.002	SWMH-10.3	15 Winter	30	+10%	30/15 Summer		
S11.003	SWMH-10.4	30 Winter	30	+10%	30/15 Summer		
S11.004	SWMH-10.5	30 Winter	30	+10%	30/15 Summer		
S11.005	SWMH-10.6	30 Winter	30	+10%	30/15 Summer		
S12.000	SWMH-11.1	30 Winter	30	+10%	100/15 Summer		
S11.006	SWMH-10.7	30 Winter	30	+10%	30/15 Summer		
S11.007	SWMH-10.8	30 Winter	30	+10%	5/30 Winter		
S13.000	SWMH-30.1	15 Winter	30	+10%	30/15 Summer		
S13.001	SWMH-30.2	15 Winter	30	+10%	5/15 Winter		
S13.002	SWMH-30.3	15 Winter	30	+10%	5/15 Summer		
S14.000	SWMH-31.1	15 Winter	30	+10%	30/15 Summer		
S14.001	SWMH-31.2	15 Winter	30	+10%	30/15 Summer		
S13.003	SWMH-30.4	15 Winter	30	+10%	5/15 Summer		
S15.000	SWMH-32.1	15 Winter	30	+10%			
S15.001	SWMH-32.2	15 Winter	30	+10%			
S13.004	SWMH-30.5	15 Winter	30	+10%	30/15 Winter		
S13.005	SWMH-30.6	15 Winter	30	+10%	30/15 Winter	100/1440 Winter	
S13.006	SWMH-30.7	15 Winter	30	+10%	30/15 Summer	100/1440 Summer	
S16.000	SWMH-40.1	15 Winter	30	+10%	30/15 Winter		
S16.001	SWMH-40.2	15 Winter	30	+10%	30/15 Summer		
S16.002	SWMH-40.3	15 Winter	30	+10%	30/15 Summer		
S16.003	SWMH-40.4	15 Winter	30	+10%	30/15 Summer		
S17.000	SWMH-44.1	15 Winter	30	+10%	30/15 Summer		
S17.001	SWMH-44.2	15 Winter	30	+10%	30/15 Summer		
S16.004	SWMH-40.5	15 Winter	30	+10%	5/15 Winter		
S18.000	SWMH-41.1	15 Winter	30	+10%	30/15 Summer		
S18.001	SWMH-41.2	15 Winter	30	+10%	30/15 Summer		
S16.005	SWMH-40.6	15 Winter	30	+10%	5/15 Summer		
S19.000	SWMH-42.1	15 Winter	30	+10%	100/15 Summer		
S19.001	SWMH-42.2	15 Winter	30	+10%	30/15 Summer		
S16.006	SWMH-40.7	15 Winter	30	+10%	30/15 Summer		
S20.000	SWMH-43.1	15 Winter	30	+10%	100/15 Winter		
S20.001	SWMH-43.2	15 Winter	30	+10%	100/15 Summer		
S20.002	SWMH-43.3	15 Winter	30	+10%	100/15 Summer		
S16.007	SWMH-40.8	15 Winter	30	+10%	30/15 Summer		
S16.008	SWMH-40.9	60 Summer	30	+10%	100/15 Summer		
S16.009	SWMH-40.10	15 Winter	30	+10%	100/15 Summer		
S3.008	SWMH-OUTFALL	1440 Winter	30	+10%			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S3.005	SWMH-20.6		69.469	0.365	0.000	1.58		408.1	SURCHARGED
S3.006	SWMH-20.7		69.277	0.249	0.000	2.71		408.6	SURCHARGED
S3.007	SWMH-20.8		69.110	0.102	0.000	2.23		408.4	SURCHARGED
S11.000	SWMH-10.1		69.942	0.225	0.000	0.94		133.1	SURCHARGED
S11.001	SWMH-10.2		69.820	0.274	0.000	1.41		145.8	SURCHARGED
S11.002	SWMH-10.3		69.766	0.258	0.000	1.31		178.1	SURCHARGED
S11.003	SWMH-10.4		69.646	0.237	0.000	1.32		181.9	SURCHARGED
S11.004	SWMH-10.5		69.488	0.189	0.000	0.95		196.9	SURCHARGED
S11.005	SWMH-10.6		69.362	0.185	0.000	1.06		208.2	SURCHARGED
S12.000	SWMH-11.1		69.243	-0.057	0.000	0.42		39.1	OK
S11.006	SWMH-10.7		69.228	0.175	0.000	1.96		226.2	SURCHARGED
S11.007	SWMH-10.8		69.166	0.191	0.000	1.47		212.2	SURCHARGED
S13.000	SWMH-30.1		70.318	0.433	0.000	0.51		31.0	SURCHARGED
S13.001	SWMH-30.2		70.261	0.598	0.000	0.73		72.4	SURCHARGED
S13.002	SWMH-30.3		70.166	0.682	0.000	1.02		72.3	SURCHARGED
S14.000	SWMH-31.1		70.293	0.118	0.000	1.13		107.8	SURCHARGED
S14.001	SWMH-31.2		70.178	0.140	0.000	1.40		97.3	SURCHARGED
S13.003	SWMH-30.4		70.132	0.682	0.000	1.99		187.7	SURCHARGED
S15.000	SWMH-32.1		69.574	-0.198	0.000	0.56		78.1	OK
S15.001	SWMH-32.2		69.449	-0.183	0.000	0.60		68.0	OK
S13.004	SWMH-30.5		69.287	0.027	0.000	1.04		292.9	SURCHARGED
S13.005	SWMH-30.6		69.133	0.013	0.000	1.79		293.1	SURCHARGED
S13.006	SWMH-30.7		69.078	0.028	0.000	1.25		292.0	SURCHARGED
S16.000	SWMH-40.1		70.095	0.111	0.000	0.27		14.1	SURCHARGED
S16.001	SWMH-40.2		70.084	0.182	0.000	0.75		72.5	SURCHARGED
S16.002	SWMH-40.3		70.044	0.333	0.000	0.81		113.2	SURCHARGED
S16.003	SWMH-40.4		69.990	0.421	0.000	1.20		100.8	SURCHARGED
S17.000	SWMH-44.1		70.004	0.304	0.000	0.50		29.3	SURCHARGED
S17.001	SWMH-44.2		69.979	0.387	0.000	0.37		18.7	SURCHARGED
S16.004	SWMH-40.5		69.967	0.419	0.000	1.00		130.6	SURCHARGED
S18.000	SWMH-41.1		70.052	0.232	0.000	0.65		130.5	SURCHARGED
S18.001	SWMH-41.2		70.009	0.356	0.000	0.86		173.5	SURCHARGED
S16.005	SWMH-40.6		69.903	0.425	0.000	1.72		311.2	SURCHARGED
S19.000	SWMH-42.1		69.672	-0.083	0.000	0.59		57.6	OK
S19.001	SWMH-42.2		69.612	0.057	0.000	1.00		97.3	SURCHARGED
S16.006	SWMH-40.7		69.527	0.172	0.000	2.83		396.4	SURCHARGED
S20.000	SWMH-43.1		69.687	-0.158	0.000	0.49		48.9	OK
S20.001	SWMH-43.2		69.631	-0.056	0.000	0.97		96.6	OK
S20.002	SWMH-43.3		69.469	-0.035	0.000	0.83		82.7	OK
S16.007	SWMH-40.8		69.373	0.043	0.000	1.26		468.4	SURCHARGED
S16.008	SWMH-40.9		69.271	0.000	0.000	1.38		387.0	OK
S16.009	SWMH-40.10		69.051	-0.149	0.000	0.99		467.7	OK
S3.008	SWMH-OUTFALL		68.921	-0.179	0.000	0.07		24.2	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S3.005	SWMH-20.6	
S3.006	SWMH-20.7	
S3.007	SWMH-20.8	
S11.000	SWMH-10.1	
S11.001	SWMH-10.2	
S11.002	SWMH-10.3	
S11.003	SWMH-10.4	
S11.004	SWMH-10.5	
S11.005	SWMH-10.6	
S12.000	SWMH-11.1	
S11.006	SWMH-10.7	
S11.007	SWMH-10.8	
S13.000	SWMH-30.1	
S13.001	SWMH-30.2	
S13.002	SWMH-30.3	
S14.000	SWMH-31.1	
S14.001	SWMH-31.2	
S13.003	SWMH-30.4	
S15.000	SWMH-32.1	
S15.001	SWMH-32.2	
S13.004	SWMH-30.5	
S13.005	SWMH-30.6	
S13.006	SWMH-30.7	
S16.000	SWMH-40.1	
S16.001	SWMH-40.2	
S16.002	SWMH-40.3	
S16.003	SWMH-40.4	
S17.000	SWMH-44.1	
S17.001	SWMH-44.2	
S16.004	SWMH-40.5	
S18.000	SWMH-41.1	
S18.001	SWMH-41.2	
S16.005	SWMH-40.6	
S19.000	SWMH-42.1	
S19.001	SWMH-42.2	
S16.006	SWMH-40.7	
S20.000	SWMH-43.1	
S20.001	SWMH-43.2	
S20.002	SWMH-43.3	
S16.007	SWMH-40.8	
S16.008	SWMH-40.9	
S16.009	SWMH-40.10	
S3.008	SWMH-OUTFALL	

100 year Return Period 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 2.000
             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 Storage Structures 1
          Number of Online Controls 1 Number of Time/Area Diagrams 0
         Number of Offline Controls 0 Number of Real Time Controls 0
```

Synthetic Rainfall Details

```
Rainfall Model                FSR      Ratio R 0.323
       Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm)                   17.800 Cv (Winter) 0.840

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


              Profile(s)                          Summer and Winter
        Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
     Return Period(s) (years)                              5, 30, 100
           Climate Change (%)                              10, 10, 10
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S3.000	SWMH-20.1	15 Winter	100	+10%	30/15 Summer			
S3.001	SWMH-20.2	15 Winter	100	+10%	30/15 Summer			
S4.000	SWMH-21.1	15 Winter	100	+10%	30/15 Summer			
S5.000	SWMH-22.1	15 Winter	100	+10%	30/15 Winter			
S4.001	SWMH-21.2	15 Winter	100	+10%	30/15 Summer			
S4.002	SWMH-21.3	15 Winter	100	+10%	30/15 Summer			
S3.002	SWMH-20.3	15 Winter	100	+10%	30/15 Summer			
S3.003	SWMH-20.4	30 Winter	100	+10%	30/15 Summer			
S6.000	SWMH-1.1	30 Winter	100	+10%	30/15 Winter			
S6.001	SWMH-1.2	30 Winter	100	+10%	30/15 Summer			
S7.000	SWMH-2.1	30 Winter	100	+10%	30/15 Summer			
S6.002	SWMH-1.3	30 Winter	100	+10%	30/15 Summer			
S8.000	SWMH-3.1	30 Winter	100	+10%	30/15 Summer			
S6.003	SWMH-1.4	30 Winter	100	+10%	5/15 Winter			
S3.004	SWMH-20.5	30 Winter	100	+10%	5/15 Winter			
S9.000	SWMH-4.1	30 Winter	100	+10%	30/15 Winter			
S9.001	SWMH-4.2	30 Winter	100	+10%	30/15 Summer			
S9.002	SWMH-4.3	30 Winter	100	+10%	30/15 Summer			
S10.000	SWMH-5.1	30 Winter	100	+10%	30/15 Summer			
S9.003	SWMH-4.4	30 Winter	100	+10%	5/15 Summer			
S9.004	SWMH-4.5	30 Winter	100	+10%	30/15 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH-20.1	70.982	1.237	0.000	1.37		82.6	FLOOD RISK	
S3.001	SWMH-20.2	70.762	1.189	0.000	1.57		89.9	FLOOD RISK	
S4.000	SWMH-21.1	70.887	0.887	0.000	0.14		7.9	SURCHARGED	
S5.000	SWMH-22.1	70.914	0.864	0.000	0.61		35.8	SURCHARGED	
S4.001	SWMH-21.2	70.880	0.948	0.000	0.89		51.0	SURCHARGED	
S4.002	SWMH-21.3	70.830	0.989	0.000	1.35		81.6	SURCHARGED	
S3.002	SWMH-20.3	70.607	1.118	0.000	1.38		175.0	SURCHARGED	
S3.003	SWMH-20.4	70.522	1.089	0.000	1.26		179.0	SURCHARGED	
S6.000	SWMH-1.1	70.487	0.920	0.000	0.38		55.0	FLOOD RISK	
S6.001	SWMH-1.2	70.453	1.077	0.000	0.55		71.5	FLOOD RISK	
S7.000	SWMH-2.1	70.442	0.943	0.000	0.23		33.3	FLOOD RISK	
S6.002	SWMH-1.3	70.421	1.113	0.000	1.21		125.9	FLOOD RISK	
S8.000	SWMH-3.1	70.410	0.943	0.000	0.38		54.0	FLOOD RISK	
S6.003	SWMH-1.4	70.375	1.105	0.000	2.61		222.0	FLOOD RISK	
S3.004	SWMH-20.5	70.225	0.975	0.000	1.56		403.1	SURCHARGED	
S9.000	SWMH-4.1	70.167	0.633	0.000	0.33		31.0	FLOOD RISK	
S9.001	SWMH-4.2	70.146	0.714	0.000	0.61		56.7	FLOOD RISK	
S9.002	SWMH-4.3	70.106	0.778	0.000	0.68		63.2	FLOOD RISK	
S10.000	SWMH-5.1	70.081	0.759	0.000	0.39		36.5	SURCHARGED	
S9.003	SWMH-4.4	70.057	0.838	0.000	1.90		133.6	SURCHARGED	
S9.004	SWMH-4.5	69.956	0.768	0.000	2.01		138.7	SURCHARGED	

100 year Return Period 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
S3.005	SWMH-20.6	30 Winter	100	+10%	5/15 Summer		
S3.006	SWMH-20.7	30 Winter	100	+10%	5/15 Summer		
S3.007	SWMH-20.8	30 Winter	100	+10%	30/15 Summer		
S11.000	SWMH-10.1	15 Winter	100	+10%	30/15 Summer		
S11.001	SWMH-10.2	15 Winter	100	+10%	30/15 Summer		
S11.002	SWMH-10.3	30 Winter	100	+10%	30/15 Summer		
S11.003	SWMH-10.4	30 Winter	100	+10%	30/15 Summer		
S11.004	SWMH-10.5	30 Winter	100	+10%	30/15 Summer		
S11.005	SWMH-10.6	30 Winter	100	+10%	30/15 Summer		
S12.000	SWMH-11.1	30 Winter	100	+10%	100/15 Summer		
S11.006	SWMH-10.7	30 Winter	100	+10%	30/15 Summer		
S11.007	SWMH-10.8	30 Winter	100	+10%	5/30 Winter		
S13.000	SWMH-30.1	15 Winter	100	+10%	30/15 Summer		
S13.001	SWMH-30.2	15 Winter	100	+10%	5/15 Winter		
S13.002	SWMH-30.3	15 Winter	100	+10%	5/15 Summer		
S14.000	SWMH-31.1	15 Winter	100	+10%	30/15 Summer		
S14.001	SWMH-31.2	15 Winter	100	+10%	30/15 Summer		
S13.003	SWMH-30.4	15 Winter	100	+10%	5/15 Summer		
S15.000	SWMH-32.1	15 Winter	100	+10%			
S15.001	SWMH-32.2	15 Winter	100	+10%			
S13.004	SWMH-30.5	15 Winter	100	+10%	30/15 Winter		
S13.005	SWMH-30.6	15 Winter	100	+10%	30/15 Winter	100/1440 Winter	
S13.006	SWMH-30.7	15 Winter	100	+10%	30/15 Summer	100/1440 Summer	
S16.000	SWMH-40.1	15 Winter	100	+10%	30/15 Winter		
S16.001	SWMH-40.2	15 Winter	100	+10%	30/15 Summer		
S16.002	SWMH-40.3	15 Winter	100	+10%	30/15 Summer		
S16.003	SWMH-40.4	15 Winter	100	+10%	30/15 Summer		
S17.000	SWMH-44.1	15 Winter	100	+10%	30/15 Summer		
S17.001	SWMH-44.2	15 Winter	100	+10%	30/15 Summer		
S16.004	SWMH-40.5	15 Winter	100	+10%	5/15 Winter		
S18.000	SWMH-41.1	15 Winter	100	+10%	30/15 Summer		
S18.001	SWMH-41.2	15 Winter	100	+10%	30/15 Summer		
S16.005	SWMH-40.6	15 Winter	100	+10%	5/15 Summer		
S19.000	SWMH-42.1	15 Winter	100	+10%	100/15 Summer		
S19.001	SWMH-42.2	15 Winter	100	+10%	30/15 Summer		
S16.006	SWMH-40.7	15 Winter	100	+10%	30/15 Summer		
S20.000	SWMH-43.1	15 Winter	100	+10%	100/15 Winter		
S20.001	SWMH-43.2	15 Winter	100	+10%	100/15 Summer		
S20.002	SWMH-43.3	15 Winter	100	+10%	100/15 Summer		
S16.007	SWMH-40.8	15 Winter	100	+10%	30/15 Summer		
S16.008	SWMH-40.9	15 Winter	100	+10%	100/15 Summer		
S16.009	SWMH-40.10	15 Winter	100	+10%	100/15 Summer		
S3.008	SWMH-OUTFALL	1440 Winter	100	+10%			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S3.005	SWMH-20.6		69.856	0.752	0.000	2.08		537.6	SURCHARGED
S3.006	SWMH-20.7		69.523	0.496	0.000	3.58		538.4	SURCHARGED
S3.007	SWMH-20.8		69.233	0.225	0.000	2.94		538.3	SURCHARGED
S11.000	SWMH-10.1		70.624	0.907	0.000	1.10		155.6	FLOOD RISK
S11.001	SWMH-10.2		70.505	0.959	0.000	1.64		170.5	SURCHARGED
S11.002	SWMH-10.3		70.455	0.947	0.000	1.40		189.9	FLOOD RISK
S11.003	SWMH-10.4		70.283	0.874	0.000	1.62		222.1	SURCHARGED
S11.004	SWMH-10.5		70.009	0.710	0.000	1.19		247.8	SURCHARGED
S11.005	SWMH-10.6		69.801	0.624	0.000	1.37		268.9	SURCHARGED
S12.000	SWMH-11.1		69.590	0.290	0.000	0.54		50.1	SURCHARGED
S11.006	SWMH-10.7		69.565	0.512	0.000	2.61		301.2	SURCHARGED
S11.007	SWMH-10.8		69.410	0.435	0.000	1.93		278.6	SURCHARGED
S13.000	SWMH-30.1		70.962	1.077	0.000	0.64		39.2	FLOOD RISK
S13.001	SWMH-30.2		70.866	1.203	0.000	0.93		92.6	FLOOD RISK
S13.002	SWMH-30.3		70.714	1.230	0.000	1.30		92.2	SURCHARGED
S14.000	SWMH-31.1		70.933	0.758	0.000	1.25		119.6	FLOOD RISK
S14.001	SWMH-31.2		70.747	0.709	0.000	1.59		110.5	FLOOD RISK
S13.003	SWMH-30.4		70.670	1.220	0.000	2.43		229.0	SURCHARGED
S15.000	SWMH-32.1		69.623	-0.149	0.000	0.73		101.6	OK
S15.001	SWMH-32.2		69.518	-0.114	0.000	0.73		82.7	OK
S13.004	SWMH-30.5		69.481	0.221	0.000	1.25		353.3	SURCHARGED
S13.005	SWMH-30.6		69.266	0.146	0.000	2.13		349.5	SURCHARGED
S13.006	SWMH-30.7		69.145	0.095	0.000	1.50		348.6	SURCHARGED
S16.000	SWMH-40.1		70.748	0.764	0.000	0.28		14.8	SURCHARGED
S16.001	SWMH-40.2		70.735	0.833	0.000	0.81		79.0	SURCHARGED
S16.002	SWMH-40.3		70.664	0.953	0.000	0.96		134.9	FLOOD RISK
S16.003	SWMH-40.4		70.560	0.991	0.000	1.55		131.0	SURCHARGED
S17.000	SWMH-44.1		70.577	0.877	0.000	0.58		33.7	FLOOD RISK
S17.001	SWMH-44.2		70.547	0.955	0.000	0.49		25.0	SURCHARGED
S16.004	SWMH-40.5		70.530	0.982	0.000	1.27		166.8	SURCHARGED
S18.000	SWMH-41.1		70.704	0.884	0.000	0.74		148.8	FLOOD RISK
S18.001	SWMH-41.2		70.621	0.968	0.000	1.11		222.9	FLOOD RISK
S16.005	SWMH-40.6		70.423	0.945	0.000	2.26		409.0	SURCHARGED
S19.000	SWMH-42.1		70.058	0.303	0.000	0.70		68.3	SURCHARGED
S19.001	SWMH-42.2		69.983	0.428	0.000	1.29		125.5	SURCHARGED
S16.006	SWMH-40.7		69.768	0.413	0.000	3.76		526.2	SURCHARGED
S20.000	SWMH-43.1		69.854	0.009	0.000	0.61		60.8	SURCHARGED
S20.001	SWMH-43.2		69.789	0.102	0.000	1.19		119.3	SURCHARGED
S20.002	SWMH-43.3		69.635	0.131	0.000	0.94		94.1	SURCHARGED
S16.007	SWMH-40.8		69.538	0.208	0.000	1.66		615.0	SURCHARGED
S16.008	SWMH-40.9		69.391	0.120	0.000	2.17		607.0	SURCHARGED
S16.009	SWMH-40.10		69.230	0.030	0.000	1.29		606.8	SURCHARGED
S3.008	SWMH-OUTFALL		69.076	-0.024	0.000	0.07		24.2	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S3.005	SWMH-20.6	
S3.006	SWMH-20.7	
S3.007	SWMH-20.8	
S11.000	SWMH-10.1	
S11.001	SWMH-10.2	
S11.002	SWMH-10.3	
S11.003	SWMH-10.4	
S11.004	SWMH-10.5	
S11.005	SWMH-10.6	
S12.000	SWMH-11.1	
S11.006	SWMH-10.7	
S11.007	SWMH-10.8	
S13.000	SWMH-30.1	
S13.001	SWMH-30.2	
S13.002	SWMH-30.3	
S14.000	SWMH-31.1	
S14.001	SWMH-31.2	
S13.003	SWMH-30.4	
S15.000	SWMH-32.1	
S15.001	SWMH-32.2	
S13.004	SWMH-30.5	
S13.005	SWMH-30.6	
S13.006	SWMH-30.7	
S16.000	SWMH-40.1	
S16.001	SWMH-40.2	
S16.002	SWMH-40.3	
S16.003	SWMH-40.4	
S17.000	SWMH-44.1	
S17.001	SWMH-44.2	
S16.004	SWMH-40.5	
S18.000	SWMH-41.1	
S18.001	SWMH-41.2	
S16.005	SWMH-40.6	
S19.000	SWMH-42.1	
S19.001	SWMH-42.2	
S16.006	SWMH-40.7	
S20.000	SWMH-43.1	
S20.001	SWMH-43.2	
S20.002	SWMH-43.3	
S16.007	SWMH-40.8	
S16.008	SWMH-40.9	
S16.009	SWMH-40.10	
S3.008	SWMH-OUTFALL	

Appendix E – Petrol Interceptor Details

The Conder Range of Bypass Separators

The Conder Range of Bypass Separators are used to fully treat all flows generated by rainfall rates of up to 6.5mm/hr. Bypass Separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where only small spillages occur and the risk of spillage is small.

Typical Application

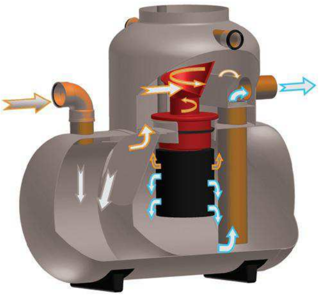
- Car parks
- Roadways and major trunk roads
- Light industrial and goods yards

Features and Benefits

- Innovative design
- Compact and easy to handle/install
- Fully compliant to the Environment Agency's PPG3 guidelines
- Low product and install costs
- Full BSI certification
- Exceeds industry standards
- Easy to service
- Fully tested and verified with a range from CNSB 3 to CNSB 1000 (Class 1)

Performance

Conder Bypass Separators have been designed to treat all flow up to the designed nominal size. Any flow in excess of the nominal size is allowed to bypass the separation chamber thereby keeping the separated and trapped oil safe.



How it Works

Step 1

During the early part of a rain storm, which is a time of high oil contamination, all of the contaminated water flow passes through the sediment collection chamber and enters the separation chamber through a patented oil skimming and filter device.

