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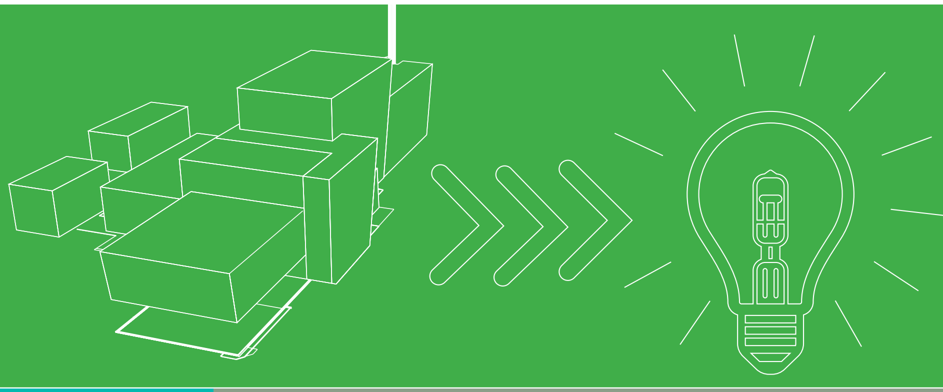
RINGASKIDDY
RESOURCE RECOVERY CENTRE

2016



Engineering Report

ARUP

Indaver

Ringaskiddy Resource Recovery Centre

Proposed Civil Infrastructure Engineering Report

Rep01

Issue 1 | January 2016

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 238129-00

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1 Introduction

Arup have been appointed by Indaver to prepare a planning application for the development of a new Resource Recovery Centre at a Greenfield site in Ringaskiddy, Co. Cork

Arup's scope includes the preparation of the engineering aspects of the application including:

- Roads
- Surface water
- Sanitary water
- Potable/fire water
- External lighting

There are a number of other disciplines that Arup are also involved with for this application but are covered elsewhere. These include the following:

- Coastal protection
- Traffic
- Environmental

This report should be read in conjunction with the engineering drawings as well as all other reports and the EIS that accompany this application.

2 Existing Site and Services

2.1 Existing Site

The site for the proposed Ringaskiddy Resource Recovery Centre is a Greenfield site located approximately 800m east of Ringaskiddy village.

The site occupies an area of approximately 13 hectares and is bounded to the north by the L2545 public road and to the east by Gobby Beach. The site gradient slopes from South to North and varies in level from circa 41mO.D. to 2.0mO.D.

The site is also divided into two separate areas by the Hammond Lane Metal Company site.

2.2 Existing L2545 Public Road

The L2545 local road runs along the northern boundary of the site. It has a posted speed limit of 50 kph. The road varies in level from approximately 3.00m OD at the western extent of the Indaver site and a level of approximately 2.45m OD at the eastern end of the Indaver site. It is a single carriageway road with an average paved width of approximately 9.0m. The road is super-elevated, with the camber on the road falling from north to south until it transitions to a south-north camber to tie-into the Haulbowline access road camber. The road has a very slack longitudinal gradient.

There is a significant risk of pluvial flooding of the road during periods of high tide combined with heavy rainfall. The existing storm water drainage system along the road consists of a 450mm diameter drain which outfalls to the sea at Gobby beach.

There are a minimal number of gullies along the public road to capture surface water and transfer it to the storm water which results in the dominant drainage mechanism for the road is “over the edge” drainage into the Indaver site on the south side of the road. A number of channels have been cut in the berm on the southern side of the road which allows surface water drain from the L2545 road into the site.

The invert level of the surface water drain which discharges at Gobby Beach is -0.28mOD.

The section of road which is most prone to flooding is located adjacent to the entrance to the public car park at Gobby beach. This is the lowest point of the road at a level of approximately 2.45m OD.