Step 2

All of the oil then proceeds to the separation chamber where it is separated to the Class 1 standard of 5 mg/l and safely trapped.

Step 3

As the rainstorm builds up to its maximum and the level of oil contamination reduces significantly, the nominal size flow continues to pass through the separation chamber and any excess flow of virtually clean water is allowed to bypass directly to the outlet.

Specification

Larger models up to CNSB 1000 are available.

Area Drained (m^2)	Tank Code including Silt	Length including Silt (mm)	Silt Capacity (L)	Oil Storage Capacity (L)	Diameter (mm)	Height (mm)	Base to inlet Invert (mm)	Base to outlet Invert (mm)	Access (mm)
1667	CNSB3s/21	1400	300	45	1026	2200	1730	1680	750
2500	CNSB4.5s/21	1785	450	67.5	1026	1875	1270	1220	600
3333	CNSB6s/21	1975	600	90	1026	1875	1270	1220	600
4444	CNSB8s/21	2165	800	120	1026	1875	1270	1220	600
5555	CNSB10s/21	2485	1000	150	1026	1875	1270	1220	600
8333	CNSB15s/21	2670	1500	225	1210	2150	1450	1400	600
11111	CNSB20s/21	3115	2000	300	1210	2150	1450	1400	600
13889	CNSB25s/21	3555	2500	375	1210	2150	1450	1400	600
16667	CNSB30s/21	3470	3000	450	1510	2690	1770	1720	750
22222	CNSB40s/21	4040	4000	600	1510	2690	1770	1720	750
27778	CNSB50s/21	4655	5000	750	1510	2690	1770	1720	750
33333	CNSB60s/21	4415	6000	900	1880	3300	2025	1975	2 x 600
44444	CNSB80s/21	5225	8000	1200	1880	3300	2025	1975	2 x 600
55556	CNSB100s/21	6010	10,000	1500	1880	3300	2025	1975	2 x 600

Note: It is a requirement of PPG3 that you have a silt capacity either in your tank or in an upstream catch pit.

Conder Bypass Separators

Premier Tech Aqua UK's range of Conder Bypass Separators are used to fully treat all flows generated by rainfall rates of up to 6.5 mm/hr. Separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of spillage is small.

Performance

Conder Bypass Separators have been designed to treat all flow rates up to the designed nominal size. Any flow in excess of the nominal size is allowed to bypass the separation chamber, thereby keeping the separated and trapped oil safe.

Typical Applications

- Car parks
- Roadways and major trunk roads
- Light industrial and goods yards

Features and Benefits

- Innovative design
- Compact and easy to handle
- Low installation costs
- Full BSI certification
- Exceeds industry standards
- Easy to service
- Fully tested and verified with a range from CNSB 3 to CNSB 1000 (Class 1)

How it works

STEP 1

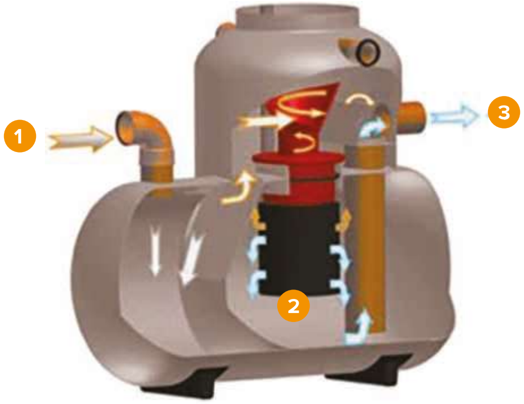
During the early part of a rain storm, which is a time of high oil contamination, all the contaminated water flow passes through the sediment collection chamber and enters the separation chamber through a patented oil skimming and filter device.

STEP 2

All the oil then proceeds to the separation chamber where it is separated to the Class 1 standard of 5 mg/L and safely trapped.

STEP 3

As the rainstorm builds up to its maximum and the level of oil contamination reduces significantly, the nominal size flow continues to pass through the separation chamber and any excess flow of virtually clean water is allowed to bypass directly to the outlet.



Specifications

Area Drained (m2)	Tank Code inc. Silt	Length inc. Silt (mm)	Silt Capacity (L)	Oil Storage Capacity (L)	Diameter (mm)	Height (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)	Access (mm)
1667	CNSB3s/21	1400	300	45	1026	2200	1730	1680	750
2500	CNSB4.5s/21	1785	450	67.5	1026	1875	1270	1220	600
3333	CNSB6s/21	1975	600	90	1026	1875	1270	1220	600
4444	CNSB8s/21	2165	800	120	1026	1875	1270	1220	600
5555	CNSB10s/21	2485	1000	150	1026	1875	1270	1220	600
8333	CNSB15s/21	2670	1500	225	1210	2150	1450	1400	600
11111	CNSB20s/21	3115	2000	300	1210	2150	1450	1400	600
13889	CNSB25s/21	3555	2500	375	1210	2150	1450	1400	600
16667	CNSB30s/21	3470	3000	450	1510	2690	1770	1720	750
22222	CNSB40s/21	4040	4000	600	1510	2690	1770	1720	750
33333	CNSB60s/21	4415	6000	900	1880	3300	2025	1975	2 x 600
44444	CNSB80s/21	5225	8000	1200	1880	3300	2025	1975	2 x 600
55556	CNSB100s/21	6010	10,000	1500	1880	3300	2025	1975	2 x 600

Larger models up to CNSB 1000 are also available.

Note: It is a requirement that you have silt capacity either in your tank or in an upstream catch pit. Specifications for larger models available upon request.

Conder Full Retention Separators

Our range of Conder Full Retention Separators are designed to treat the full flow that can be delivered by a drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65 mm/hr.

Full Retention Separators are used where there is a risk of regular contamination from oil and a foreseeable risk of significant spillages.

Performance

All Conder Full Retention Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.

Typical Applications

- Sites with a high-risk of oil contamination
- Fuel storage depots
- Refuelling facilities
- Petrol forecourts
- Vehicle maintenance areas/workshops
- Where discharge is to a sensitive environment

Features and Benefits

- All surface water is treated
- Automatic closure device (ACD) fitted as standard

How it works

STEP 1

Contaminated water enters the separator where the liquid is retained for a sufficient period to ensure that the lighter than water pollutants (such as oil, petrol) separate and rise to the surface of the water.

STEP 2

The decontaminated water then passes through the coalescing filter before it is safely discharged from the separator, with the remaining pollutants being retained in the separator.

STEP 3

Retained pollutants must be emptied from the separator once the level of oil is reached, or the oil level alarm is activated. This waste should be removed from the separator under the terms of The Waste Management Code of Practice.

Specifications

Area Drained (m²)	Tank Code inc. Silt	Length inc. Silt (mm)	Silt Capacity (L)	Oil Storage Capacity (L)	Diameter (mm)	Height (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)
222	CNS4s/11	2319	400	40	1026	1655	1295	1245
333	CNS6s/11	3414	600	60	1026	1655	1295	1245
444	CNS8s/11	3197	800	80	1210	1855	1480	1430
556	CNS10s/11	3957	1000	100	1210	1855	1480	1430
833	CNS15s/11	3870	1500	150	1510	2180	1780	1730
1111	CNS20s/11	5060	2000	200	1510	2180	1780	1730
1667	CNS30s/11	5369	3000	300	1880	2560	2030	1980
2222	CNS40s/11	7059	4000	400	1880	2560	2030	1980
2778	CNS50s/11	4080	5000	500	2600	3315	2730	2680
3333	CNS60s/11	4805	6000	600	2600	3315	2730	2680
3889	CNS70s/11	5529	7000	700	2600	3315	2730	2680
4444	CNS80s/11	6254	8000	800	2600	3315	2730	2680
5556	CNS100s/11	6751	10,000	1000	2600	3315	2730	2680

Note: It is a requirement that you have silt capacity either in your tank or in an upstream catch pit.

Conder Forecourt Separators

Conder Forecourt Separators have been designed for specific use in petrol filling stations and other similar applications. The size of this separator has been specifically increased in order to retain the possible loss of the contents from one compartment of a road tanker, which could be up to 7,600 litres.

Forecourt Separators are an essential infrastructure requirement for all forecourts to ensure compliance with both health and safety and environmental legislation.

Performance

All Conder Forecourt Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.

Typical Applications

- Petrol forecourts
- Refuelling facilities
- Fuel storage depots

Features and Benefits

- All surface water is treated
- Available in Class 1 and Class 2
- Automatic Closure Device (ACD) fitted as standard
- Includes 2000L silt capacity

How it works

STEP 1

Contaminated water enters the separator where the liquid is retained for a sufficient period to ensure that the lighter than water pollutants (such as oil, petrol) separate and rise to the surface of the water.

STEP 2

The decontaminated water then passes through the coalescing filter before it is safely discharged from the separator, with the remaining pollutants being retained in the separator.

STEP 3

Retained pollutants must be emptied from the separator once the level of oil is reached, or the oil level alarm is activated. This waste should be removed from the separator under the terms of The Waste Management Code of Practice.

Specifications

Tank Code	Volume (L)	Length (mm)	Diameter (mm)	Height (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Access (mm)
ANO/11*	10,000	4250	1800	2100	1600	1550	750
ANT/12**	10,000	4250	1800	2100	1600	1550	750
LNO/11***	10,000	4250	1800	2100	1600	1550	750

*Class 1 Forecourt Separator suitable for discharging to surface water drains. **Class 2 Forecourt Separator suitable for discharging to foul drains only. ***Class 1 Forecourt Separator suitable for installation in granular materials.

Appendix F – SurfSep^{TM} Details

CDS Dimensions (mm)

	CDS10404	CDS0604	CDS0606	CDS0804	CDS0806	CDS0808	CDS1010	CDS1012	CDS1015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table — CDS Polypropylene Manhole Units

Model Reference	Hydraulic Peak Flow Rate l/s	Treatment Flow Rate l/s	Drainage Area — Impermeable m²	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
CDS 0404	30	12.5	2,000	900	150/225
CDS 0604	70	23	5,000	1200	225
CDS 0606/01	140	38	10,000	1200	225-375
CDS 0606/02	200	38	15,000	1200	225-375
CDS 0806	350	49	25,000	1500	450
CDS 0808	400	72	30,000	1500	450
CDS 1010	480	116	35,000	2000	450
CDS 1012	550	152	40,000	2000	450/750
CDS 1015	**700**	**211**	**50,000**	**2000**	**450/750**
CDS 0804	275	31	20,000	1500	300

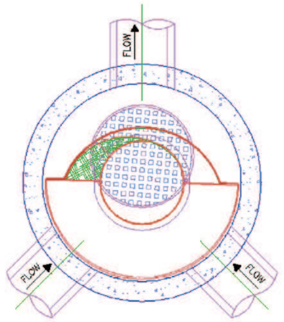
Proposed Peak Fow Rate for each model calculated using Rational Lloyd Davis with a rainfall intensity of 50mm/hr. For greater flows — special design/ construction required.

In-Line CDS

For small catchment, these units are used within the drainage system in-line and are supplied as BBA Approved* complete manhole polypropylene units from the selection table above.

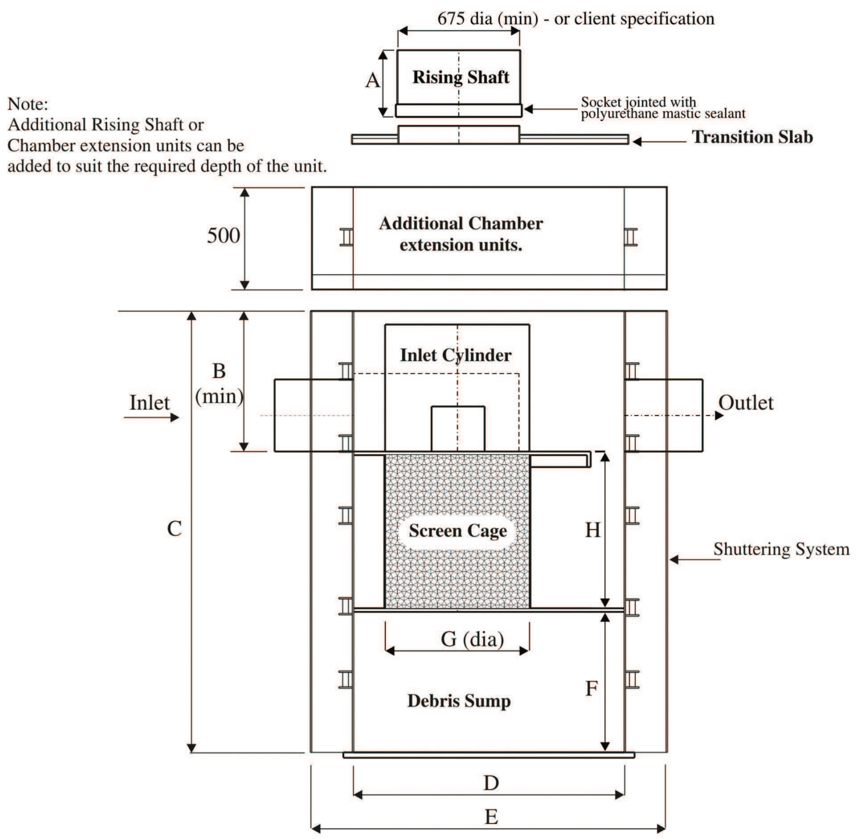
Off-Line CDS

Larger catchment areas and retrofit projects designed with larger surface runoff conveyance capacity can receive treatment using a CDS unit placed adjacent to the storm pipeline. Water is channeled to these offline CDS configurations using a diversion structure. The diversion structure and its weir send the water quality flow to the offline CDS unit and also ensure larger flow events from less frequent storm events properly bypass the offline unit without cause flooding upstream of the unit.



Model Designation

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a CDS screen for installation into standard commercially available pre-fabricated manhole chambers. Example: CDS 0806 designates a separation screen dia. 0.8 m and screen height of 0.6m.


Note:
Additional Rising Shaft or Chamber extension units can be added to suit the required depth of the unit.

Support

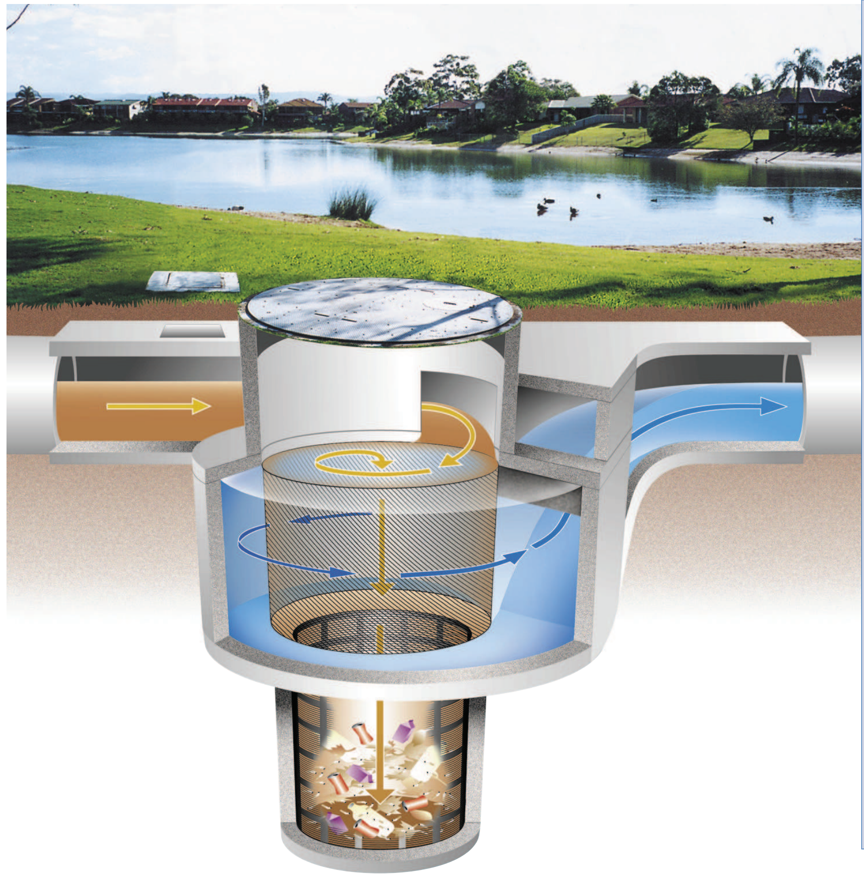
- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.

800.338.1122
contechstormwater.com

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266 related foreign patents or other patents pending.

Surface Water Treatment SUDs Protector

CONSTRUCTION PRODUCTS INC.



Primary Features

- **Effective** — Targets 80% solids removal
- **Non-Blocking** — Unique design takes advantage of indirect screening and properly proportioned hydraulic forces that virtually makes the unit unblockable.
- **Non-Mechanical** — The unit has no moving parts and requires no mechanical devices to support the solid separation function.
- **Low Maintenance Costs** — The system has no moving parts and is fabricated of durable materials.
- **Compact & Flexible** — Design and size flexibility enables the use of various configurations.
- **High-flow Effectiveness** — The technology remains highly effective across a broad spectrum of flow ranges.
- **Assured Pollutant Capture** — All materials captured are retained during high flow conditions.
- **Safe & Easy Pollutant Removal** — Extraction methods allow safe and easy removal of pollutants without manual handling.

The CDS Non Blocking screening technology is an innovative method of liquid/solid separation for stormwater runoff.

The technology accomplishes high efficiency separation of settleable particulate matter and capture of floatable material.

A unique feature is it's compact design. It is available as packaged systems, which can either be installed inside pre-cast concrete chamber rings, or complete BBA Approved Polyethylene manholes.

Applications

- Commercial/residential developments
- Municipal/roadway development
- Industrial development
- Pre-treatment for wetlands, ponds and swales
- Rainwater harvesting
- Pre-treatment for oil separators
- Pre-treatment for media and ground in-filtration systems
- Pre-treatment for underground detention/retention system

Sustainable Urban Drainage System (SUDS)

Developments that achieve SUDS integrate techniques for managing the surface water runoff so that it more closely replicates the natural pre-development conditions of the catchments. Additionally, best practices to control pollution close to their source of generation and achieve surface water quality improvements as well as provide amenity benefits are also required in achieving sustainable urban drainage systems.

Presently in the UK, Scotland and Ireland, SUDS is a planning requirement to be incorporated into the surface water drainage whenever possible and in Scotland, this is a legal requirement.

---

* BBA - this certificate relates to Pipex universal manholes and access chambers which are manufactures from welded polypropylene (PP)

Sizing Unit Selection

In stormwater applications, an analysis of the catchment in terms of its size, topography and land use will provide information for determining flow to be expected for various return periods.

The CDS is designed to treat flow that mobilizes the gross pollutants within the catchment. Since there are variations in catchment response due to region, land use and topography, it is recommended that the selection of flow to be treated will be for return periods of between 3 months and 1 year.

Balancing the cost to the operator against the benefits to the environment

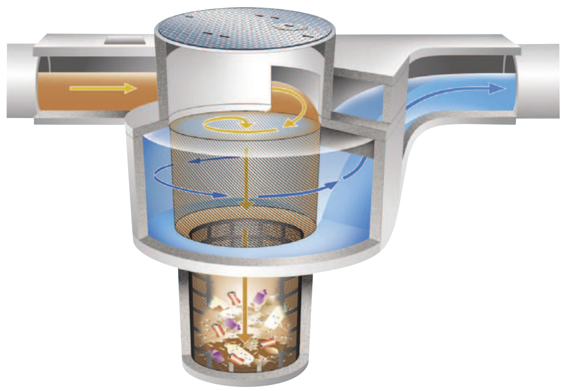
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity for the conveyance facility – typically known as the 'first flush'.

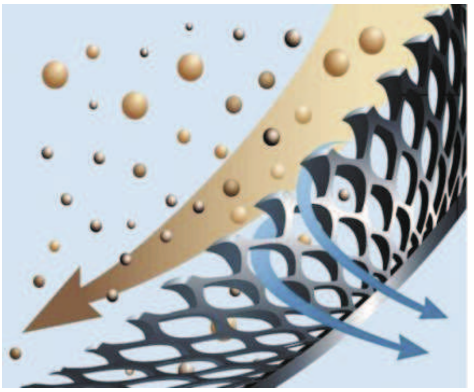
Therefore it is typical not to design the CDS models to process the conveyance system's maximum flow in order to achieve a very high level of pollutant removal.

The added value benefit to the operator is reduced civil costs without compromising the benefits to the environment.

How it works

Water and pollutants enter the system and are introduced tangentially inside the separation chamber forming a circular flow motion. Floatables and suspended solids are diverted to the slow moving centre of the flow. Negatively buoyant solids settle out to an undisturbed sump chamber below, while the water passes countercurrently through the separation screen. Floatables remain at the water surface and retained within the screen.





Surface Water Treatment Systems

Hydraulic Design

Every application requires a detailed hydraulic analysis to ensure the final installation will optimize solids separation without blocking the screen.

After the design flow has been determined, the appropriate standard model can be selected. A selection table is provided on page 4.

The Ultimate SUDs Protector

There are four principal areas of proprietary SUDs technology:

- Infiltration
- Flow control
- Storage/attenuation
- Treatment

When installed upstream of any proprietary SUDs technology, the CDS protects the receiving SUDs from fine solids and debris that would otherwise accumulate over time rendering the SUDs non-operational, as the worse case.

To remove fine solids and debris that would otherwise accumulate over time reducing the down stream effectiveness of downstream SUDs assets, CDS units have been successfully installed in front of:

- Soakaways
- Infiltration Trenches
- Filters
- Wetlands
- Ponds and Water Features
- Detention and Retention Systems
- Oil Separators
- Create storage systems

Infiltration

CDS units have been successfully installed in front of ground infiltration systems to remove grit. Fine solids and debris which accumulates in and around the SUDs causing visual degradation in the short term and accumulation of silt and grits leading to reduced volume in the long term.

Studies have also shown that heavy metals & PAH's accumulate within the SUDs over time before being released back to the environment resulting in elevated concentrations.

Operation & Performance

Performance Criteria

Note: Screen apertures of 4.8 mm and 2.4 mm are available.

Typical Aperture Performance

- Shall remove all solids with a single dimension greater than aperture size and positively contain those solids until the unit is cleaned.
- Shall remove and positively contain 100 percent of all neutrally buoyant particles with a single dimension greater than aperture size for all flow conditions to design capacity.
- Shall remove and positively contain 100 percent of all floating trash and debris with a single dimension greater than aperture size for all flow conditions to the design capacity
- Shall remove a minimum of 50 percent of oil and grease (as defined as the floating portion of total hexane extractable materials) for all flow conditions to the design capacity, without the addition of absorbents.
- Shall provide the following minimum particle removal efficiencies (based on a specific gravity of 2.65):

Maintenance

CDS maintenance can be site and drainage area specific. The installation should be inspected periodically to assure its condition to handle anticipated runoff. If pollutant loadings are known, then a preventive maintenance schedule can be developed based on runoff volumes processed.

New Installations

Check the condition of the installation after the first few events. This includes a visual inspection to ascertain that the unit is operating correctly and measuring the amount of deposition that has occurred in the unit. This may be achieved using a 'Dip Stick'.

Ongoing Operation

For the first 12 months the sediment sump capacity should be inspected quarterly and recorded. When the inspection indicates that the sediment is approaching the top of the sump (base of screen) a cleanout should be undertaken.

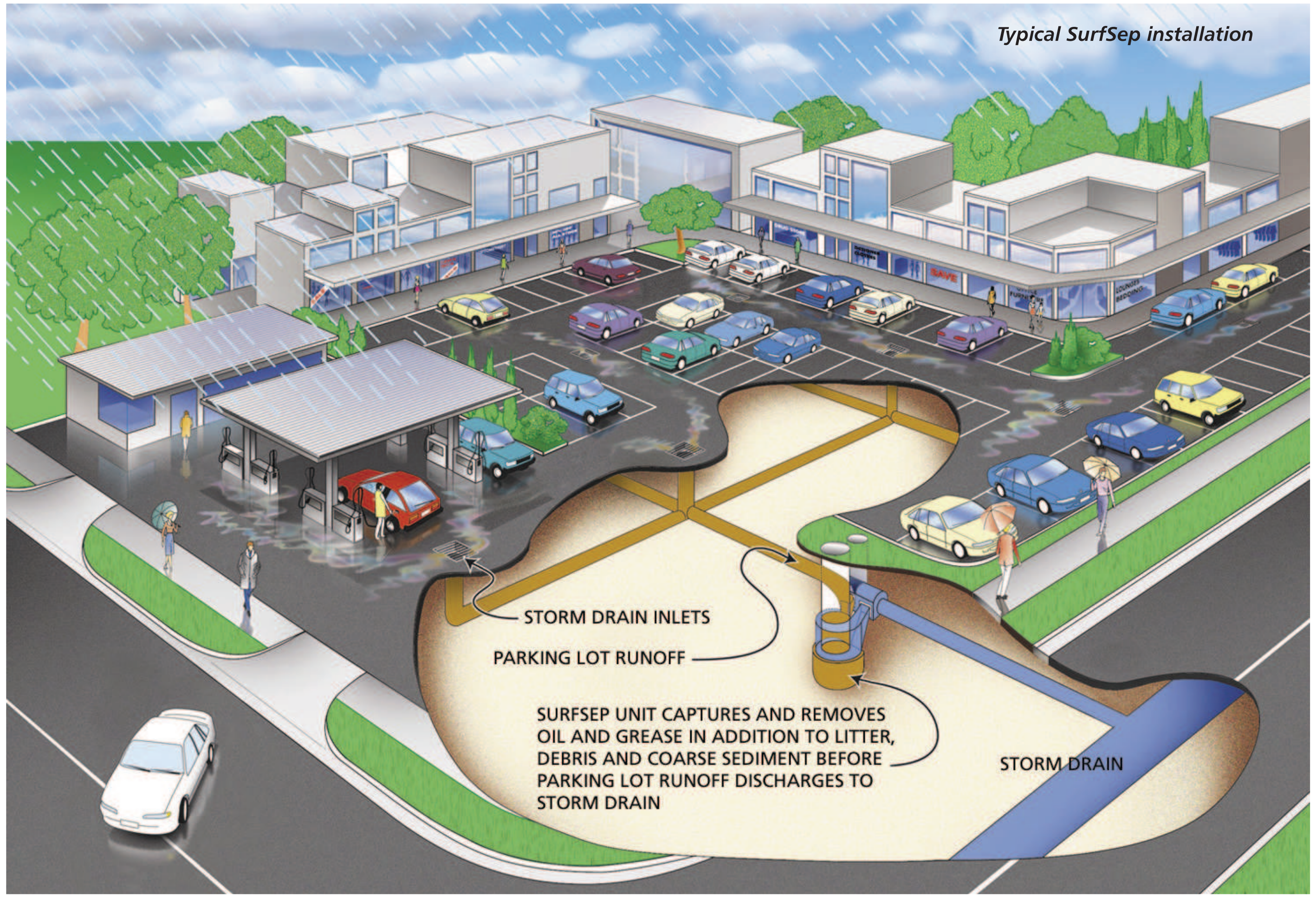
Cleaning Methods

- Eduction (Suction)
- Basket Removal
- Mechanical Grab

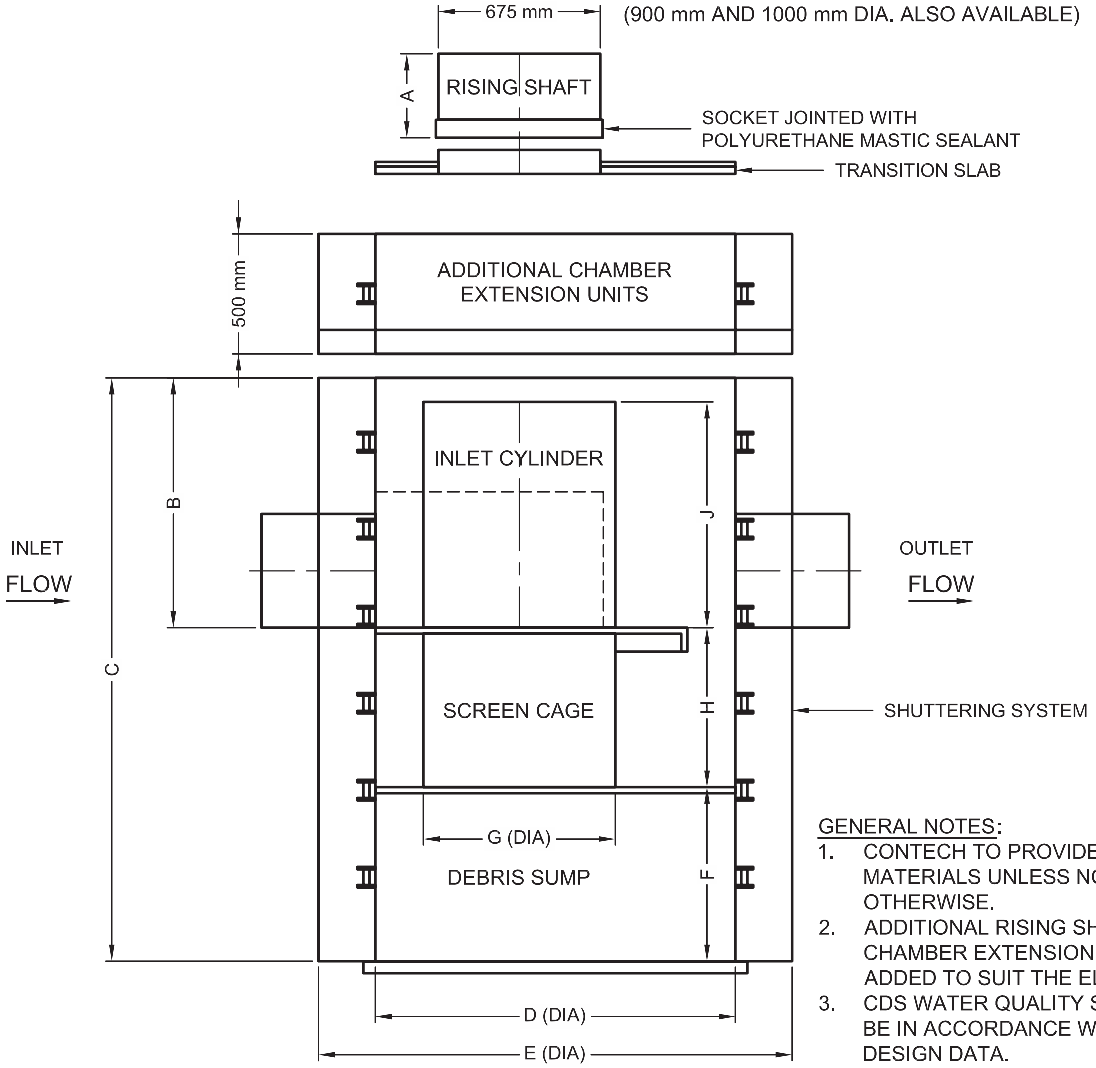
Maintenance Cycle

Minimum once per year. Depending on the pollutant load it may be necessary to maintain the installation more frequently.

The operator shall be able to devise the most efficient maintenance schedule for any particular installation over a 12 month operating cycle.



Typical SurfSep installation



GENERAL NOTES:

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. ADDITIONAL RISING SHAFT OR CHAMBER EXTENSION UNITS CAN BE ADDED TO SUIT THE ELEVATIONS.
3. CDS WATER QUALITY SYSTEM SHALL BE IN ACCORDANCE WITH SITE DESIGN DATA.

DIMENSIONS (ALL FIGURES IN mm)

	CDS 0404	CDS 0604	CDS 0606	CDS 0804	CDS 0806	CDS 0808	CDS 1010	CDS 1012	CDS 1015
A	350	350	350	350	350	350	350	350	350
B	397	789	789	1021	1026	1026	969	1289	1289
C	1245	1973	2173	2230	2430	2630	3040	3560	3860
D (DIA)	800	1200	1200	1500	1500	1500	2000	2000	2000
E (DIA)	1112	1576	1576	1994	1994	1994	2524	2524	2524
F	403	700	700	720	720	720	1030	1030	1030
G (DIA)	405	610	610	810	810	810	960	960	960
H	425	484	684	489	684	884	1041	1241	1541
J	375	629	629	829	828	828	800	1109	1109

PROPRIETARY INFORMATION -
NOT TO BE USED FOR CONSTRUCTION PURPOSES

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CONTECH®
CONSTRUCTION PRODUCTS INC.
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TYPICAL DETAIL
CDS® SURFSEP SYSTEM
PLASTIC CHAMBER CONFIGURATION

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Appendix G – Site Specific Flood Risk Assessment Report

Clifton Scannell Emerson
Associates

Site-Specific Flood Risk Assessment Report

EngineNode Data Centre

Client: EngineNode

Date: 13th February 2020

Job Number: 18_086

Civil Engineering
Structural Engineering
Transport Engineering
Environmental Engineering
Project Management
Health and Safety

CONSULTING ENGINEERS

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Document Control Sheet

Project Name:	EngineNode Data Centre
Project Number:	18_086
Report Title:	Site-Specific Flood Risk Assessment Report
Filename:	RPT-18_086-005

Issue No.	Issue Status	Date	Prepared by	Checked by
1st	DRAFT	11/02/2020	SE	RG
2nd	FINAL	13/02/2020	SE	RG

Table of Contents

List of Figures

1 Introduction

1.1 Background

CSEA was requested to undertake a Sit-specific Flood Risk Assessment (SSFRA) to support the submission of a planning application for the EngineNode Limited for the proposed data storage and energy centre development on site at Gunnocks, Conlee, Co. Meath.

The net development area is approximately 25ha. The site is boarded to the west by R147 and approximately 270m east of the Motorway M3 (as shown in figure 1 below). The existing site is a greenfield site which is currently used as agricultural land.

The proposed development consists of four number two-storey data storage buildings, each containing data halls within each building, a single storey energy centre building, an AGI, HV electrical substation, and ancillary services.

The objective of this report is to assess the site and development proposal in accordance to the requirements of the OPW guidelines, 2009, “The Planning System and Flood Risk Management Guidelines for Planning Authorities”.

Figure 1 Site Location, Gunnocks, Conlee, Co. Meath

1.2 Background Information

1.2.1 Catchment-based Flood Risk Assessment and Management

Catchment-based Flood Risk Assessment and Management (CFRAM) program has been implemented by the Office of Public Works (OPW) as a competent authority in Ireland for the EU floods directive. Over 29 Flood Risk Management Plans (FRMPs) have been prepared in coordination with the implementation of the Water Framework Directive (WFD). The FRMPs involved undertaking detailed engineering assessment and producing flood protection measures. The assessment addressed the potential impact of the proposed measures on waterbodies hydromorphology and quality status.

1.2.2 OPW Flood Guidelines for Planning Authorities

The purpose of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the OPW in 2009 (OPW Guidelines) is to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

1.2.3 Objectives of OPW Guidelines

Floods can have broad range of impact on people, property, infrastructure and the environment. Flood can cause damage to the infrastructure including electricity and other utilities with significant detrimental impacts on local and regional economies. This may also cause long-term closure of businesses leading to economic loss other than the damage caused during the event. The core objectives of the OPW Guidelines include:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

1.2.4 Flood Risk Assessment FRA Key Concepts

For carrying out a Site-specific Flood Risk Assessment (SSFRA), the OPW Guidelines recommend using Source-Path-Receptor concept model to identify where the flood originates from, what is the floodwaters path and the areas in which assets and people might be affected by such flooding (section 2.18 of the OPW Guidelines, 2009). Figure 2 show a schematic representation of S-P-R model.

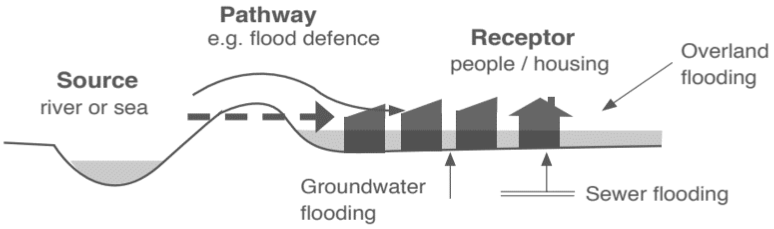


Figure 2 Source-Path-Receptor Model (extracted from OPW Guidelines, 2009)

The other key concept in flood management is the "Flood Risk". it is "the combination of the likelihood of flooding and the potential consequences arising". Consideration of flood risk must be addressed in terms of:

- The likelihood of flooding. Expressed as percentage probability or exceedance each year; and;
- The consequences of flooding as the associated hazard e.g. flood depth and velocity.

Flood risk is then expressed with the relationship:

Flood Risk = Likelihood of flooding x Consequences of flooding.

1.2.5 Flood Zones

Flood Zone is the spatial inundation area that fall within a range of likelihood of flooding. The OPW Guidelines specified three levels of flood zones:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% Annual Exceedance Probability (AEP) or 1 in 100 for river flooding or 0.5% AEP or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding);

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in Zones A or B.

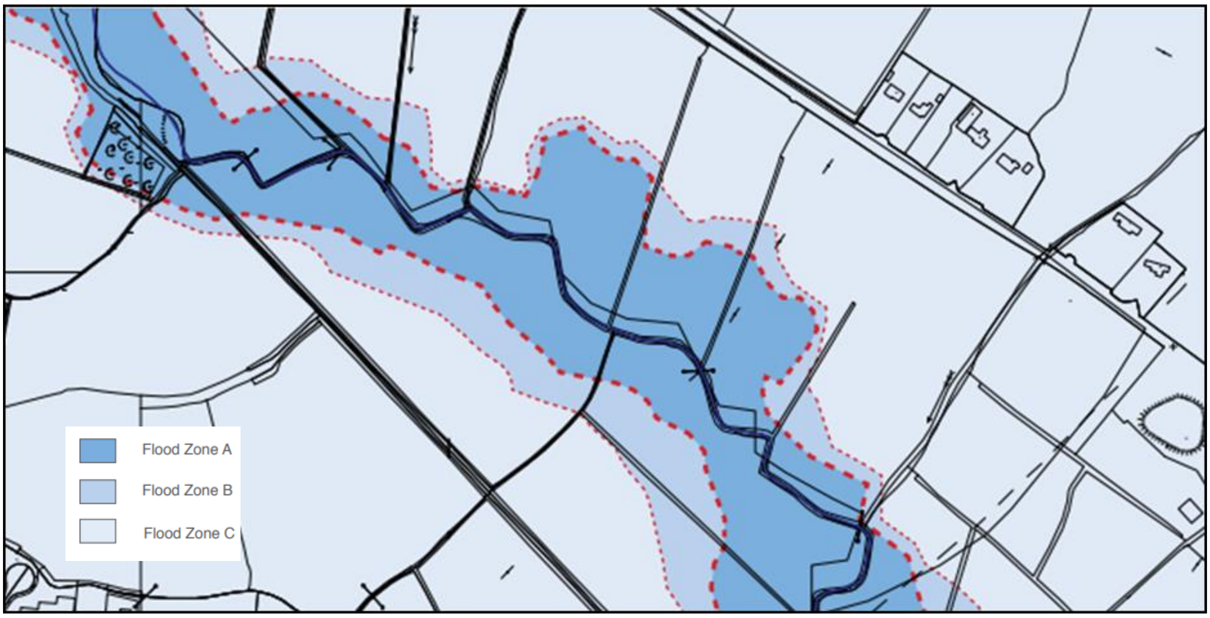


Figure 3 Example of the three flood risk zones (extracted from OPW Guidelines, 2009)

According to the OPW Guidelines, the planning implication of each of the zones mentioned above are:

Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone.

Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone

Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

1.2.6 Sequential Approach

Sequential approach is an important tool used in the planning process which gives preference to locate a new development in the Low Flood Risk Zone and ensures that it does not have an adverse impact of flooding.
According to the sequential approach, If the development lies within a Flood Zone, it is required to consider measures for mitigating flood impact to an acceptable level. It is also required to provide justifications and strategic reasons for locating a proposed development on a higher risk flood zone (see Figure 4 and 5 below).

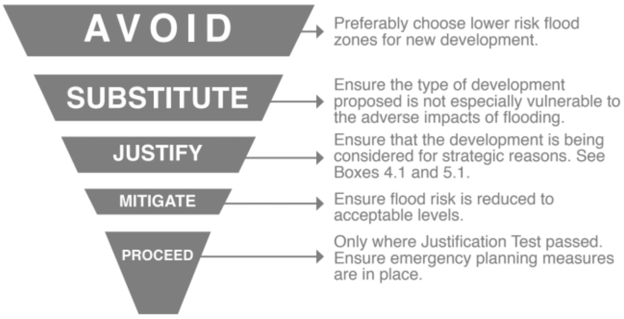


Figure 4 FRA Sequential Approach (extracted from OPW Guidelines, 2009)

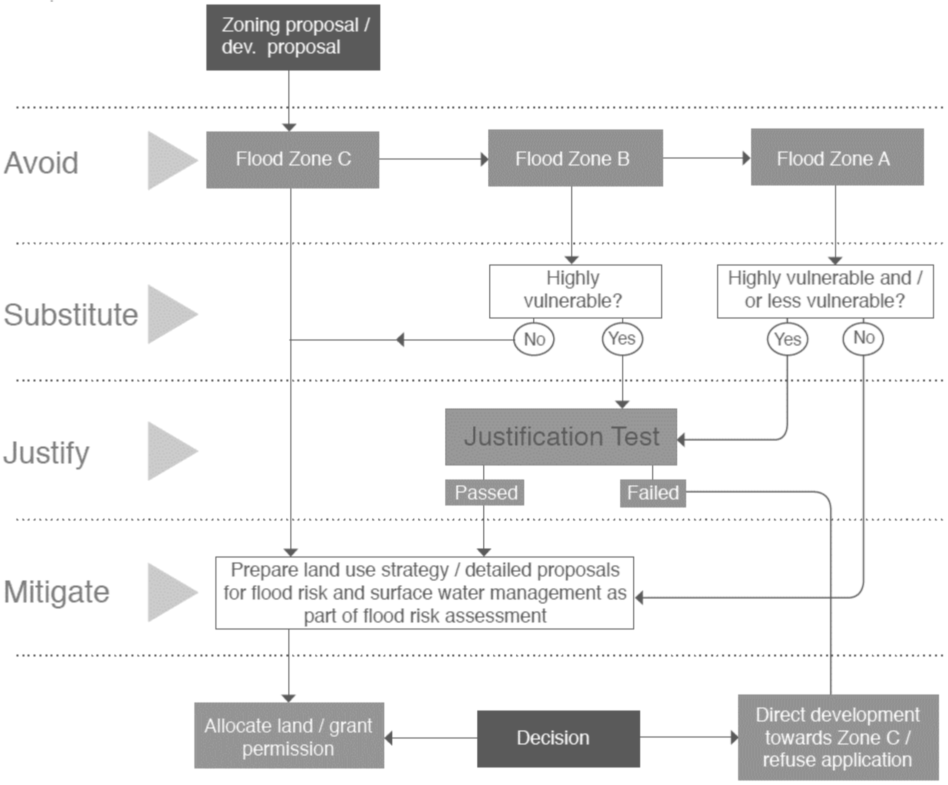


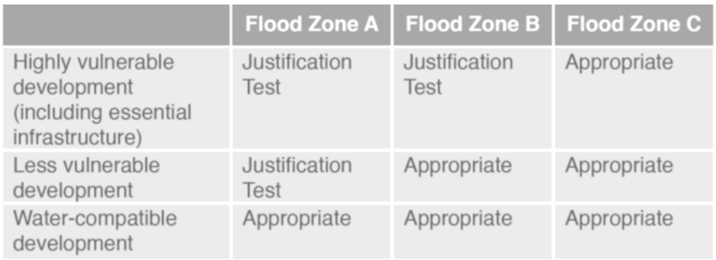
Figure 5 Sequential approach mechanism in the planning process (extracted from OPW Guidelines, 2009)

1.2.7 Development Classification

The OPW Guidelines provided three vulnerability categories based on the type of development which are:

- **Highly vulnerable:** This includes essential infrastructure, such as primary transport and utilities distribution, electricity generating power stations and sub-stations
- **Less vulnerable:** This category includes Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
- **Water compatible:** Includes water-based flood control and recreational developments and other amenity open space, outdoor sports and recreation and essential facilities such as changing rooms.

The OPW Guidelines, as described in Section 2.2.4 of this report, sets out a sequential approach which makes use of flood risk assessment and classifies vulnerability of flooding of different types of development.
Table 3.2 of the OPW Guidelines illustrates those types of development that would be appropriate to each flood zone (reproduced in Table 1 below) and those that would be required to meet a Justification Test in accordance to Box. 5.1 in the Guidelines.



	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Table 1 Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009)

1.3 Impact of Climate Change on Flood Risk

The OPW states in the “Climate Change Sectoral Adaptation Plan 2015-2019” that climate change will significantly increase the flood risk by different mechanisms including:

- Sea level rising
- Increase in Rainfall/Runoff
- Increase in wind speed and hence extreme storms surge events.

The OPW specified two main Climate Change Scenarios for the Pilot CFRAMS Studies, which are: (1) Mid-Range Future Scenario MRFS and; (2) High-End Future Scenario HEFS. Table 2 below shows the parameters of each scenario.

Parameter	**MRFS**	**HEFS**
Rainfall	+20%	+30%
Flood Flows	+20%	+30%
Sea Level Rising	+500 mm	+1000 mm

Table 2 Flood Parameters for the Mid-Range Future and High-End Future Scenarios. Adopted From “Climate Change Sectoral Adaptation Plan 2015-2019”

1.4 OPW Flood Risk Maps

The OPW Flood Maps Viewer available in www.floodinfo.ie, allows access to flood mapping data through an interactive map search. The available OPW Flood Risk Maps for the study area account only for Fluvial Flooding (Rivers). Information on Fluvial Flooding over the extent of the study area was found in flood risk map No. E09DUN-EXFCD-F6-04 for Dunboyne area in Co. Meath (Refer to **Appendix B**).

1.5 Site-Specific Flood Risk Assessment for Development

The OPW Guidelines require a Site-Specific Flood Risk Assessment to “gather relevant information sufficient to identify and assess all sources of flood risk and the impact of drainage from the proposal”. It should “quantify the risks and the effects of any necessary mitigation, together with the measures needed or proposed to manage residual risks”. It considers the nature of flood hazard, taking account of the presence of any flood risk management measures such as flood protection schemes and how development will reduce the flood risk to acceptable levels. A detailed assessment for a development application should conclude that the development is not at risk from core flood risk elements and that residual risks can be successfully managed with no unacceptable impacts on adjacent lands.

1.6 Flood Risk Assessment Stages

The stages of a Flood Risk Assessment as defined by “The Planning System and Flood Risk Management, Guidelines for Planning Authorities” and its Technical Appendices are as follows:

- Stage 1 – Flood Risk Identification
- Stage 2 – Initial Flood Risk Assessment
- Stage 3 – Detailed Flood Risk Assessment

The following sections of this SSFRA follows this approach.

2 Stage 1: Flood Risk Identification

2.1 General

In this stage of SSFRA, we use the existing information to identify any flooding issues related to the site that may require any further investigation.

2.2 Source of Information

Information source reviewed for flood risk identification are listed in table 3 below:

Information Source		Remarks
1	Predictive and historic flood maps and benefiting lands maps available on www.floodmaps.ie.	Refer to **Appendix A**. There were no OPW land commission schemes or benefitting land zones within the subject site's boundary. No flood events were recorded near the site.
2	Predictive fluvial, coastal, pluvial and groundwater flood maps available on www.floodinfo.ie.	Refer to **Appendix B**. The proposed development is located outside the extents of the 1 in 1000 year (0.1% AEP) of the "Tolka" river catchment.
3	Previous CFRAMS studies on the area of "Dunboyne/Clonee".	The "Tolka" river catchment and watercourse network near the study are was reviewed based on the report "UoM 9 – Liffey and Dublin Bay Hydraulic Modelling Report for Dunboyne Area". An extract from this report in Figure 6 indicates that there is no significant stream as part of the Tolka river system passes through the subject site's area.
4	Information on watercourse and streams in the study area such as those available from OS Maps, EPA and GeoHiv	An extract from EPA map viewer https://gis.epa.ie/EPAMaps/; with active *stream* and *flow direction* layers in Figure 7 shows the presence of a stream running through the proposed site that originates from an adjacent 3rd part land.
5	Information on existing drainage system and historical flooding in the study area from Meath County Council MCC	Refer to **Appendix F** for correspondence between CSEA and MCC regarding flooding issues in the site location.