A flood risk assessment has been carried out on the existing road to determine the extent of any possible flooding and to determine proposed remedial works to protect the proposed development from future flooding

2.3 Existing Services

There is an extensive network of both overhead and underground services which either run through the site or along the boundary of the site. This services have been assessed as part of this application. The existing services are detailed on drawing C-000-070.

A number of these services will need to be diverted as part of this development. They include the following:

- 300mm∅ 19 bar gasmain (On site)
- 125mm∅ 4 bar gasmain
- 10kV overhead ESB line (On site)
- 450mm∅ watermain
- Existing Eircom duct bank
- 450mm∅ surface water sewer
- 220kV underground electrify cables and associated fibre optic cables

The diversion of services will be dealt with in Section 3.3 of this report.

3 Proposed Site and Services

3.1 Proposed Site

As part of the proposed development the overall site will be split into two individual areas for the purpose of this design:

- Main Site which contains the Process and Administration Buildings as well as the new ESB 38kV substation compound and other ancillary buildings
- Western Field which is being raised to form a finished level plateau

A separate Flood Risk Assessment report has been carried out for the proposed development and can be found in the accompanying EIS.

Drawings C-000-001 to -003 detail the proposed road and carpark layout for the development.

3.1.1 Proposed Main Site

The Main Site which is located east of the Hammond Lane site slopes from south to north varying in level from 27m to 2.40m. The main resource recovery centre will be located on this site.

A new entrance will be constructed off the upgraded L2545 to provide access to the site.

As the majority of traffic on the site will be HGV vehicles the majority of internal site roads will be 8m wide hot rolled asphalt roads. 360 degree access has been provided to the main process building to satisfy the fire access requirements in Part B of the building regulation.

All service yards where vehicles either park or carry out regular turning manoeuvres will be finished with reinforced concrete. The proposed carpark surface finish will be an asphalt concrete surface.

A minimum site level of 4.55m is set internally for all access roads and the development once access is taken off the upgraded L2545 public road.

Drawing C-000-003 details the main site road and carpark layout

3.1.2 Western Field

The Western Field which is located between Hammond Lane and the public road also slopes from south to north varying in level from 35m to 2.0m.

It is proposed to construct a 10,000m^2 (1ha) raised plateau in this area of the site.. The proposed plateau level will match the minimum level on the main site of 4.55m. It is proposed to construct the raised plateau using excavated rock from the main site.

A new entrance will be constructed off the public road to provide access to the site.

Drawing C-000-002 details the road layout for the Western Field area of the site

3.2 Proposed Services

3.2.1 Proposed Surface Water

As part of the proposed development the overall site will be split into 3 separate catchments. One complete drainage model has been developed detailing the full surface water drainage for the application. This model also includes the upgrade works associated with the L2545 public road:

- Main Site
- Western Field
- L2545 Public Road

The upgrade works for the L2545 are detailed in Section 4 of this report.

The main site is made up of a traditional carrier pipe network to convey all surface water runoff to the surface water tanks. A dedicated network will collect all runoff from the roof areas and will discharge direct to Tank 02.

A second network will collect the runoff from all site roads and service yards and will discharge to Tank 01. This runoff may be susceptible to hydrocarbon contamination and therefore will require the runoff to pass through a Class 1 interceptor before being monitored and sampled separately within Tank 01 prior to discharging to Tank 2 and the public sewer.

Both networks are detailed further in Section 3.2.1.4 of this report.

In addition to the sampling and monitoring in Tank 01 all surface water runoff will be sampled and monitored in the final manhole (SW MH 50) before discharge from the site to the public sewer. The details of these monitoring stations are given in Section 3.2.1.3 below.

The Western Field will have no positive drainage connection from the site to the public sewer. As we are creating no new hardstanding area all runoff from the site will continue to infiltrate to ground matching the existing drainage regime.

The proposed surface water drainage is detailed on drawings C-000-010 to -012.