Table 3 Information Source Consulted

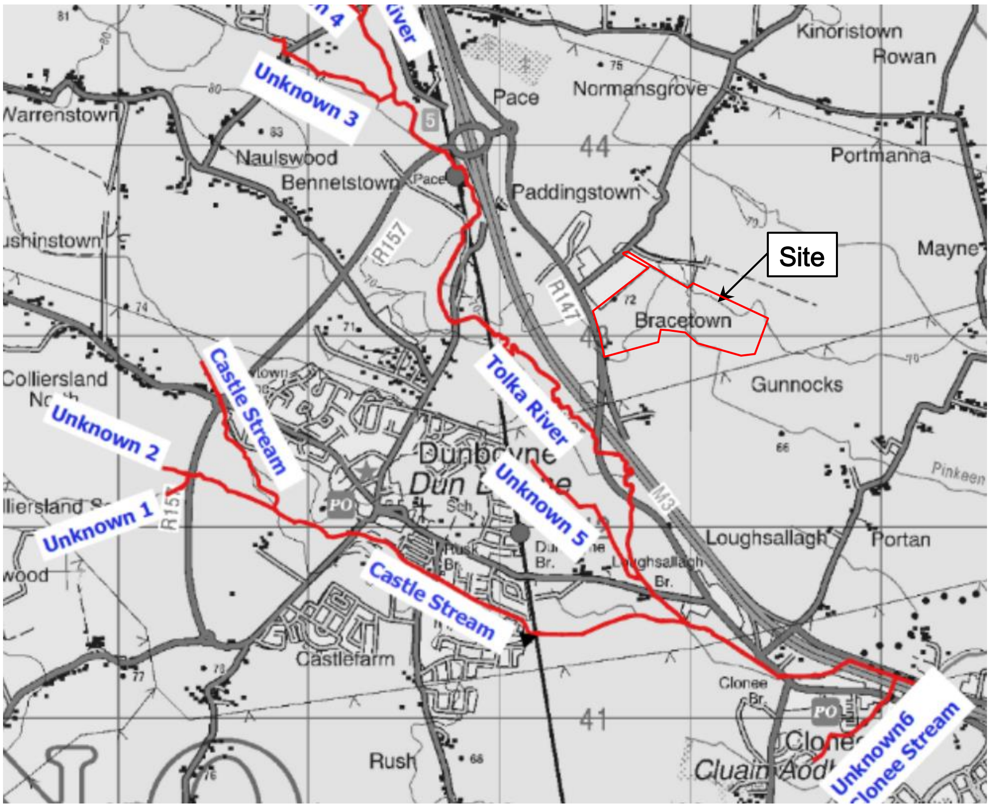
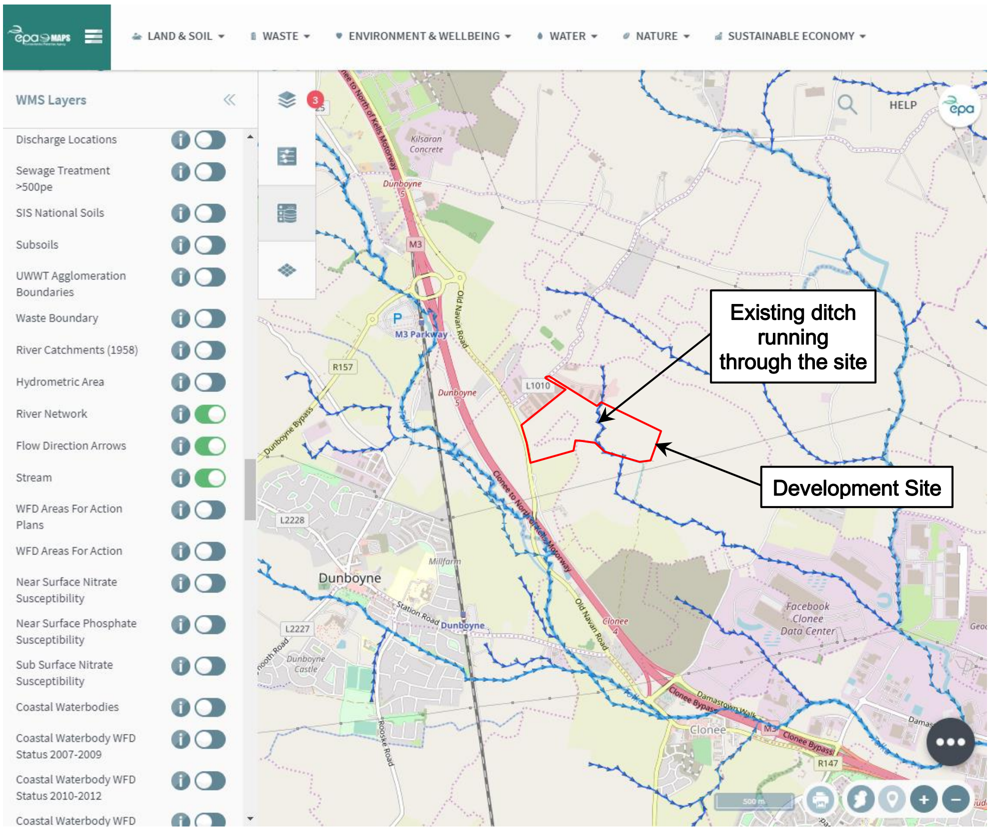


Figure 6 Tolka River network and proposed site location. Extract from "UoM 9 – Liffey and Dublin Bay Hydraulic Modelling Report for Dunboyne Area"



Discharge Locations ○
Sewage Treatment >500pe ○
SIS National Soils ○
Subsoils ○
UWWT Agglomeration Boundaries ○
Waste Boundary ○
River Catchments (1958) ○
Hydrometric Area ○
River Network ●
Flow Direction Arrows ●
Stream ●
WFD Areas For Action Plans ○
WFD Areas For Action ○
Near Surface Nitrate Susceptibility ○
Near Surface Phosphate Susceptibility ○
Sub Surface Nitrate Susceptibility ○
Coastal Waterbodies ○
Coastal Waterbody WFD Status 2007-2009 ○
Coastal Waterbody WFD Status 2010-2012 ○
Coastal Waterbody WFD ○

Figure 7 Location of the proposed development site on an extract from EPA map viewer https://gis.epa.ie/EPAMaps/; with the active layers *river networks*, *stream* and *flow direction.*

2.3 Source-Path-Receptor

A Source-Pathway-Receptor model has been produced to assess the possible sources of floodwater and their likelihood, the pathways by which flood water reaches receptors and the receptors that could be affected by potential flooding, as summarized in Table 4 below.

Source	Path	Receptor	Likelihood	Impact	Risk
Tidal	Tidal flooding from coasts 15.0 km away from the site	People and Property (the proposed development).	Remote	High	Very Low
Fluvial	Flooding from Tolka River 300m away from the site	People and Property (the proposed development).	Remote	High	Very Low
Fluvial	Flooding from the existing ditches running through the site	People and Property (the proposed development).	Possible	High	Moderate
Pluvial/Surface Water	Flooding from surcharging of the development's proposed surface water network	People and Property (the proposed development).	Possible	High	Moderate
Pluvial/Surface Water	Flooding from rise in water levels in the attenuation basins'	People and Property (the proposed development).	Possible	High	Moderate
Ground Water	Rising GWL on the site	People and Property (the proposed development).	Possible	High	Moderate
Other Source	Flooding due to human or mechanical error in sizing of Petrol interceptor or the hydrobrake/ blockage at any drainage system component.	People and Property (the proposed development).	Possible	High	Moderate

Table 4 Source-Path-Receptor analysis

From the SPR analysis presented above, it is noted that the proposed development site is not subject to tidal (Coastal) or fluvial flooding (Tolka River) due to its remote geographic location from these sources and therefore very low risk of flooding. However, Moderate risk remains from minor ditches running through the site and from internal drainage system service to the development.

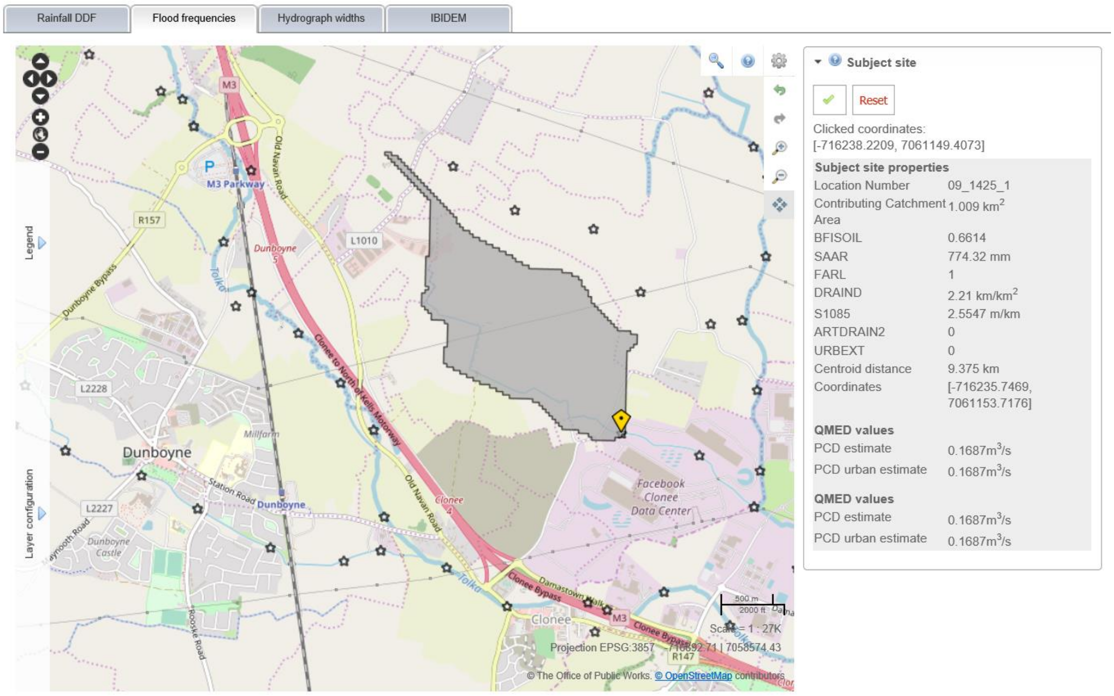
Stage 2 and 3 of this SSFRA will provide further details on the possible source of flooding noted in table 4 above.

3 Stage 2: Initial Flood Risk Assessment

3.1 Fluvial Flooding from existing Ditches

The Source-Pathway-Receptor model also identified that there could be a potential for Fluvial flood risk within the development site related to the existing drainage ditches within the site.

The main ditch runs through the site has a catchment area of approximately 1.0 km^2 according to Flood Studies Updates (FSU) web portal data as shown in Figure 8 below.



Clicked coordinates:
[-716238.2209, 7061149.4073]

Subject site properties	
Location Number	09_1425_1
Contributing Catchment Area	1.009 km^2
BFISOIL	0.6614
SAAR	774.32 mm
FARL	1
DRAIND	2.21 km/km^2
S1085	2.5547 m/km
ARTDRAIN2	0
URBEXT	0
Centroid distance	9.375 km
Coordinates	[-716235.7469, 7061153.7176]
QMED values	
PCD estimate	0.1687m^3/s
PCD urban estimate	0.1687m^3/s
QMED values	
PCD estimate	0.1687m^3/s
PCD urban estimate	0.1687m^3/s

Figure 8 FSU run for ungauged sites showing the subject ditch's catchment area and characteristics

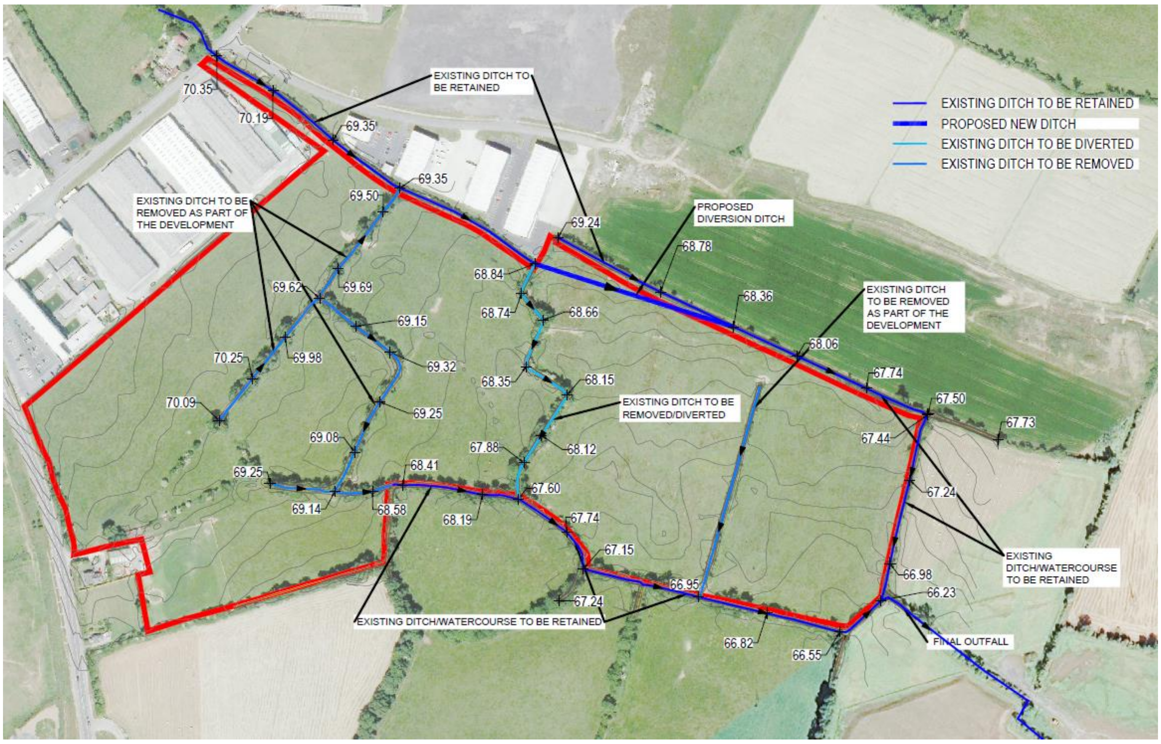


Figure 9 Proposed arrangement for the existing ditches running in the site.

The analysis of topographical survey carried out for the site shows the existing ditches network in the study area and their flow direction as displayed in Figure 9. As part of the proposed surface water drainage, the existing ditches around the site will be retained. Ditches that originate from within the site will be removed as their catchments will drain as part of the proposed development's drainage system. It is noted that the identified ditch running through the site will be diverted by an open channel that runs within the norther border of the development. Further analysis on the capacity and associated flood risk with the proposed diversion work will be discussed in Stage 3 of this SSFRA.

3.2 Pluvial Flooding from Surface Water Drainage

The Source-Pathway-Receptor model presented in Stage 1 indicated the likelihood of Fluvial and Pluvial flooding types within the site. The identified risk of flooding in the study area is primarily associated with the future drainage networks service to the proposed development (see Figure 10).

The drainage system has a potential to cause local flooding unless it is designed in accordance with the regulations e.g. Greater Dublin Strategic Drainage Study (GDSDS) and to take account of flood 100-year storm return periods plus 20% allowance for climate change.

Proper operation and maintenance of the drainage system should be implemented to reduce the pluvial flood risk due to human/ mechanical error. **Appendix C** presents a proposed Operation and Maintenance O&M Plan for the drainage system in the development.

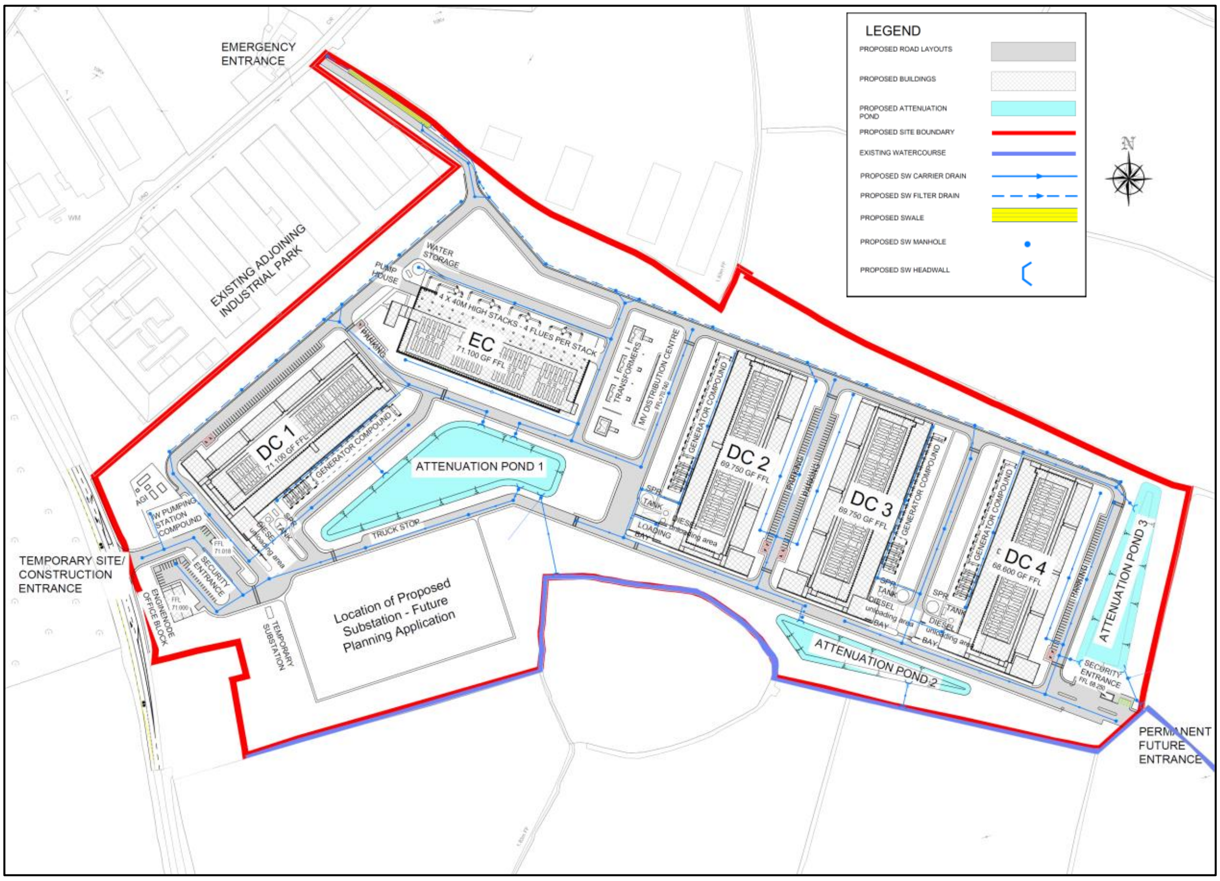


Figure 10 Proposed surface water drainage layout

3.3 Ground Water Flooding

Based on the geotechnical investigation on the site, ground water was encountered in most trial pits at 1.2 m to 2.5 m BGL. During the site walkover survey, no marshy ground was observed. No groundwater wells or marsh areas are located within the site (based on review of information available on EPA and OSI websites). Therefore, the risk of groundwater flooding occurring at the site is considered negligible.

3.4 Flood Zone Category

Following the assessment of the flood risks to the site and the available information it is considered that the proposed site is located within Flood Zone C as per the OWP Guidelines and as indicated by the CFRAMS maps – refer to Appendix B. Therefore, the proposed development on the subject site is appropriate for this flood zone category, and a justification test is not required.

4 Stage 3: Detailed Flood Risk Assessment

As a justification test is not required, a detailed flood risk assessment must be carried out which considers moderate Fluvial and Pluvial Flood Risk in relation to the following;

- Proposed Surface Water Management measures.
- Impact of proposed arrangement of the existing ditches.
- Residual risks.

4.1 Proposed Surface Water Management measures

The proposal of surface water drainage system service to the development (refer to figure 10) has been designed with the application of the following approaches, parameters and methods:

- Drainage design consists of Sustainable Drainage system (SuDS) with roof downpipes, gullies, pipes, manholes, attenuation ponds and discharge control at outlets.
- SuDS systems will be provided including filter drains, permeable pavements, treatment storage and petrol interceptors.
- Attenuation to be three number ponds.
- All pipe networks and attenuation designed to convey 1 in 100 storm-event without flooding.
- All calculations have allowed for an additional allowance of 10% in rainfall intensities to allow for climate change.
- Site discharge rate is controlled to Greater Dublin Strategic Drainage Study (GDSDS) standards.
- Proposed operation and maintenance activities for surface water drainage system in the development is to be implemented as described in **Appendix C.**

4.2 Impact of Proposed Arrangement of the Existing Ditches.

A. Ditches to be removed

As discussed in Section 3.1, those minor ditches and hedgerows within the site that serve as land drains only and are not watercourses. Upon development of the site, these ditches will serve no drainage function as positive drainage system will be constructed in lieu, therefore, their removal poses no flood risk post-development.

B. Ditches to be diverted

The existing ditch running through the development site was identified in Stage 1 of this SSFRA has a potential moderate flooding impact on the site, and therefore, further assessed in in section 4.3 of this report. The catchment area draining to the ditch was estimated as 1.0 km^2 according to FSU run. It is proposed to remove this ditch as part of site development works and constructing a new ditch runs in the open space adjacent to the north boarded 3rd party land.

The catchment area is less than 25 km^2, therefore it is appropriate to use IH124 to estimate Qbar:

$$Q_{bar} = \ 0.00108\ x\ AREA^{0.89}\ x\ SAAR^{1.17} x\ SOIL^{2.17}$$

Where: AREA = 1.0 km^2
SAAR = average annual rainfall = 775mm (FSU data)
SOIL= Soil type index (0.1-0.53) = 0.37 → moderate drainage condition according to EPA soil map available https://gis.epa.ie/EPAMaps/
Q_{Bar} = 0.3 l/s
Growth factor used for Q_{100yr} = 2.6 (as per GDSDS), hence,
Q_{100yr} = 0.78 m^3/s
Q_{100yr} + 10% Climate Change = 0.86 m^3/s

The diversion work proposes an open channel of 1m bottom width and will tie-in to the existing upstream and downstream levels as shown in Figure 11. The hydraulic characteristics and capacity of the proposed channel section are presented in Figure 12. It is noted that the flow depth is approximately 0.58m during $Q_{100yr+CC}$ and hence no risk of overbank flow during this event.

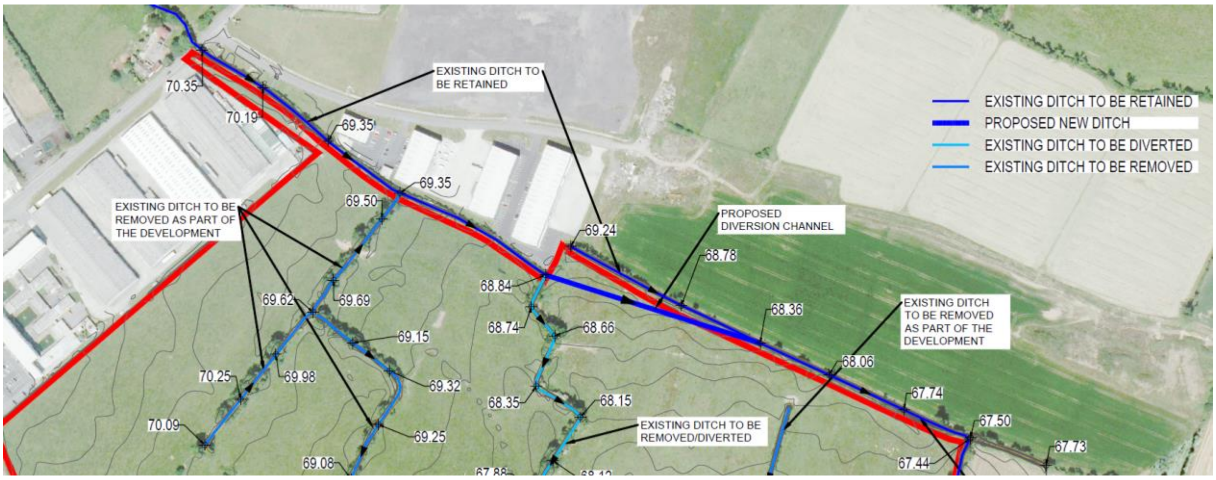
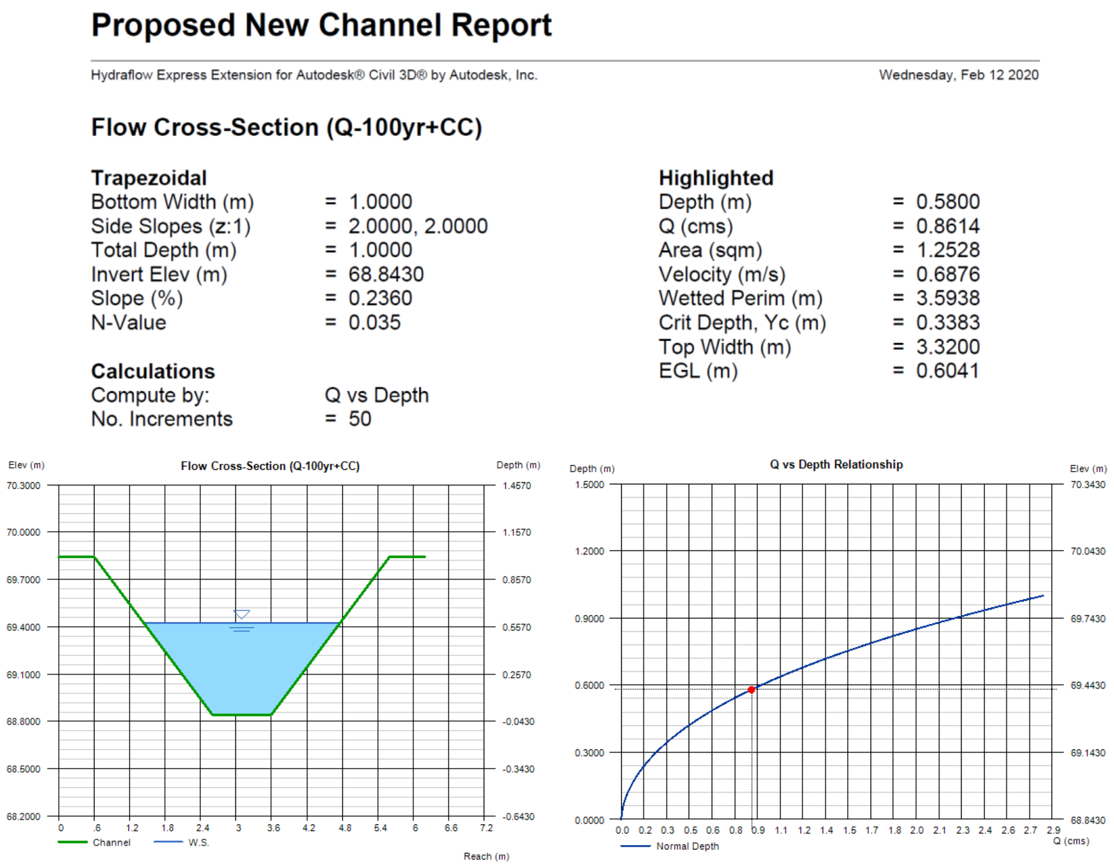


Figure 11 Location of the proposed diversion channel



Proposed New Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Feb 12 2020

Flow Cross-Section (Q-100yr+CC)

Trapezoidal
Bottom Width (m) = 1.0000
Side Slopes (z:1) = 2.0000, 2.0000
Total Depth (m) = 1.0000
Invert Elev (m) = 68.8430
Slope (%) = 0.2360
N-Value = 0.035

Calculations
Compute by: Q vs Depth
No. Increments = 50

Highlighted
Depth (m) = 0.5800
Q (cms) = 0.8614
Area (sqm) = 1.2528
Velocity (m/s) = 0.6876
Wetted Perim (m) = 3.5938
Crit Depth, Yc (m) = 0.3383
Top Width (m) = 3.3200
EGL (m) = 0.6041

Figure 12 Hydraulic analysis of the proposed new channel used for diversion (Calculated by Hydraflow Civil3D)

4.3 *Assessment of Residual Risk*

4.3.1 General

As discussed in sections 4.1, the flood risk associated with the proposed surface water drainage system will be reduced through the compliance with GDSDS design guidelines and the implementation of proper O&M approach. It was shown in section 4.2 that there is no negative impact from the proposed removal of the existing ditches system in the development.

However, the remining residual flood risk may be associated with the proposed alteration/modification of watercourse. A hydraulic model (1D steady state HEC-RAS) was used to assess the impact of the proposed diversion work on the connected ditches downstream which run along the site boarder from the north and the east. The assessment will be based on a design flow of 100-year storm event plus climate change allowance ($Q_{100yr+CC}$). The design flow will account for a contributing catchment of 1.0km^2 as discussed in section 4.2 -B.

In the following sections, HEC RAS model parameters, data and results will be presented in summary.

4.3.2 Geometric data

The geometric data which describes the physical boundary of the system were prepared through Civil3D export, see Figure 13. The data comprises 6no. of cross-sections along the proposed new channel and 14no. of cross-sections along existing ditches. The total model is C.662m in length with variable spacing between cross-sections. Detail geometric data are presented in Appendix D. Figure 13 below shows the locations of cross-sections along the modelled channel.

The recommended Manning's roughness 'n' values may be found in HEC-RAS reference manual. The selected Manning's 'n' was set as a constant along the modelled reach with a value of 0.035.

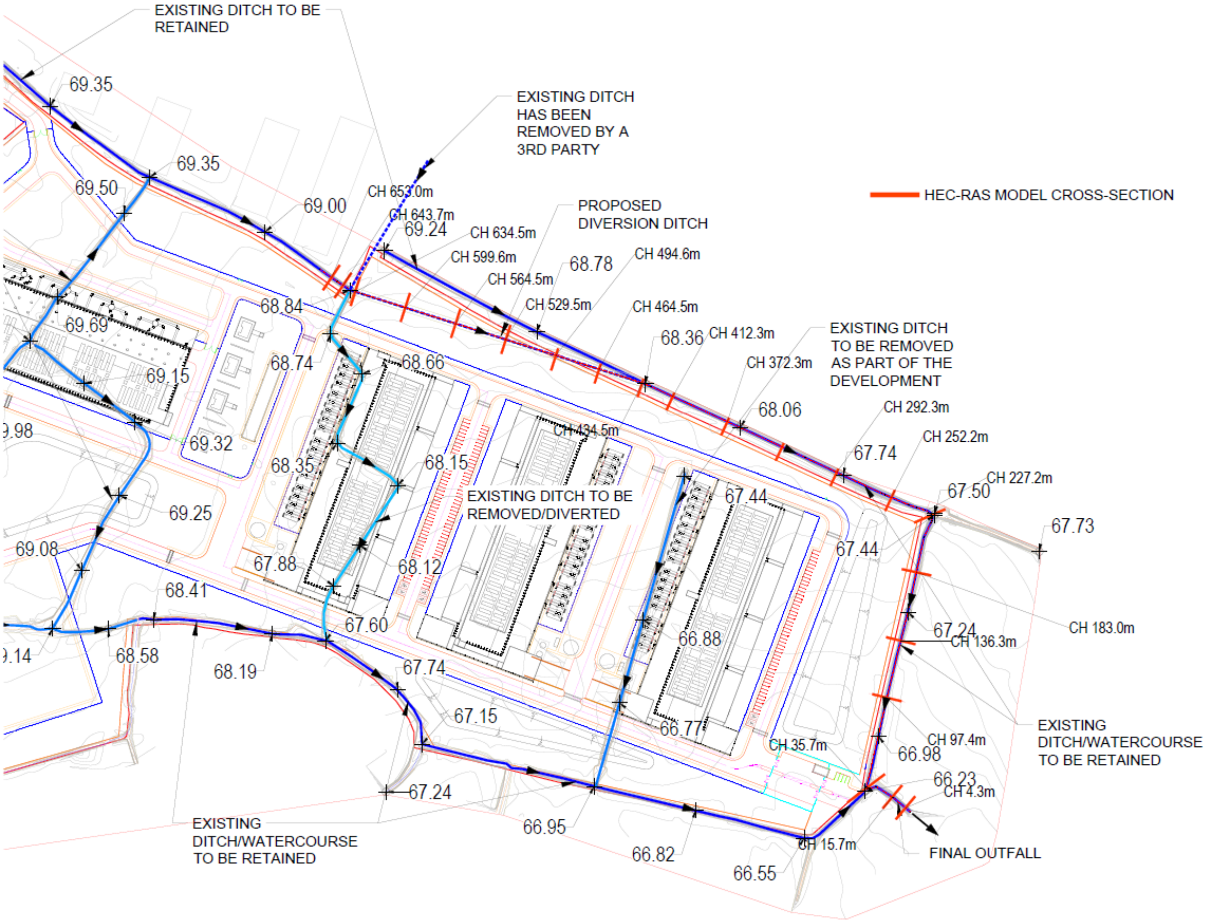


Figure 13 Location of cross-sections used in the hydraulic model

4.3.3 Boundary Conditions BC

Hydraulic performance of the proposed culvert was examined for different flow condition as discussed in section 4.1. Table 1 shows the upstream boundary condition (B.Cs) used in the model represented as different flow events entering the system at the most upstream cross-section (X-C No. 653.0) and downstream B.Cs corresponding to each flood event.

Table 5 Boundary Conditions used in HEC-RAS model

Return Period	Upstream B.C @ X-C 653.0 Discharge (m^3/s)	Downstream B.C @ X-C 4.3, Normal depth m/m
$Q_{10\ years}$	0.30	0.001
$Q_{30\ years}$	0.37	0.001
$Q_{100\ years}$ +CC 20%	0.86	0.001

4.3.4 Results

The resulting water surface profiles of the steady flow model is shown in Figure 14 below. The profiles represent different boundary conditions set-up as discussed in section 4.3.3. The model results indicate that design flow is accommodated within the channel in all sections along the profile. It is noted that no overbank flow occur at any section along the modelled stream channel (new and existing sections), and therefore, no flood risk due to the proposed new channel. Detailed results fo HEC-RAS model are shown in Appendix D.

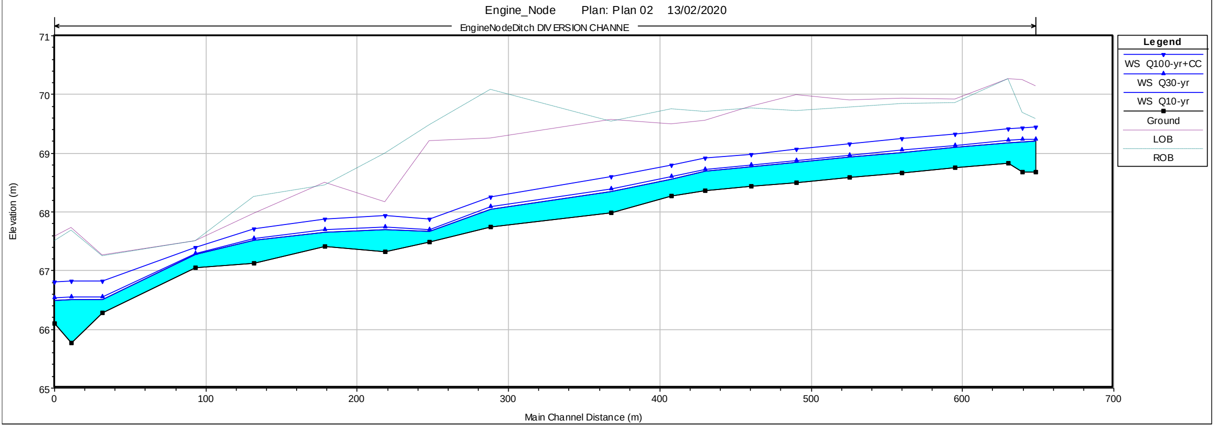


Figure 14 HEC-RAS resulted longitudinal water surface profile for the modelled ditch

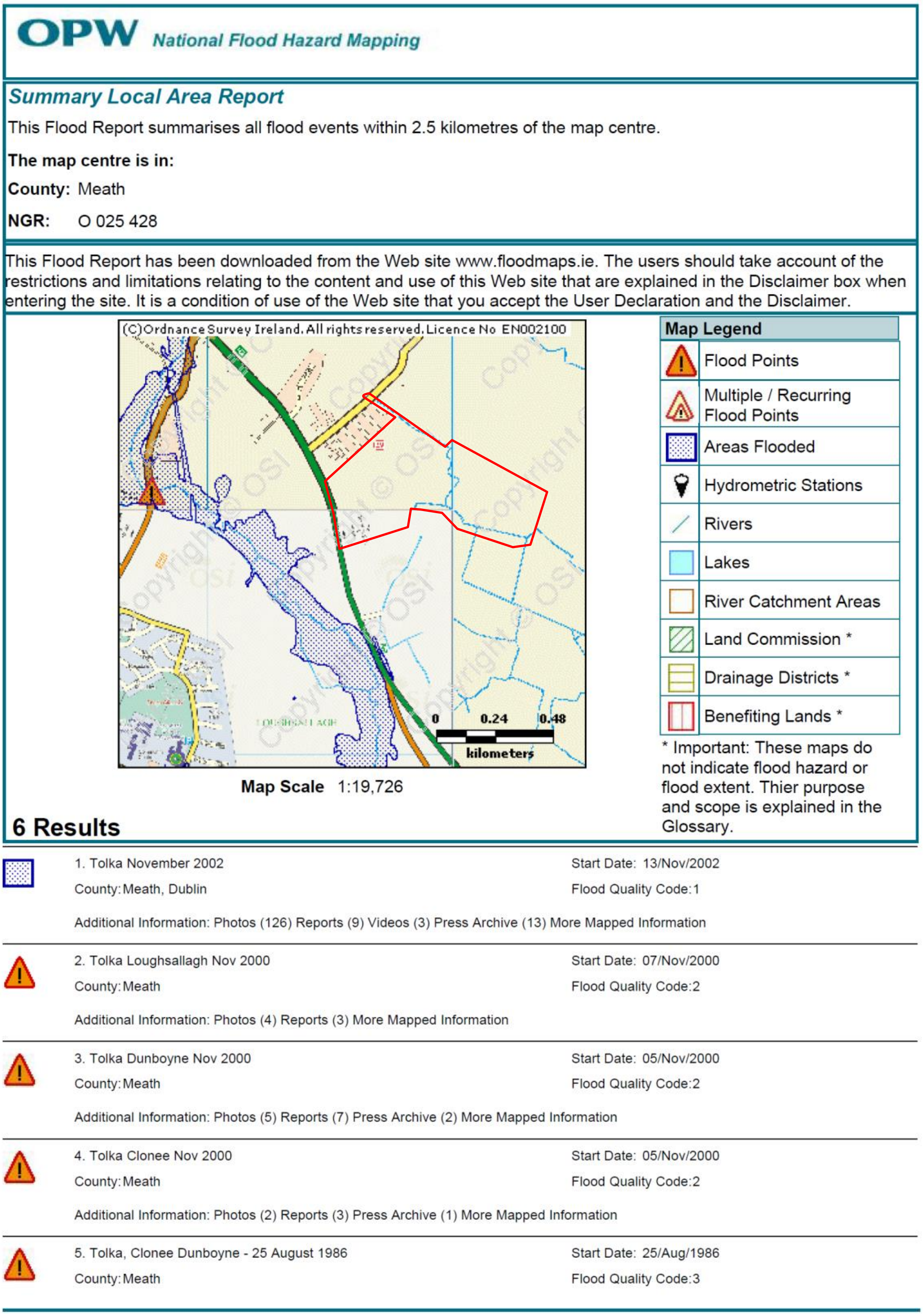
5 Conclusion

This Site-Specific Flood Risk Assessment for the proposed development was undertaken to the requirements of the OPW Guidelines, 2009, “Planning System and Flood Risk Management Guidelines for Planning Authorities”. Following the flood risk assessment stages, it was determined that the site is within Flood Zone C as defined by the Guidelines and based on the CFRAMS mapping. Therefore, the development on the subject site is appropriate for the site’s flood zone category and a justification test as outlined in the Guidelines is not required. The Guidelines sequential approach is met with the ‘Justify’ & ‘Mitigate’ principals being achieved.

A regularly maintained drainage system would ensure that the network remains effective and in good working order should a large pluvial storm occur.

It was also concluded that the proposed minor alterations to the existing ditches/watercourse within the development poses no flood risk to the development or to the adjacent third party lands.

Appendix A: Historic flood maps and benefiting lands maps available on www.floodmaps.ie



OPW *National Flood Hazard Mapping*

Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Meath

NGR: O 025 428

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.

Map Legend	
⚠	Flood Points
⚠	Multiple / Recurring Flood Points
▦	Areas Flooded
●	Hydrometric Stations
╱	Rivers
☐	Lakes
☐	River Catchment Areas
▨	Land Commission *
▤	Drainage Districts *
▥	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

Map Scale 1:19,726

6 Results

▦ 1. Tolka November 2002 — Start Date: 13/Nov/2002
County: Meath, Dublin — Flood Quality Code:1
Additional Information: Photos (126) Reports (9) Videos (3) Press Archive (13) More Mapped Information

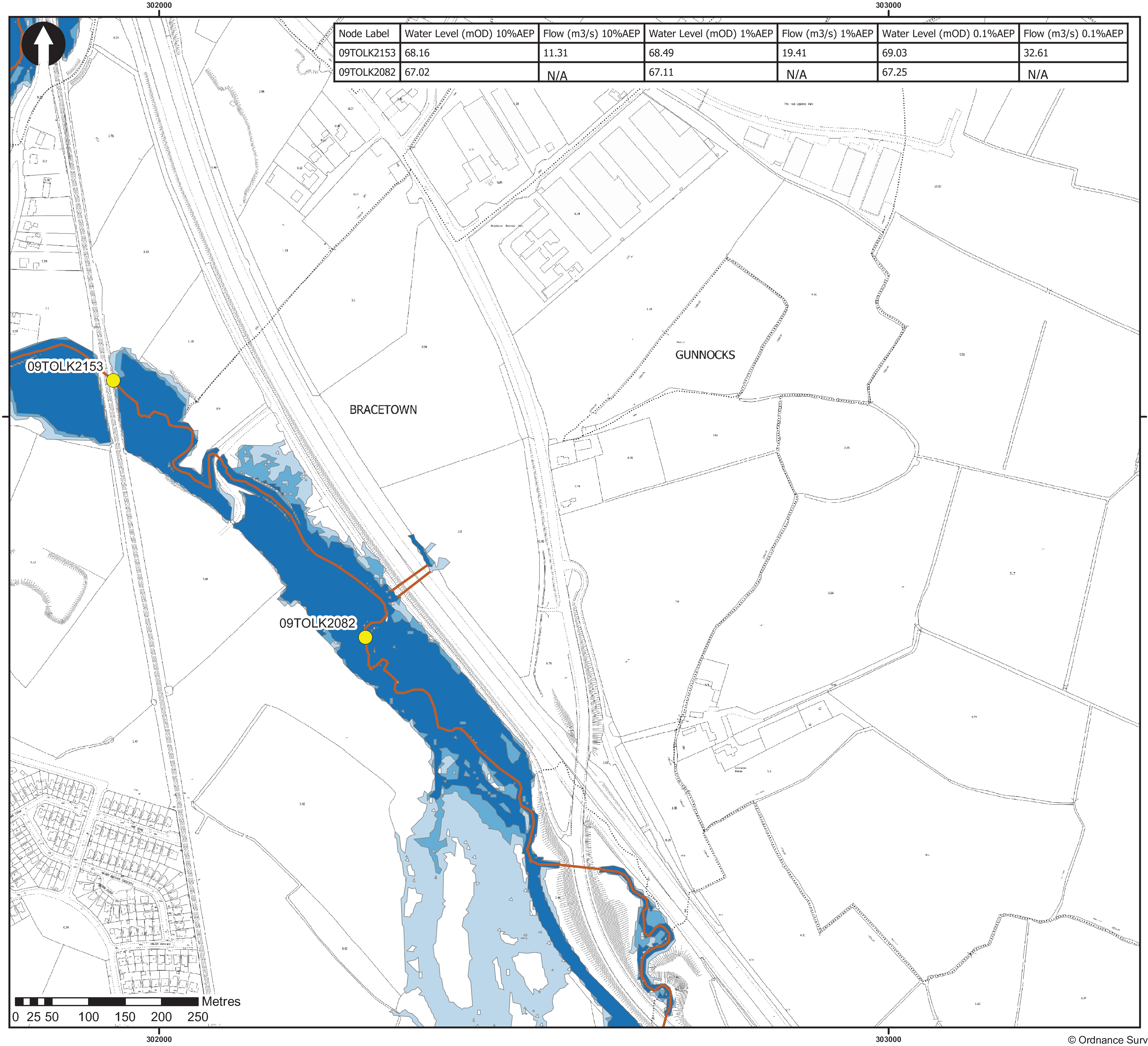
⚠ 2. Tolka Loughsallagh Nov 2000 — Start Date: 07/Nov/2000
County: Meath — Flood Quality Code:2
Additional Information: Photos (4) Reports (3) More Mapped Information

⚠ 3. Tolka Dunboyne Nov 2000 — Start Date: 05/Nov/2000
County: Meath — Flood Quality Code:2
Additional Information: Photos (5) Reports (7) Press Archive (2) More Mapped Information

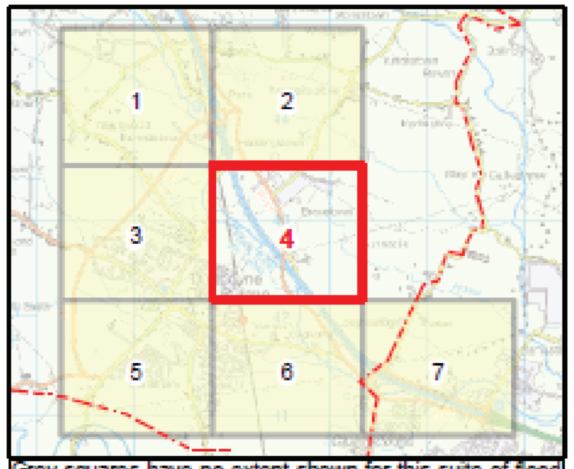
⚠ 4. Tolka Clonee Nov 2000 — Start Date: 05/Nov/2000
County: Meath — Flood Quality Code:2
Additional Information: Photos (2) Reports (3) Press Archive (1) More Mapped Information

⚠ 5. Tolka, Clonee Dunboyne - 25 August 1986 — Start Date: 25/Aug/1986
County: Meath — Flood Quality Code:3

Appendix B: CFRAM Flood Risk Map



Node Label	Water Level (mOD) 10%AEP	Flow (m3/s) 10%AEP	Water Level (mOD) 1%AEP	Flow (m3/s) 1%AEP	Water Level (mOD) 0.1%AEP	Flow (m3/s) 0.1%AEP
09TOLK2153	68.16	11.31	68.49	19.41	69.03	32.61
09TOLK2082	67.02	N/A	67.11	N/A	67.25	N/A



Grey squares have no extent shown for this suite of flood maps so no maps have been produced.

⬚	AFA Boundary
—	Modelled River Centreline
▨	Defended Area
—	Defence - Embankments
⋈	Model Limits
●	Model Nodes
■	10% AEP Fluvial Extent
■	1% AEP Fluvial Extent
■	0.1% AEP Fluvial Extent

IMPORTANT USER NOTE:
THE FLOWS PRESENTED IN THIS MAP ARE RELEVANT TO THE LOCATION SHOWN ONLY. THEY SHOULD NOT BE USED WITHOUT FIRST REFERRING TO THE HYDRAULIC MODELLING REPORT TO UNDERSTAND THE CONTEXT OF THE HYDROLOGY AT THE SITE

THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

JBA consulting

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

JBA Consulting
24 Grove Island
Corbally
Limerick, Ireland

Map: Dunboyne Flood Extent

Map Type: Flood Extent		Final
Map Area: HPW	Source: Fluvial	Scenario: Current
Drawn by: TS Date: Jul 2019	Scale:	
Checked by: TC Date: Jul 2019	1:5,000	
Approved by: JC Date: Jul 2019		Original @ A3
Map No: E09DUN_EXFCD_F6_04	**Sheet:** 4 of 7	

Appendix C: Surface Water Operation and Maintenance (O&M) Activities

All operation and maintenance activities should be in accordance to the following guidelines:

- Greater Dublin Strategic Drainage Study GDSDS- Volume 3 – Environmental Management
- CIRIA 2015SuDS Manual, Part E - Chapter 32

Considerations for surface water O&M:

Requirement	Assessment/Action
Maintenance access **– ensuring appropriate and long-term access to all points in the system where future maintenance may be required**	A standard minimum of 600mm diameter opening is provided for all manhole, chambers and treatment system. Removable gullies grate opening with a minimum size of 450mm X 320mm.
Forebays and/or appropriate pre-treatment structures to facilitate the sediment management process.	Service manholes are proposed upstream and downstream of the attenuation system. Road gullies and the petrol interceptor will also facilitate sediment management process.
Bypass systems or appropriate temporary drainage infrastructure for use if required during sediment management or other maintenance activities.	Not required
The availability of disposal areas for organic arisings (green waste) and sediments.	To be included as part of maintenance contract of the development.