3.2.1.1 Surface Water Design Criteria

The following are the design standards and guidelines used in the design of the surface water drainage:

- BS EN 752 – Drains and sewer system outside buildings.
- Greater Dublin Strategic Drainage Study (GDSDS) Volume 2 – New Developments.
- BS EN 858-2 – Separator system for light liquids (e.g oil and petrol).

- Pipe network has been designed to ensure no surcharging during a 2 year return period storm event.
- Pipe & attenuation tank simulated for the 30 year return period storm.
- An additional 10% has been allowed for climate change in relation to rainfall intensities.
- Proposed minimum self-cleansing velocities – 1.0m/s minimum.
- Colebrook White roughness value of 0.6mm for all pipework.
- Met Eireann rainfall data for site
    - ❖ M5/60 = 16.90mm
    - ❖ Ratio r = 0.22

3.2.1.2 Surface Water Discharge Control

As stated above the main site will be constructed on an existing Greenfield site. In accordance with the design requirements for Greenfield sites the surface water discharge from the main site will be limited to a pre-development rate (Q_{bar}) from the following:

$$Q_{bar} = 0.00108Area^{0.89} \text{ x } SAAR^{1.17} \text{ x } Soil^{2.17}$$

Where:

- Site area = 4ha
- Rainfall = 1209mm
- Soil type = 0.3
- Q_{bar} = 18L/Sec

All surface water discharging from the site will be controlled using 2No. surface water pumps, one duty and one standby, which will be located in Tank 02. Both pumps will have capacity to pump the full duty individually. The rising main shall be a 150mm HDPE pipe with electrofusion welded joints and will discharge to SW MH 50 before discharging by gravity to the public sewer.

3.2.1.3 Surface Water Quality

The final discharge from the site is to the council sewer which immediately discharges to Lower Harbour. In accordance with BS EN 858 as we are discharging to the surface water sewer and to the harbour we will be installing a Class 1 hydrocarbon interceptor prior to the discharge from the site.

As most of the regular traffic within the site will be HGV vehicles either parking or manoeuvring, we are proposing to treat all the runoff for hydrocarbon contamination in a Full Retention interceptor in accordance with BS EN 858.

In addition and due to the higher risk of contamination at the fuel loading area a forecourt separator will be located on the drainage collecting runoff from this area. This element of drainage on the fuel loading area will also include a small

2m³ holding take to collect any minor spillages that may occur while refuelling is taking place.

Each interceptor shall be fitted with an oil sensor and an alarm which will be tied back to the site BMS system.

Details of the hydrocarbon interceptors can be found in Appendix C of this report.

There will be two locations for surface water sampling and monitoring on the site:

- Monitoring Station 1 = Inlet to Tank 01 for runoff from all roads and hardstanding areas.
- Monitoring Station 2 = Surface water manhole SW MH 50 for all the runoff from the full site.

Station 1 will be an internal monitoring station for Indaver use to control possible spillages on site. Station 2 (SW MH 50) is the final manhole before surface water discharges to the public sewer and will be the sampling location for the Local and Licencing Authorities. All runoff from the site is tested at this point. During normal operation runoff will discharge at the agreed (Q_{bar}) rate of 18l/s, however if an out of specification reading is detected then the pump set within Tank 02 is switched off automatically combining both tanks store the contaminated runoff.

Each monitoring and sampling point will incorporate the following equipment:

- TOC Analyser.
- Conductivity Sensor.
- pH sensor.
- Flow meter (at final outfall manhole only)

Each monitoring station will be tied back into the main control system for monitoring and reporting purposes via a local control kiosk to be located at each station.

The operation of the monitoring and sampling points will control the discharge from the site. There are a number of different scenarios where the surface water will either be partially isolated or completely stopped. They include either of the two monitoring points reading out of specification samples or the activation of the fire alarm. Table 01 details these different scenarios and the automatic action taken.