Types of SuDS systems used that require O&M activities:

- **Detention Pond:** 3no. of proposed ponds.
- **Soakaway:** N/A.
- **Pervious Paving:** proposed permeable paving areas proposed within the development area
- **Treatment system:** proposed petrol interceptor as part of road and parking drainage system

O&M activities required as following:

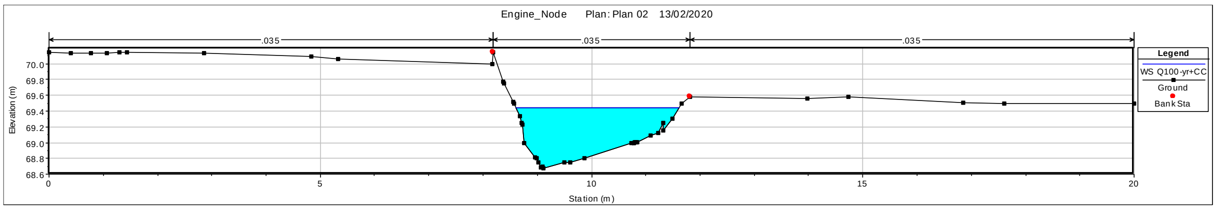
Operation and maintenance activities	SuDS Component			
O&M Activities	Attenuation Tank	Soakaway	Pervious Paving	Treatment System
Regular maintenance				
Inspection	■	■	■	■
Litter/debris removal	■		■	
Grass cutting			■	
Weed/invasive plant control	■		■	
Shrub management			■	■
Shoreline vegetation management				
Aquatic vegetation management				
Occasional maintenance				
Sediment management	■	■	■	■
Vegetation/plant replacement				
Vacuum sweeping and brushing			■	
Remedial maintenance				
Structure rehabilitation/repair	□	□		□
Infiltration surface reconditioning		□		
■ Will be required				
□ May be required				

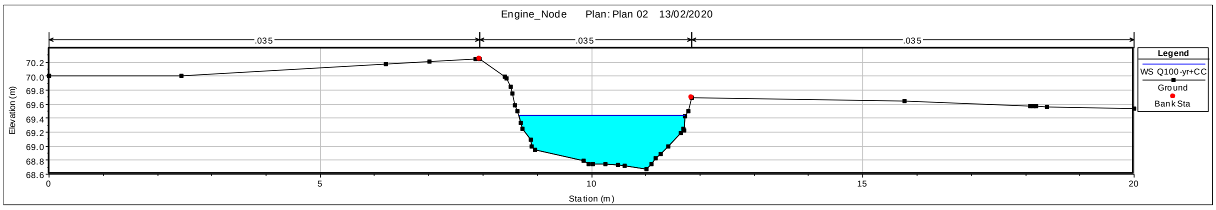
Appendix D: HEC-RAS Model Results

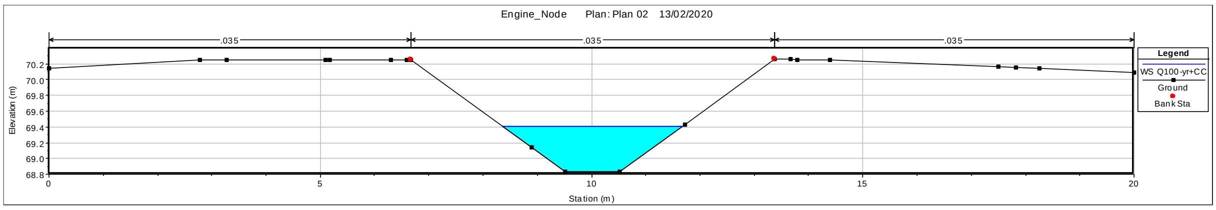
Summary Table for maximum flood level Q 100 year + Climate Change

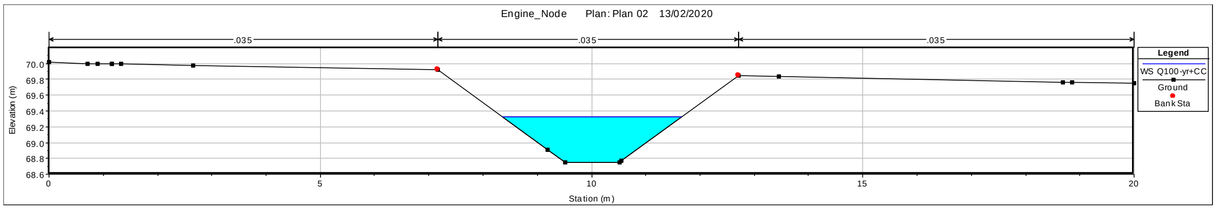
Reach	River Sta	Profile	Q Total (m3/s)	Min Ch. El (m)	W.S. Elev (m)	Crit. W.S. (m)	E.G. Elev. (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
DIVERSION CHANNE	653.02	$Q_{100\text{-yr+CC}}$	0.86	68.68	69.44		69.46	0.001380	0.57	1.50	3.01	0.26
DIVERSION CHANNE	643.73	$Q_{100\text{-yr+CC}}$	0.86	68.68	69.44		69.45	0.000847	0.49	1.74	3.06	0.21
DIVERSION CHANNE	634.48	$Q_{100\text{-yr+CC}}$	0.86	68.83	69.41		69.43	0.002355	0.69	1.25	3.32	0.36
DIVERSION CHANNE	599.62	$Q_{100\text{-yr+CC}}$	0.86	68.75	69.33		69.35	0.002380	0.69	1.24	3.31	0.36
DIVERSION CHANNE	564.5	$Q_{100\text{-yr+CC}}$	0.86	68.67	69.24		69.27	0.002392	0.69	1.24	3.31	0.36
DIVERSION CHANNE	529.5	$Q_{100\text{-yr+CC}}$	0.86	68.58	69.16		69.18	0.002445	0.70	1.23	3.29	0.36
DIVERSION CHANNE	494.64	$Q_{100\text{-yr+CC}}$	0.86	68.50	69.07		69.10	0.002570	0.71	1.21	3.27	0.37
DIVERSION CHANNE	464.48	$Q_{100\text{-yr+CC}}$	0.86	68.43	68.99		69.01	0.002824	0.73	1.17	3.25	0.39
DIVERSION CHANNE	434.49	$Q_{100\text{-yr+CC}}$	0.86	68.36	68.91		68.94	0.002302	0.68	1.26	3.30	0.35
DIVERSION CHANNE	412.25	$Q_{100\text{-yr+CC}}$	0.86	68.27	68.79		68.85	0.006693	1.06	0.81	2.31	0.57
DIVERSION CHANNE	372.29	$Q_{100\text{-yr+CC}}$	0.86	67.98	68.61		68.65	0.003812	0.88	0.98	2.22	0.42
DIVERSION CHANNE	292.25	$Q_{100\text{-yr+CC}}$	0.86	67.75	68.26		68.30	0.004902	0.96	0.89	2.21	0.48
DIVERSION CHANNE	252.25	$Q_{100\text{-yr+CC}}$	0.86	67.48	67.87		67.98	0.014921	1.43	0.60	1.97	0.83
DIVERSION CHANNE	222.74	$Q_{100\text{-yr+CC}}$	0.86	67.32	67.93		67.93	0.000142	0.19	4.54	10.71	0.09
DIVERSION CHANNE	182.97	$Q_{100\text{-yr+CC}}$	0.86	67.41	67.88		67.92	0.003784	0.82	1.04	2.84	0.43
DIVERSION CHANNE	136.31	$Q_{100\text{-yr+CC}}$	0.86	67.13	67.72	67.48	67.75	0.003242	0.80	1.07	2.56	0.39
DIVERSION CHANNE	97.36	$Q_{100\text{-yr+CC}}$	0.86	67.06	67.39	67.39	67.48	0.023123	1.30	0.66	3.89	1.01
DIVERSION CHANNE	35.71	$Q_{100\text{-yr+CC}}$	0.86	66.29	66.83		66.83	0.000291	0.26	3.32	9.12	0.13
DIVERSION CHANNE	15.67	$Q_{100\text{-yr+CC}}$	0.86	65.77	66.82		66.82	0.000284	0.33	2.56	3.08	0.12
DIVERSION CHANNE	4.3	$Q_{100\text{-yr+CC}}$	0.86	66.11	66.80	66.40	66.82	0.001001	0.52	1.64	2.89	0.22

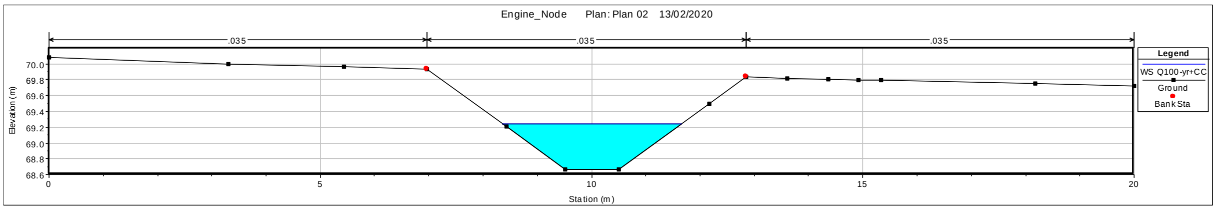
Cross Section – Model Output







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Station (m)
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Ground
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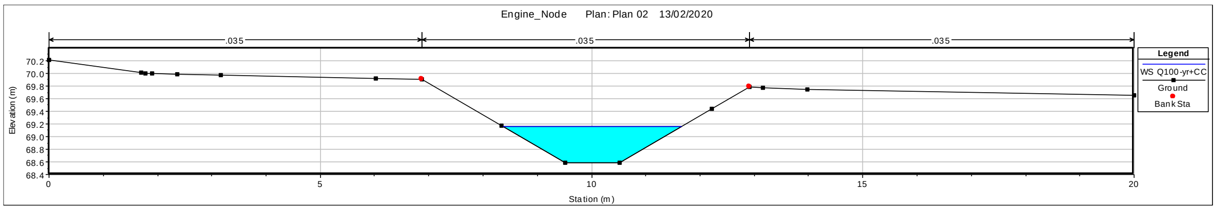
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Ground
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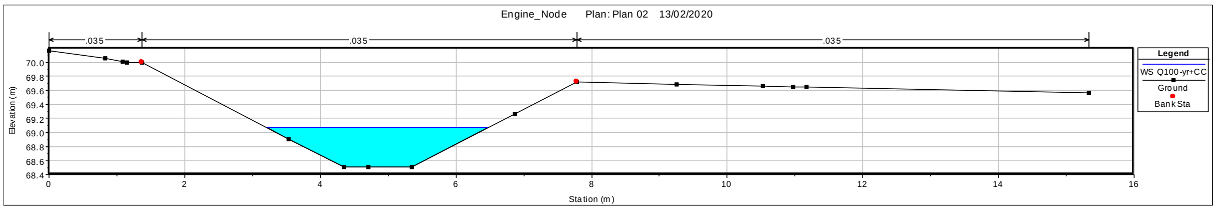
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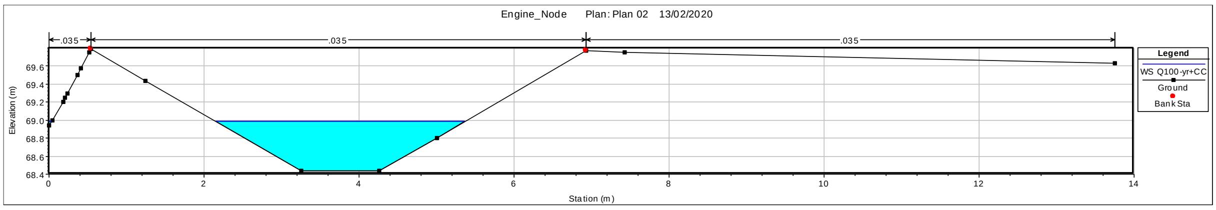
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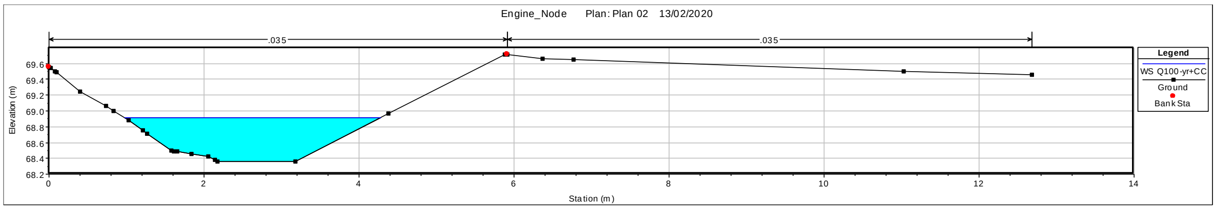
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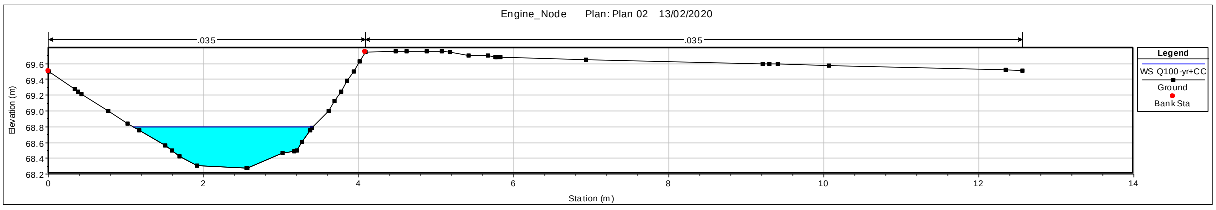
Legend
WS Q100-yr+CC
Ground
Bank Sta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Station (m)
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Ground
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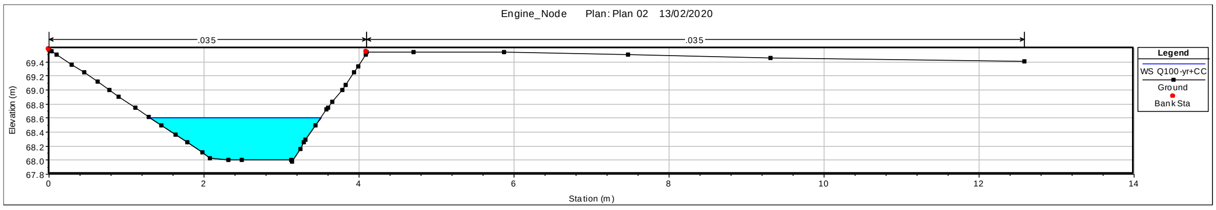
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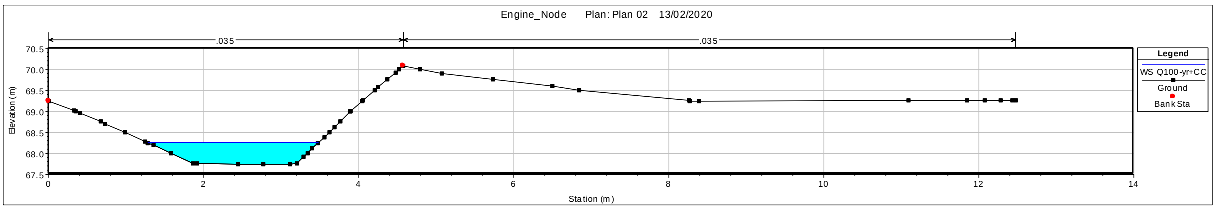
Station (m)
Legend
WS Q100-yr+CC
Ground
Bank Sta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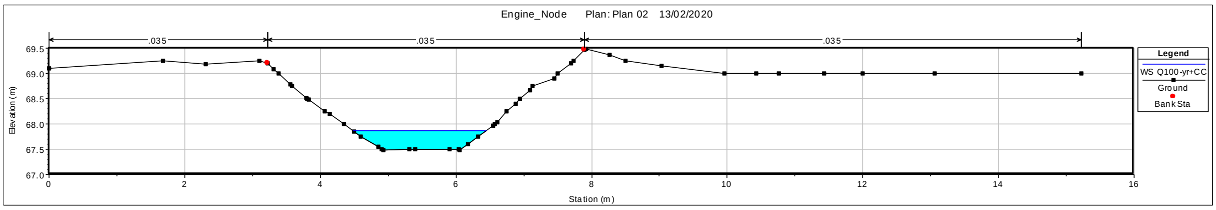
Bank Sta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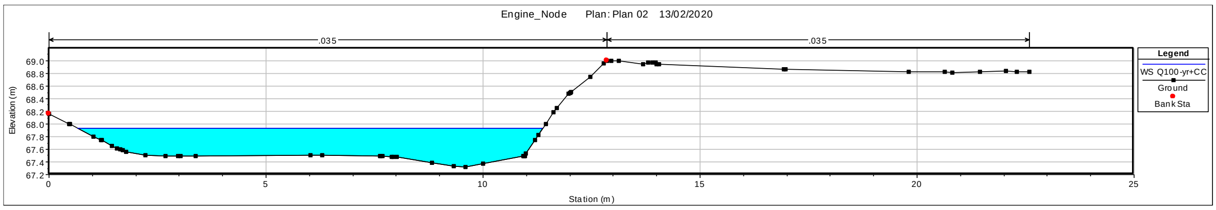
Bank Sta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Station (m)
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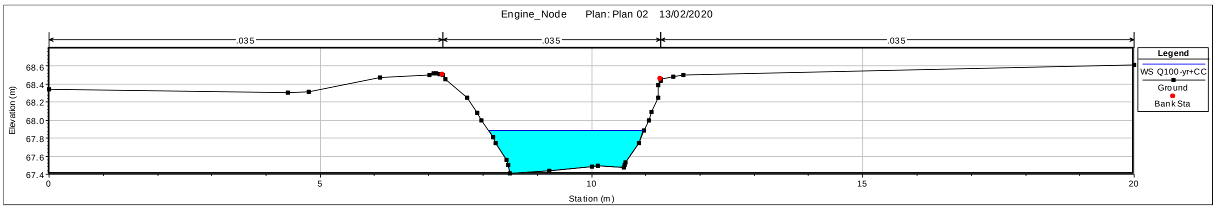
WS Q100-yr+CC
Ground
Bank Sta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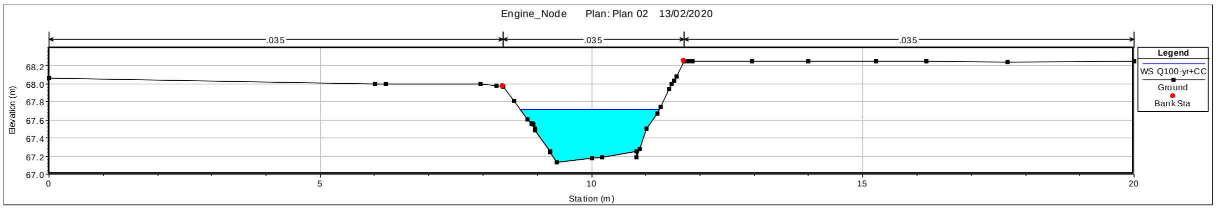
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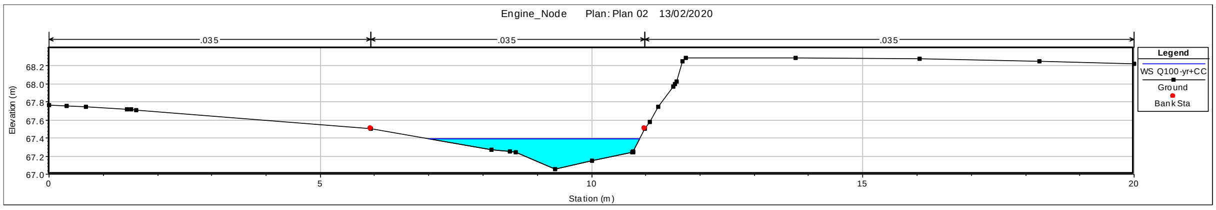
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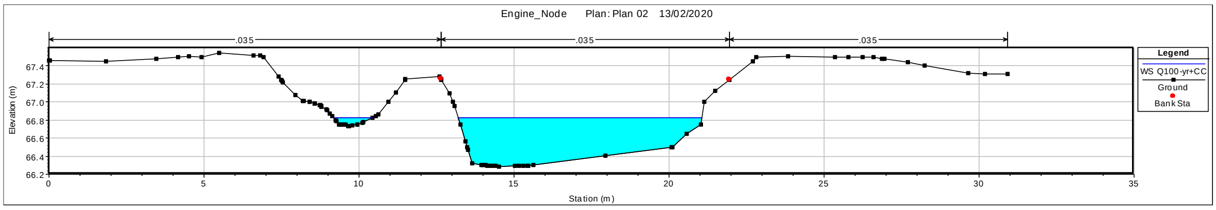
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WS Q100-yr+CC
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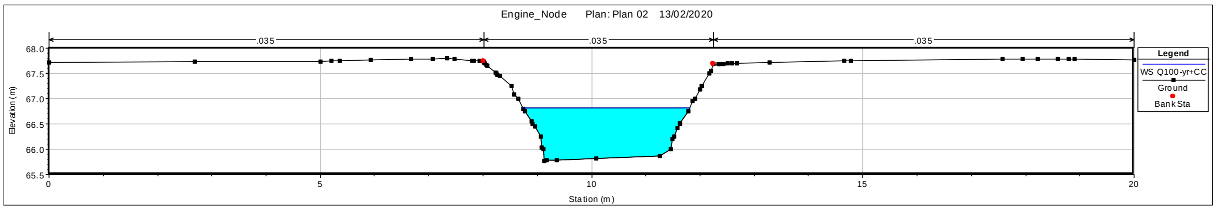
Bank Sta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Station (m)
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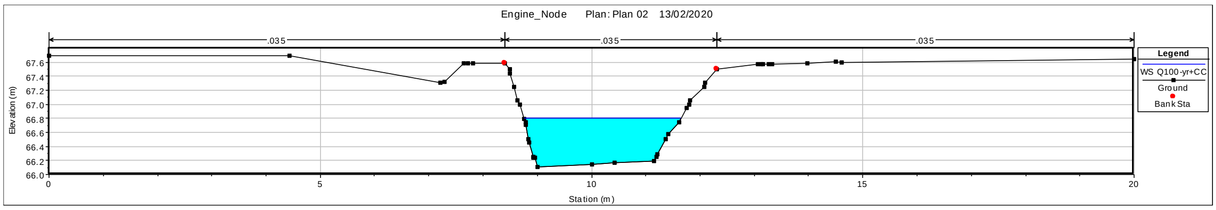
WS Q100-yr+CC
Ground
Bank Sta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Elevation (m)
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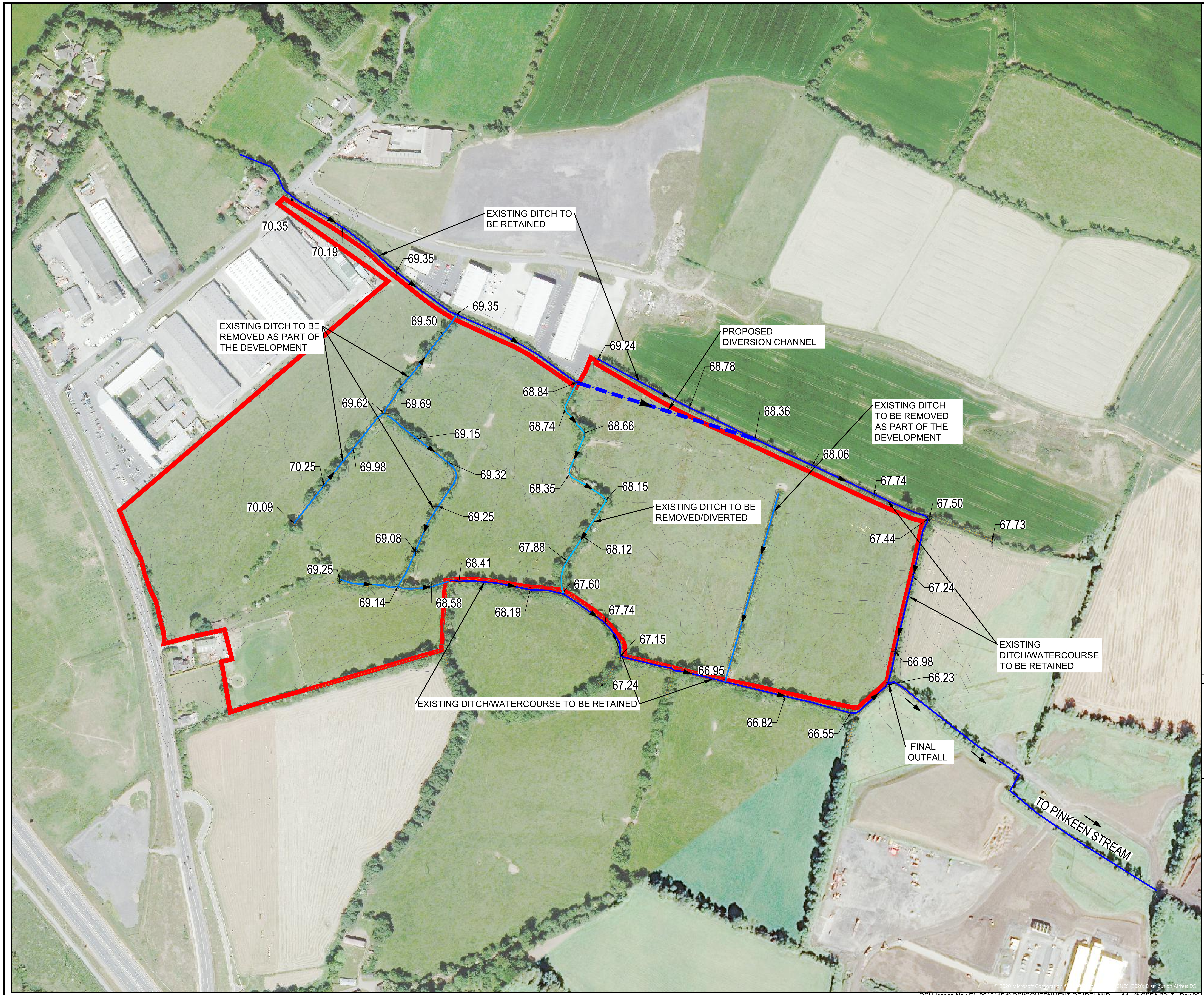
Station (m)
Legend
WS Q100-yr+CC
Ground
Bank Sta

Appendix E: Drawings of Proposed Alterations to Existing Ditches.



A1

N

LEGEND

━	EXISTING DITCH TO BE RETAINED
▬ ▬	PROPOSED NEW DITCH
━	EXISTING DITCH TO BE DIVERTED
━	EXISTING DITCH TO BE REMOVED
━	SITE BOUNDARY

Revision	Description	Drw'n	Chk'd	Date

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ENGINENODE

Project: ENGINENODE
CLONEE

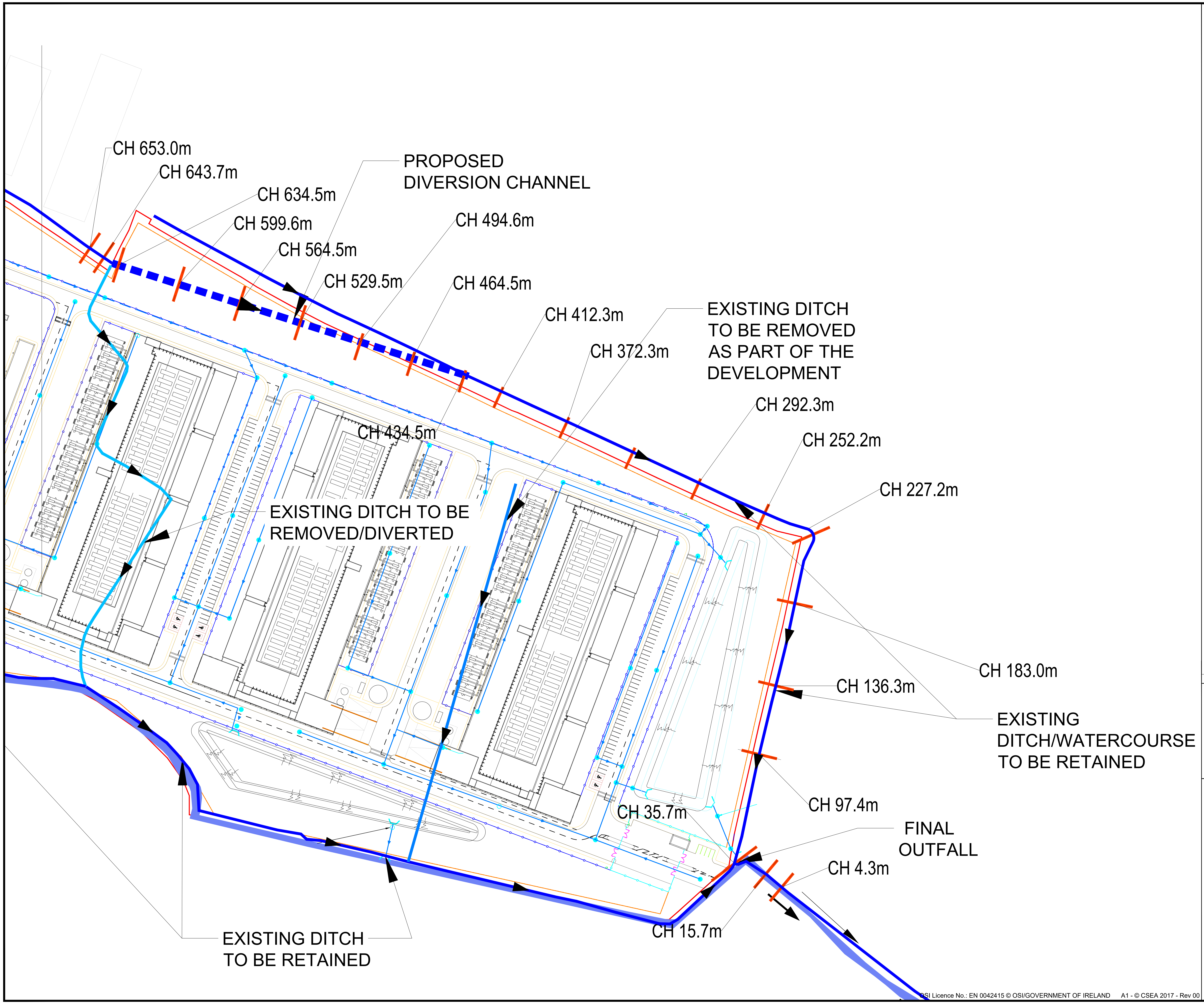
Dwg. Title: EXISTING DITCHES/WATERCOURSE LAYOUT

Drawn By: SE
Date: 10/02/2020
Checked by: RG
Scale: 1:2000 @ A1

Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
18_086	CSE	00	XX	DR	C	1089

Status Code: S0
Suitability Description: WORK IN PROGRESS
Revision: P01
Project Status: PLANNING
CSEA Job No.: 18_086

A1



N

LEGEND

━	EXISTING DITCH TO BE RETAINED
╍	PROPOSED NEW DITCH
━	EXISTING DITCH TO BE DIVERTED
━	EXISTING DITCH TO BE REMOVED
━	HEC-RAS MODEL CHANNEL CROSS-SECTION
━	PROPOSED SITE BOUNDARY
300Ø @ 1:300 ━▶━	PROPOSED SW CARRIER DRAIN
╍▶╍	PROPOSED SW FILTER DRAIN
🟨	PROPOSED SWALE
● SWMH-44.2 CL 70.931m IL 69.292m	PROPOSED SW MANHOLE
‹	PROPOSED SW HEADWALL
🟦	PROPOSED ATTENUATION POND
⬜	PROPOSED ROAD LAYOUTS
▨	PROPOSED BUILDINGS
━	EXISTING WATERCOURSE

Revision	Description	Drw'n	Chk'd	Date

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ENGINENODE

Project: ENGINENODE
CLONEE

Dwg. Title: MODELLED STREAM LAYOUT

Drawn By: SE
Date: 10/02/2020

Checked by: RG
Scale: 1:1000 @ A1

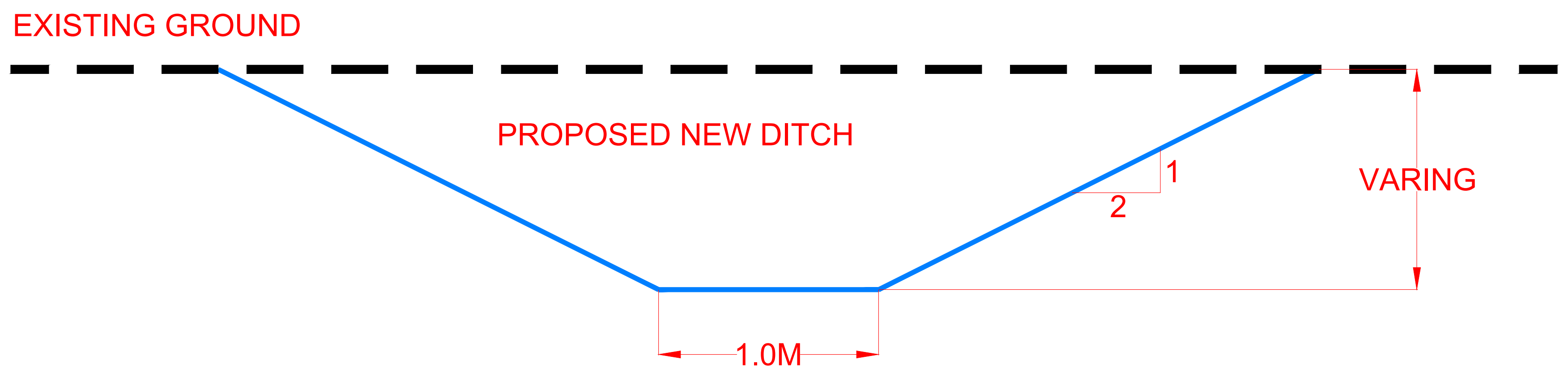
Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
18_086	CSE	00	XX	DR	C	1090

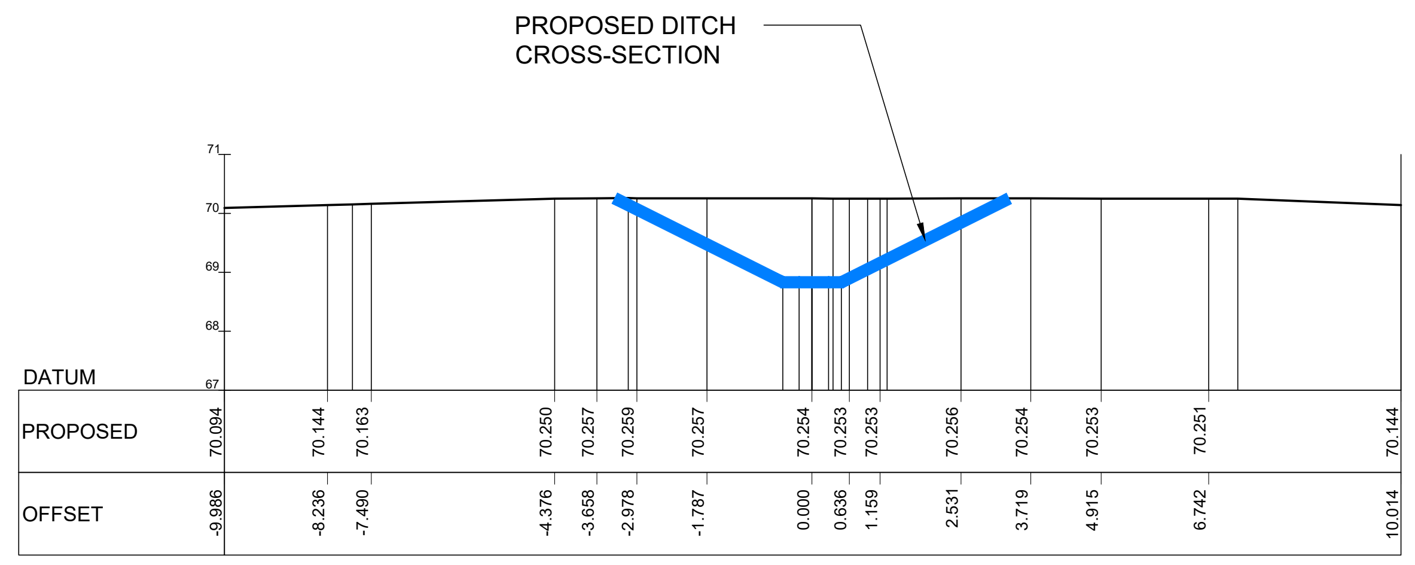
S0 WORK IN PROGRESS
Status Code / Suitability Description

P01 PLANNING
Revision / Project Status

18_086
CSEA Job No.

A1





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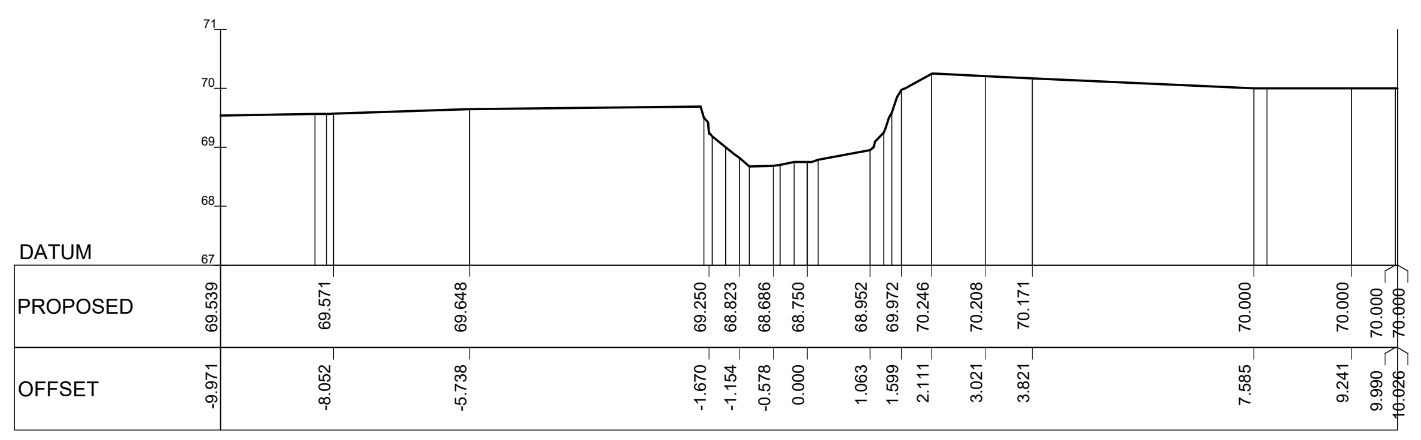

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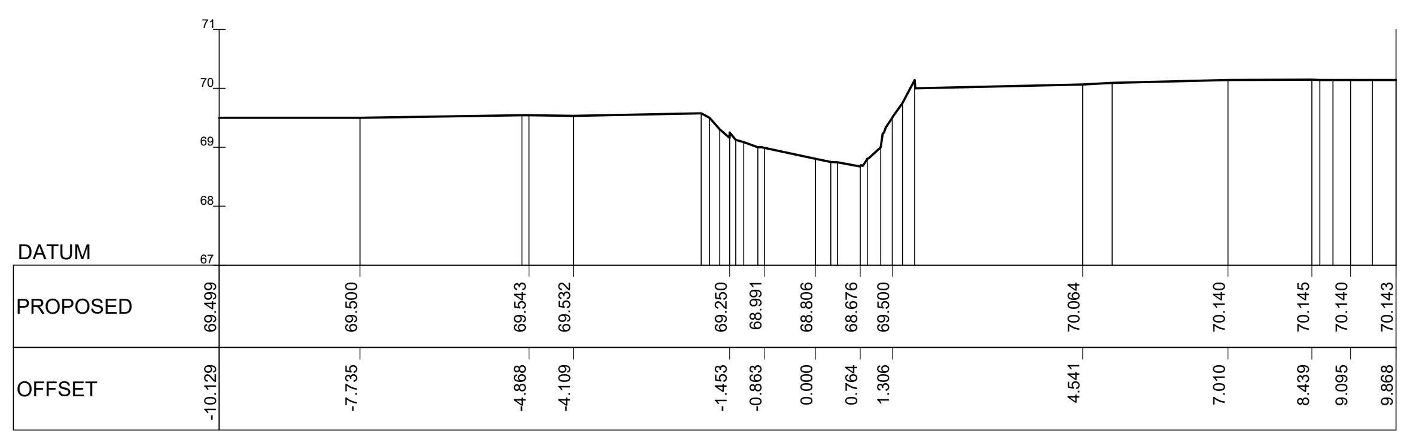

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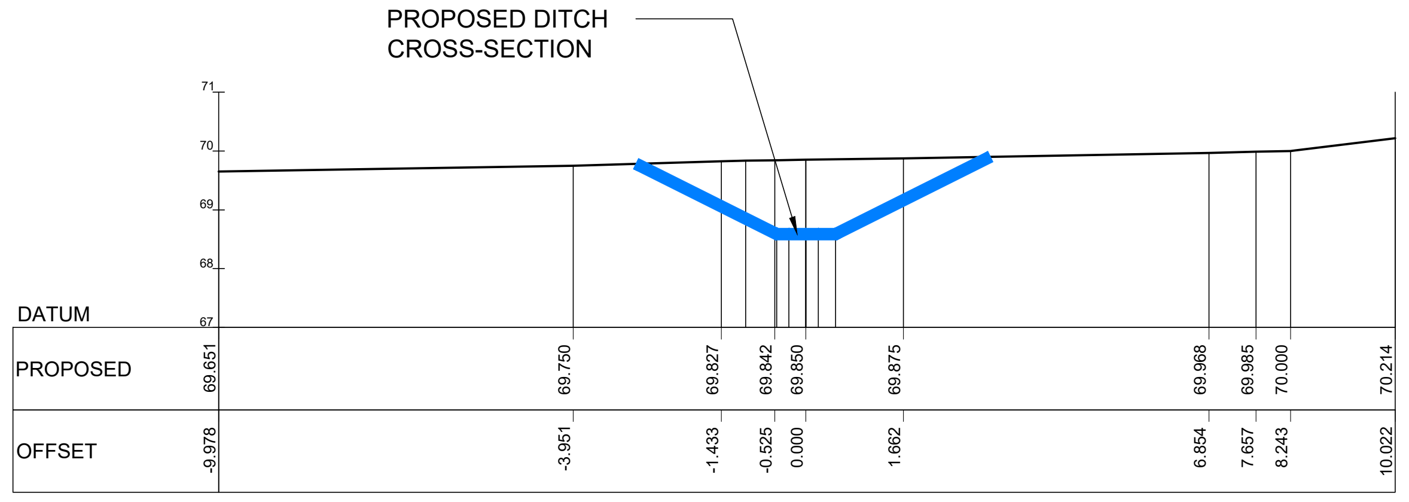

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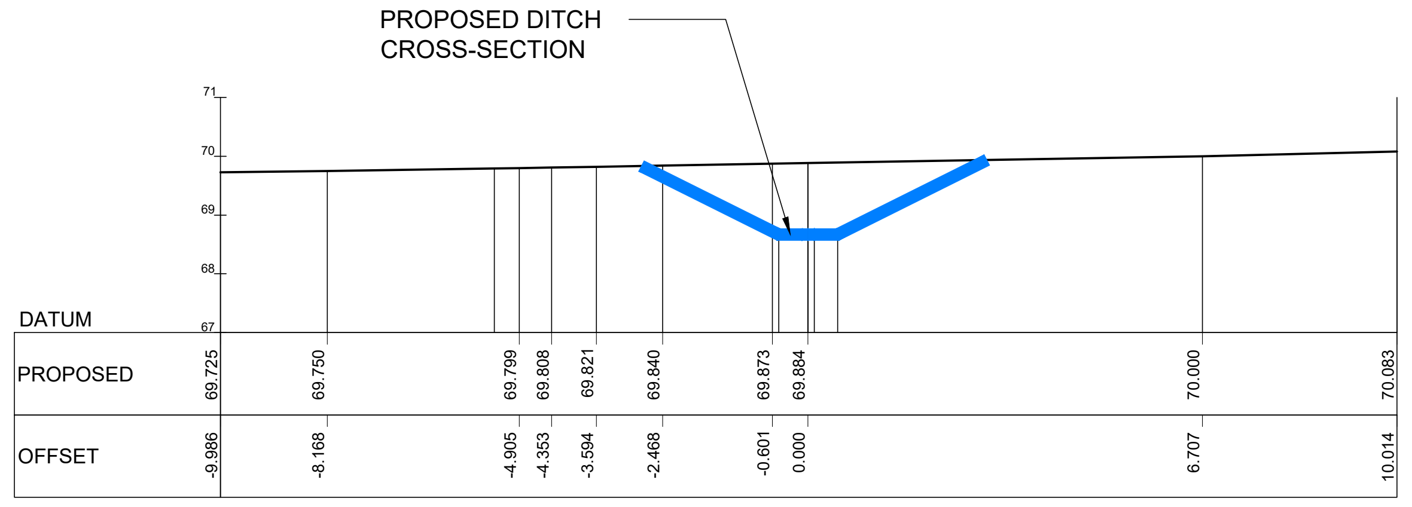

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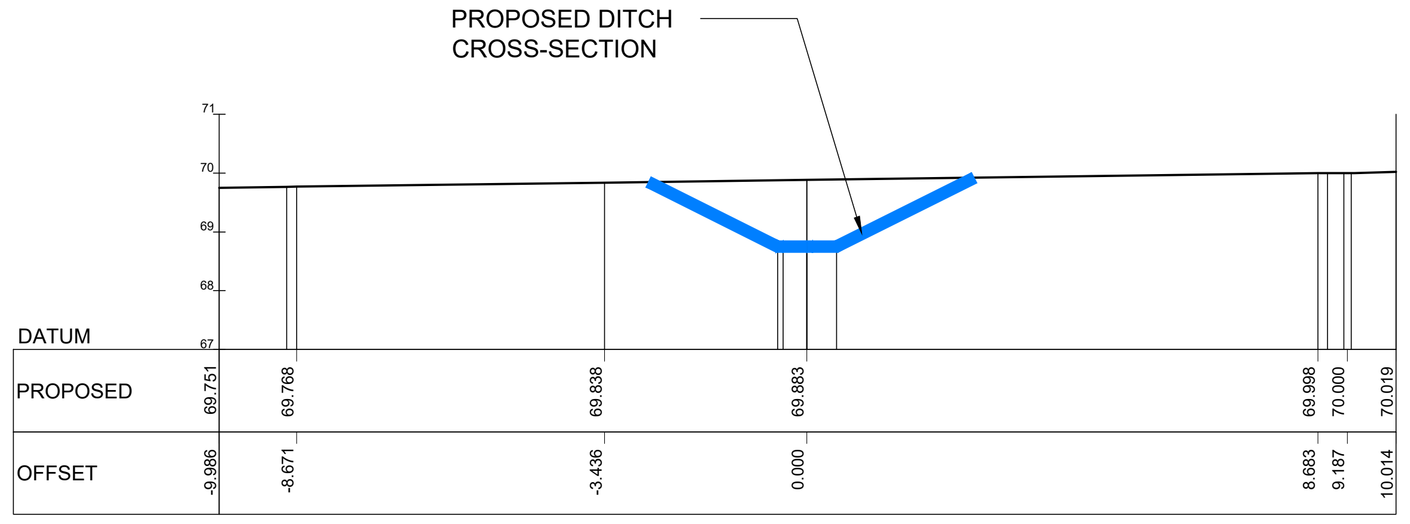

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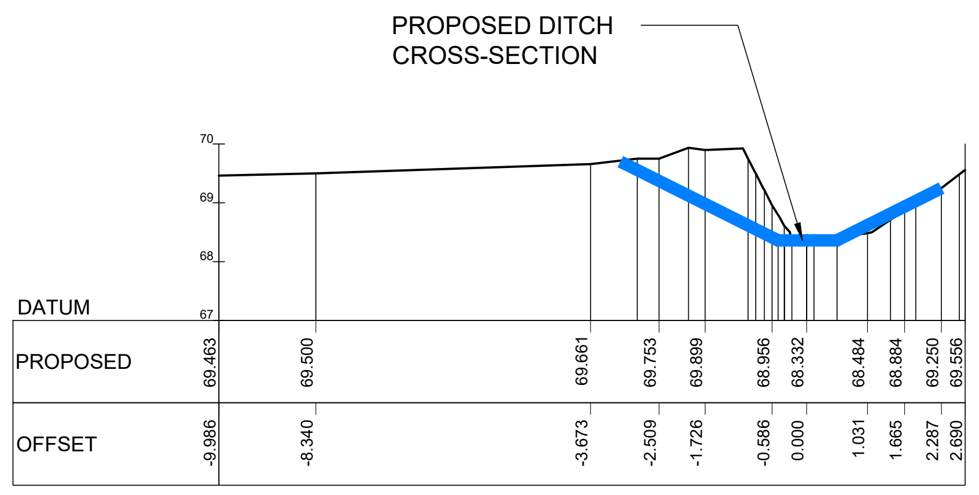