Tank Number	All runoff In Specification	Monitoring Station 1 Out of Specification	Monitoring Station 2 Out of Specification	Fire Alarm
Tank 01	Open	Closed	Open	Open
Tank 02	Open	Open	Closed	Closed

Table 1: Surface Water Tank Operation Scenarios

Depending on the volume of contaminated waste Indaver will either dispose of the waste off site at a licensed facility or by pumping the waste to the Liquid Aqueous

Waste Tank before pumping back into the Process Building for injection into the furnace.

3.2.1.4 Pipe Networks

The piped drainage network on site has be split into two separate networks:

- Buildings
- Roads and hardstanding area.

This was done to ensure only areas at risk of possible hydrocarbon contamination i.e. roads and yards, are treated. Under BS EN 858 roof areas can be considered as clean runoff not requiring treatment.

The first carrier pipe network will collect all runoff from the roof areas across the site. This network will connect direct to Surface Water Tank No. 02 by-passing Tank 01. As roof runoff can be considered as clean water the runoff will by-pass monitoring station 1. The pipe diameter across this network varies from 225mm∅ to 450mm∅. No road gullies or drainage channels will connect to this network.

The second carrier pipe network on site will collect all runoff from roads and hardstanding areas in a network of road gullies and drainage channel before conveying the runoff to Fire Water Retention Task 01 via two class 1 full retention separators and the forecourt separator. As this network is most at risk of contamination all the runoff collected by this network will be tested at Monitoring Station 1.

The proposed carrier pipework shall be Polypipe Ridgidrain pipework and fittings for both networks.

Appendix A details the proposed surface water network associated with the full Site surface water drainage network. Appendix B details the simulation results for the network.

3.2.1.5 Surface Water Attenuation

As the surface water discharge from the site is being restricted to a pre-development rate of 18l/sec surface water attenuation will be required. A new reinforced concrete tank will be constructed under the carpark to attenuate the excess runoff. The attenuation volume is based on the 30 year return period storm event allowing for 10% additional flow for climate change.

However as the site will require fire water retention the tank volume size has been based on the EPA Guidelines for fire water retention i.e. 20yr 24hr storm even plus the fire water volume from the worst case fire event. All though the final volume will not be confirmed until the fire certificate stage an estimation of the storage volume requirement has been carried out to determine an approximate tank volume for planning. Table 2 details the storage volume provided by each tank.

Structure	Storage Volume (m³)
Fire Water Retention Tank 01	1690
Surface Water Attenuation 02	1250
Total Storage Volume	2940

Table 2 - Surface Water Attenuation / Retention Volumes

Once the final fire water retention volume has been confirmed during the fire certificate stage the overall tank volume will be adjusted accordingly.

3.2.1.6 Western Field

The works associated with the western field does not include the creation of any new hardstand except for the access ramp to the finished plateau.

As the finished plateau will be constructed from crushed rock the plateau will be relatively pervious. All rain falling on the plateau will pass through the crushed stone and will infiltrate to the ground. A new infiltration trench will be located at the northern end of the embankment to aid with the infiltration of runoff to the ground. This proposal of infiltrating the runoff to ground matches the existing drainage regime on the site.

The runoff from the access ramp will be collected at the bottom of the ramp and discharged into the existing 450mm∅ surface water sewer. The approximate runoff from the ramp will be 4L/Sec.

3.2.2 Proposed Sanitary Water

The following section details the proposed sanitary drainage proposals for the development.

All waste water generated by this development for disposal to the public sewer will be domestic waste. It is proposed to treat this domestic waste on site in a new temporary waste water treatment plant (WwTP) prior to pumping to the public sewer.

It should be noted that in general the process is a dry process and any process water collected from floor washings etc., will be collected and injected into the furnace, i.e. there will be no discharge of process water from the site.

Drawings C-000-020 to -022 details the sanitary water drainage for the development.