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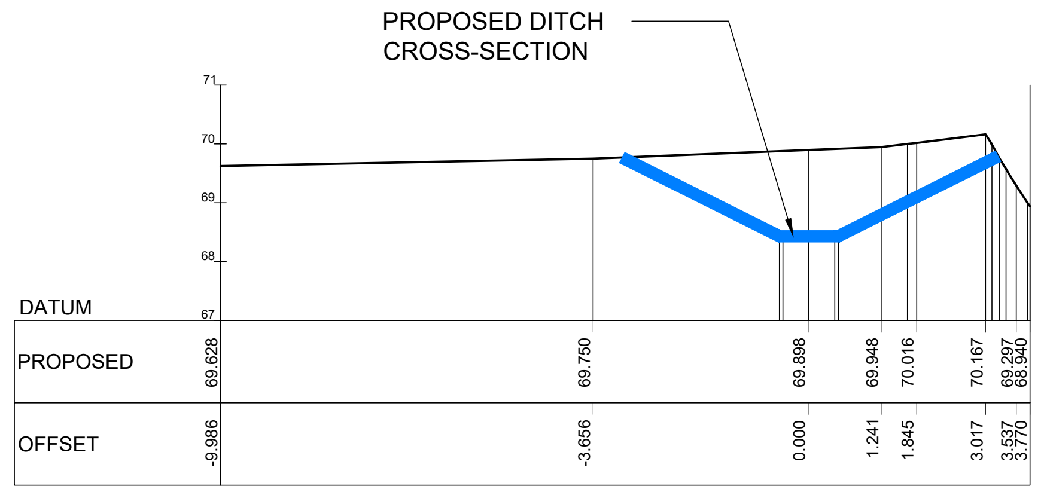

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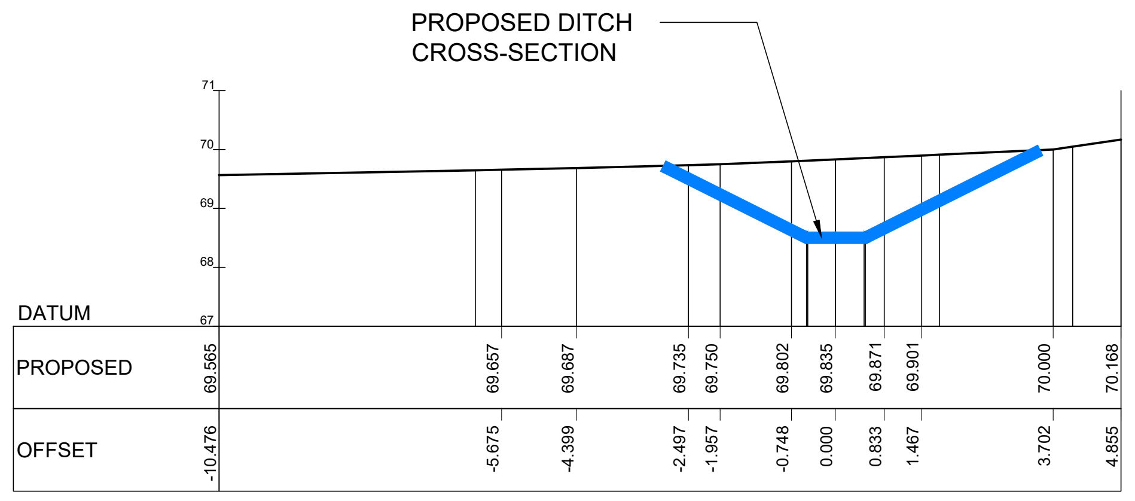

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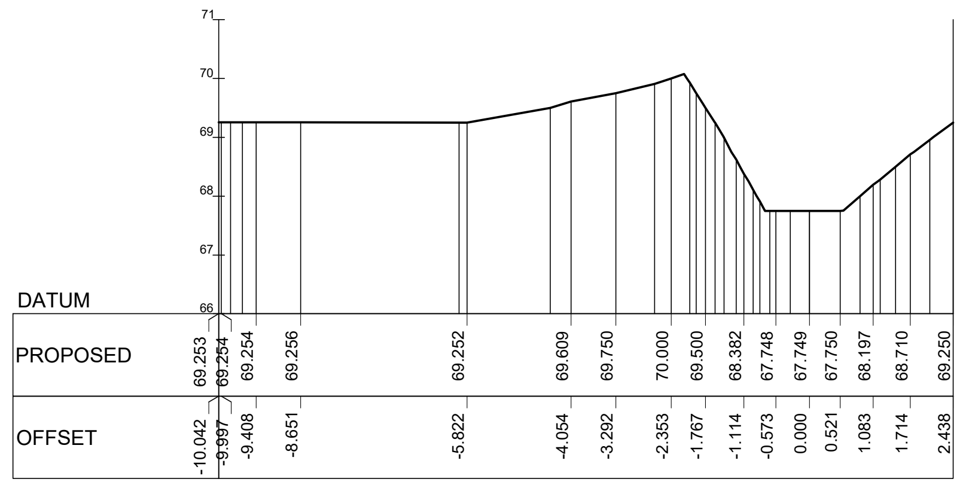

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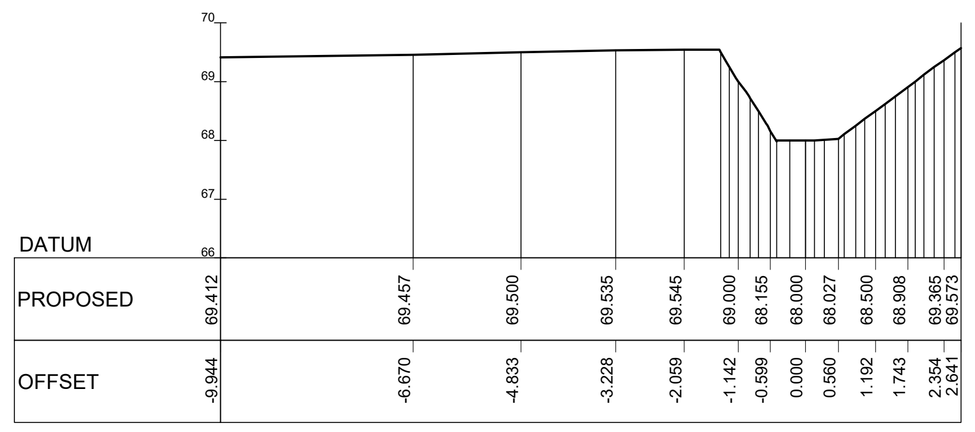

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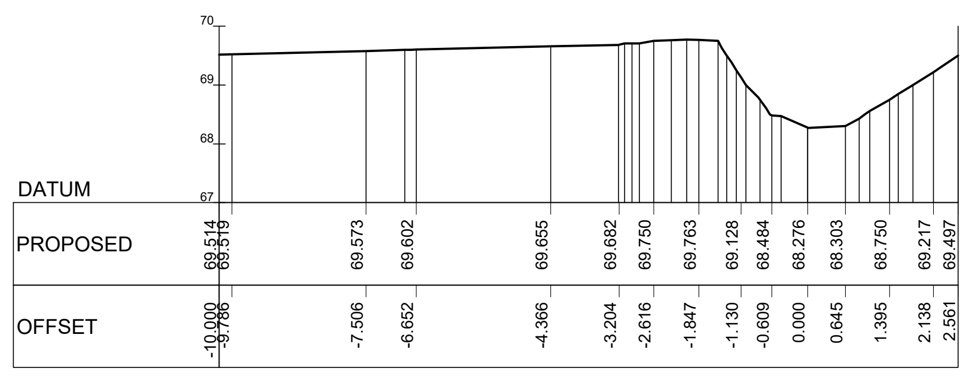

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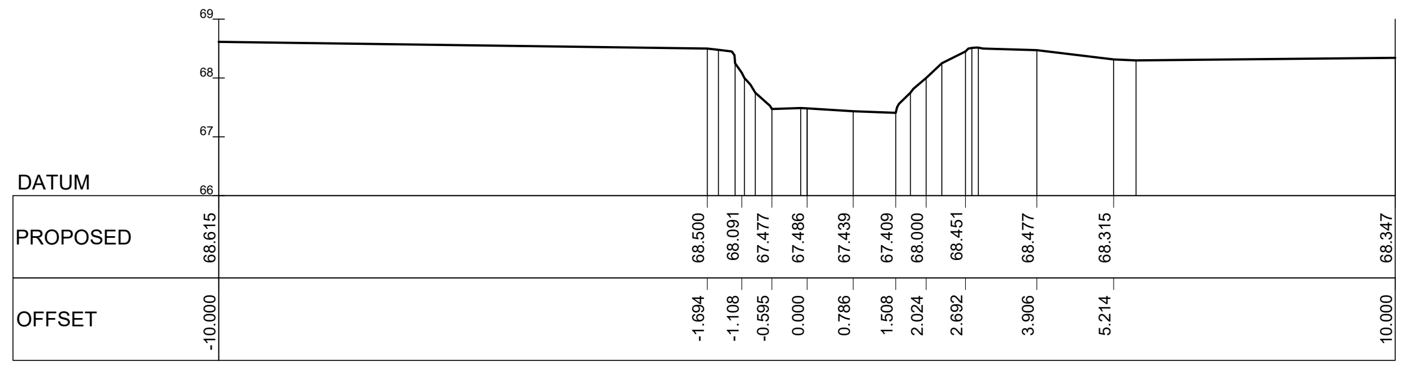

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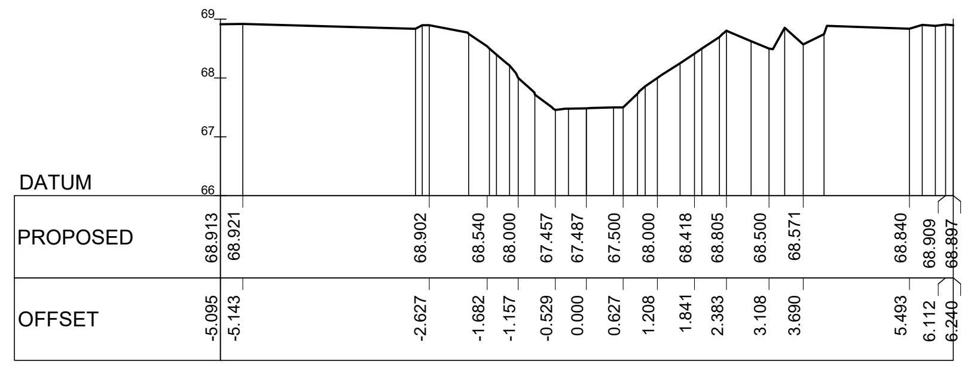

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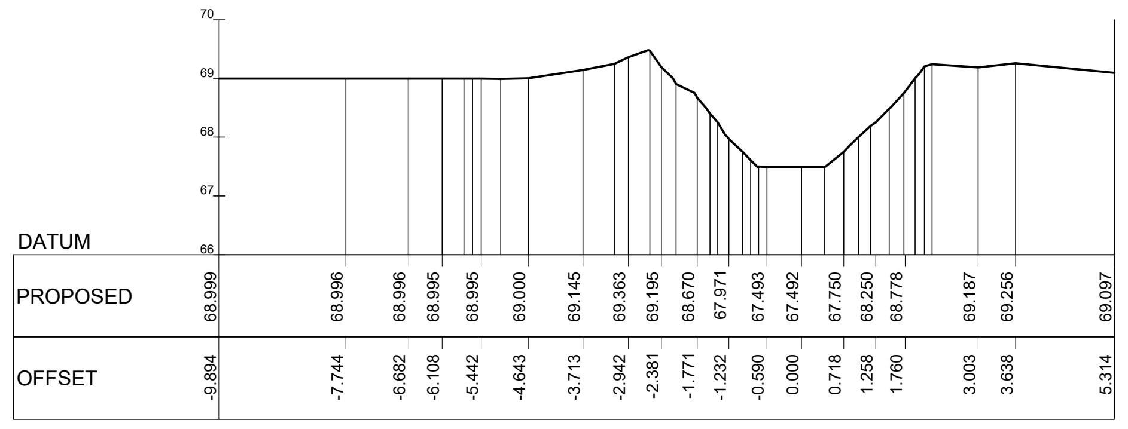

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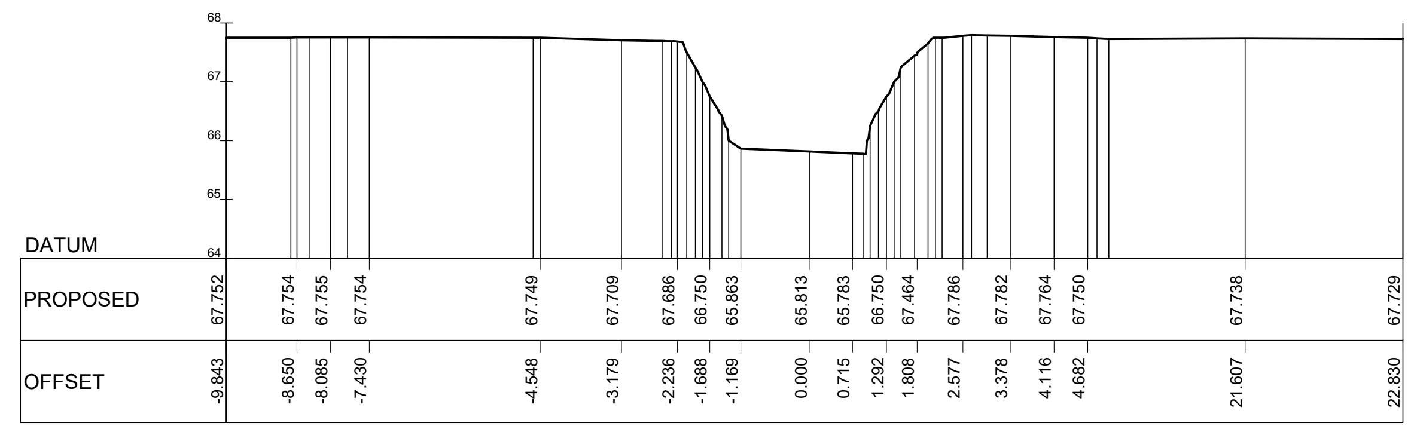

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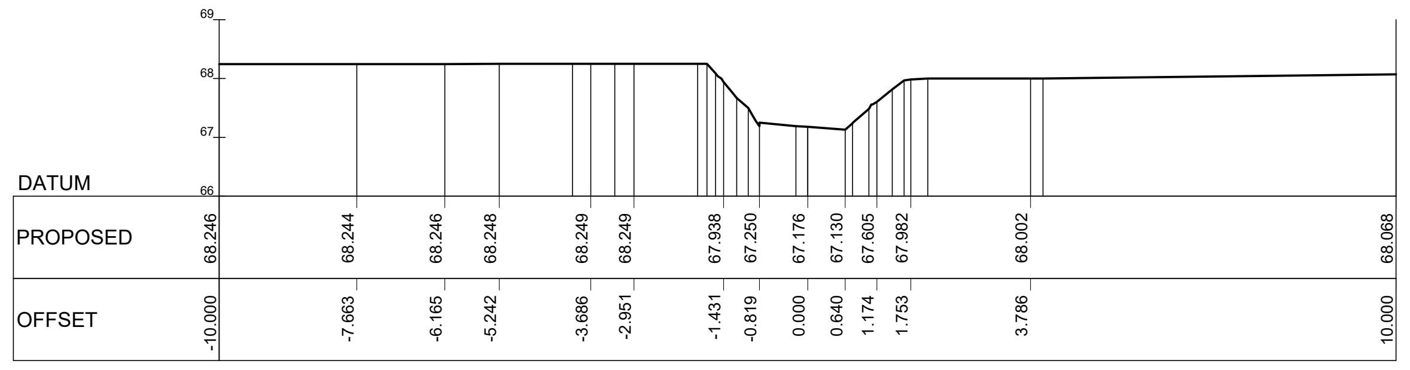

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Revision	Description	Drw'n	Chk'd	Date

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ENGINENODE

Project
ENGINENODE
CLONEE

Dwg. Title
EXISTING AND PROPOSED DITCH SECTIONS

Drawn By SE
Date 10/02/2020
Checked by RG
Scale NTS @ A1

Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
18_086	CSE	00	XX	DR	C	1091

Status Code S0
Suitability Description WORK IN PROGRESS
Revision P01
Project Status PLANNING
CSEA Job No. 18_086

Appendix F: Related Correspondence Between CSEA and Meath County Council

Siddig Elshareef

From: Conor Doherty <Conor.Doherty@csea.ie>
Sent: Tuesday 20 August 2019 10:08
To: David Keyes
Cc: Laurence McCrudden; Philip Traynor; David O'Reilly; Paul Aspell
Subject: RE: 18_086 - EngineNode Data Centre
Attachments: ENGN-CSE-00-XX-DR-C-1010 - Surface Water Outfall to Pinkeen Stream.pdf

David,

Please find attached drawing as requested.

If you have any queries please do not hesitate to get in touch.

Regards,

Conor

From: David Keyes <david.keyes@meathcoco.ie>
Sent: Tuesday 20 August 2019 09:44
To: Conor Doherty <Conor.Doherty@csea.ie>
Cc: Laurence McCrudden <Laurence.McCrudden@csea.ie>; Philip Traynor <philip.traynor@meathcoco.ie>; David O'Reilly <david.oreilly@meathcoco.ie>; Paul Aspell <paul.aspell@meathcoco.ie>
Subject: RE: 18_086 - EngineNode Data Centre

Conor,

Please forward on the relevant drawing.
I am referring to David O'Reilly and Paul Aspell who deal with Surface Water issues on Planning Applications

Regards
David

From: Conor Doherty [mailto:Conor.Doherty@csea.ie]
Sent: 20 August 2019 09:32
To: Philip Traynor; David Keyes
Cc: Laurence McCrudden
Subject: RE: 18_086 - EngineNode Data Centre

Philip,

Many thanks for the update., much appreciated.

Regards,

Conor

From: Philip Traynor <philip.traynor@meathcoco.ie>
Sent: Tuesday 20 August 2019 09:29
To: Conor Doherty <Conor.Doherty@csea.ie>; David Keyes <david.keyes@meathcoco.ie>
Subject: FW: 18_086 - EngineNode Data Centre

Conor,
I am not aware of any legacy issues regarding flooding at this location, however, by way of this email, I have forwarded on to David Keyes, SEO, Environment for follow up.
Regards,
Phillip

From: Conor Doherty [mailto:Conor.Doherty@csea.ie]
Sent: 19 August 2019 14:32
To: Philip Traynor
Subject: FW: 18_086 - EngineNode Data Centre

Philip,

Just to follow up our phone call this morning we would be grateful if you could advise if there are any issues with discharging attenuated surface water flow to the ditch/watercourse shown in blue on the attached drawing.

If you would like to meet to discuss please let us know.

Regards,

Conor

From: Conor Doherty
Sent: Friday 16 August 2019 11:46
To: Philip.traynor@meathcoco.ie
Cc: Laurence McCrudden <Laurence.McCrudden@csea.ie>
Subject: 18_086 - EngineNode Data Centre

Philip,

We are working on a planning application for development of a Data Centre campus at a site in Bracetown Co. Meath. I received your contact details from Paul Aspell who asked us to get in touch with you regarding Surface Water Drainage from the site. (A layout plan indicating the site location relative to local watercourses is attached for your information).

Would it be possible to meet with you at a time of your convenience next week?

Many thanks for your assistance.

Kind Regards,

Conor Doherty
Senior Civil Engineer

Clifton Scannell Emerson Associates Consulting Engineers
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Twitter. www.twitter.com/cseassociates | Linkedin. www.linkedin.com/pub/clifton-scannell-emerson-associates
Find out more at www.csea.ie

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****

****

Meath County Council?s new corporate headquarters are:
Buvinda House,
Dublin Road,
Navan,
Co. Meath, C15 Y291

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****

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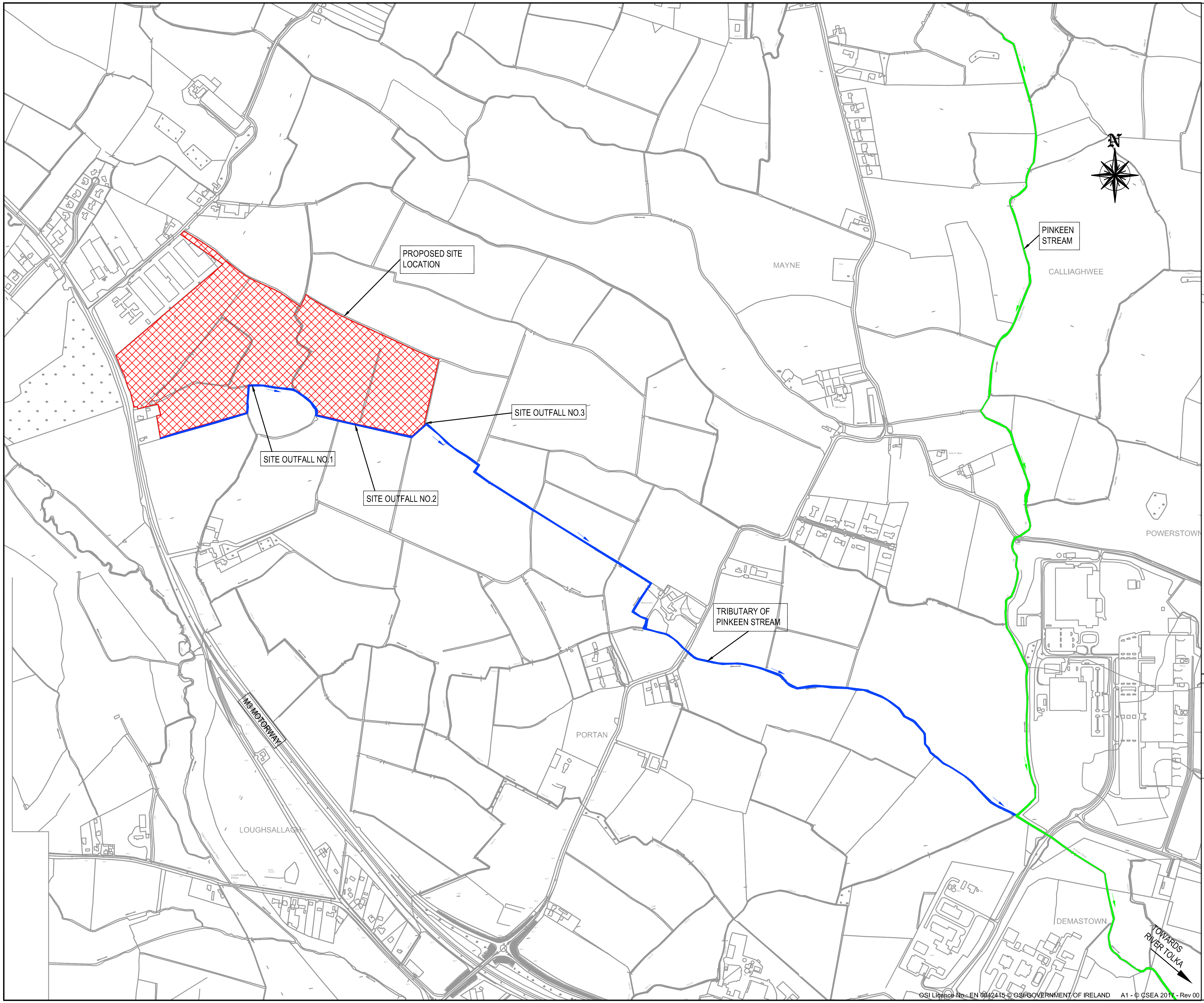
Meath County Council?s new corporate headquarters are:
Buvinda House,
Dublin Road,
Navan,
Co. Meath, C15 Y291

A1



LEGEND

▨	PROPOSED SITE LOCATION
🟩	EXISTING PINKEEN STREAM
🟦	EXISTING TRIBUTARY TO PINKEEN STREAM

Revision	Description	Drw'n	Chk'd	Date

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ENGINENODE

Project: ENGINENODE
CLONEE

Dwg. Title: PROPOSED SURFACE WATER OUTFALL
TO PINKEEN STREAM

Drawn By: PH
Date: 15/07/2019
Checked by: COD
Scale: 1:1500 @ A1

Project Code		Originator		Zone/ Phase		Level		Type		Role		Dwg. No.
ENGN	-	CSE	-	00	-	XX	-	DR	-	C	-	1010

Status Code: S0
Suitability Description: WORK IN PROGRESS
Revision: PL01
Project Status: PRELIMINARY
CSEA Job No.: 18_086

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