3.2.2.1 Design Criteria

The following is the design criteria used in the design of the proposed foul network:

- BS EN 752 – Drains and sewer systems outside buildings.
- Part H Building Regulations.
- Minimum fall of 1:80.

- Colebrook-White roughness value of 1.5mm for all pipework.
- Wastewater Treatment Plant shall be designed and tested to EN 12566-3:2005 & the EPA Code of Practice.

3.2.2.2 Proposed Drainage Network

There will be two primary areas where sanitary water will be generated:

- Process Building.
- Administration Building

The sanitary water from the welfare facilities of both the Process & Administration Buildings will be collected in a traditional gravity drainage network and conveyed to a new on-site wastewater treatment plant.

Following treatment the treated effluent will be pumped to the public sewer which is located approximately 200m west of the proposed entrance to the Western Field

As part of the planning design for the project we have been in discussions with Irish water and have submitted a pre-connection enquiry application for the discharge of 1.90m^3/day.

Irish Water have confirmed based on the pre-connection enquiry that the existing network has capacity to cater for the developments requirement.

The proposed sanitary water generated by the development is detailed on Table 3 below.

Staff	DWF 30l/h/d	DWF l/s	6DWF l/s	PE
63	1.9m^3	0.09	0.52	21

Table 3: Sanitary Water Flow Rates and Volumes

All pipework will be 150mm∅ at a minimum fall of 1:80 to ensure adequate self-cleansing velocities are achieved. The proposed pipework for the development shall be Polypipe Polysewer Pipework and fittings.

3.2.2.3 Domestic Wastewater Treatment

Currently Irish Water are developing plans for a new wastewater treatment plant (WwTP) to be located at Shanbally as part of the Cork Lower Harbour Main Drainage Project. However this will not be operational until the end of 2017 so following discussions with Irish Water it is proposed to install a temporary wastewater treatment plant as part of our development to treat the domestic waste generated by the development.

Once the Irish Water WwTP is fully operational the temporary plant will be decommissioned and untreated sewage will be pumped direct to the public sewer for treatment as part of the Cork Lower Harbour Main Drainage scheme. Refer to a drawing C-000-022 for the proposed location of the WwTP and pump station

It is proposed to provide Blivet BL 3000 wastewater treatment plant which is designed and manufactured by Butler Manufacturing Services. The unit is an aerobic biological treatment system which incorporates three separate treatment stages as follows:

- Primary Sedimentation
- Secondary Biological Treatment / Aerotar Aerobic Treatment
- Final clarification / Humus Tank

Firstly the incoming wastewater is treated in the primary sedimentation zone, which incorporates lamella plate separators. The lamellas which are angled at 60° and 50mm spacing, allow the average upward flow velocity of 0.9 m/hr to be achieved, which significantly enhance the sedimentation process. Typically the suspended solids concentration will be reduced by circa 75%.

The next stage of the overall treatment process is the biological treatment stage where the settled wastewater is brought into contact with the fixed film reactor and active aeration system (rotating drum). As the drum rotates through the settled wastewater biological treatment takes place. The treated wastewater must first flow through a filter providing additional screening before flowing onto the final settlement tank.

The final settlement or Humus tank is a discrete compartment denying ingress of untreated or partially treated liquor. The design is similar to the Primary Settlement Tank on an upward flow basis at 60° slope and 25mm spacing allow the average upward flow velocity of 0.9 m/hr.

Figure 1 shows a schematic of the treatment process for the proposed treatment facility.

The proposed final pump station will incorporate 2 submersible pumps, 1 duty and 1 standby, which will pump the treated effluent to the public sewer via a 125mm O.D. rising main. The pump station will also include for 24 hour emergency storage volume of circa 15.5m^3.

Table 4 gives the final discharge standard that will be pumped to the public sewer in Ringaskiddy village:

Parameter	**Value**
Design Flow	1.9m^3/d
BOD	20 mg/l
Suspend Solids	30 mg/l

Table 4: WwTP Discharge Standards

As state previously only treated domestic effluent will be treated and discharged to the public sewer. No process waste will be discharged to the public sewer.

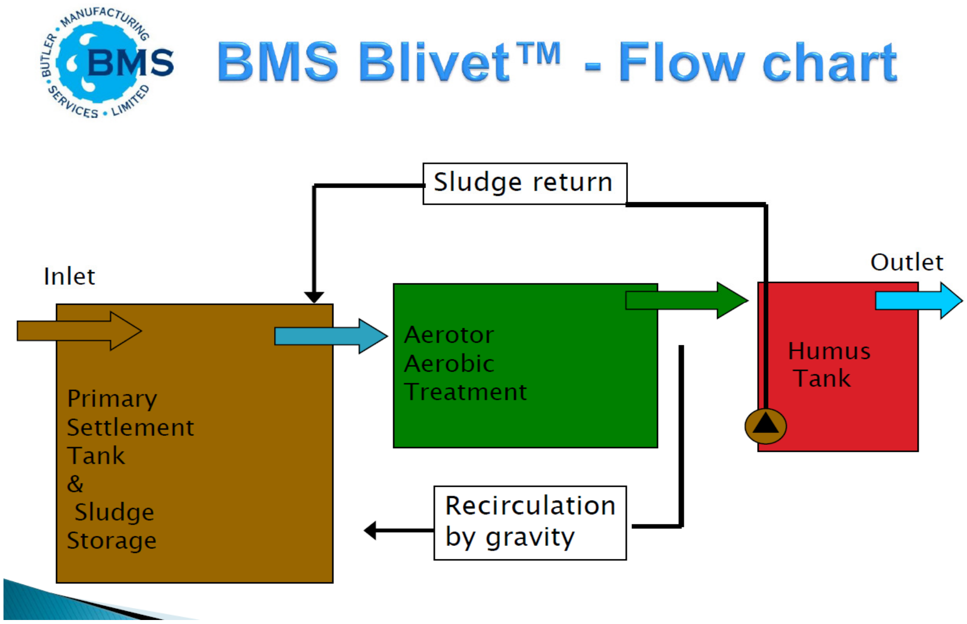

Figure 1 - WwTP Flow Chart

Refer to Appendix D for details of the wastewater treatment plant.

3.2.3 Proposed Potable and Fire Water

The proposed development will incorporate 2 separate water systems:

- Potable main
- Fire main

The proposed works for the water main also includes the diversion of the existing 450mm Irish Water main which is located on the north side of the public road.

Drawings C-000-030 to -031 detail of the potable and fire water system for the development.

3.2.3.1 Design Criteria

The following is the design criteria used in the design of the proposed potable and fire water mains:

- Part B of the Building Regulations
- BS 9990 – Code of practice for non-automatic fire-fighting systems in buildings
- Water demand for the development - 5.40m^3/hr.
- BS EN 545 – Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods

3.2.3.2 Potable Network

The existing water supply network in the area of the site consist of a 450mm∅ water main which is located on the north side of the L2545 public road, before reducing in size to a 200mm∅ main at the junction with the Haulbowline access road. Drawing C-000-070 shows the location of the existing services including the Irish Water main

As part of the planning design for the project we have been in discussions with Irish water and have submitted a pre-connection enquiry application for a supply of circa 5.40m^3/hr.

Irish Water have confirmed based on the pre-connection enquiry that the existing network has capacity to cater for the developments requirement of 5.40m^3/hr. Irish Water requested that the connection be made to the 200∅ main and not the 450mm main. A bulk water meter will be provided on the new connection as per Irish Water's requirements.

We have also been asked by Cork County Council who are acting as agents for Irish Water to upgrade the 450mm∅ diameter asbestos main over the full extent of the L2545 public road upgrade works due to the possible risk of damage to the main during the construction work for the road upgrade.

3.2.3.3 Fire Water Network

All though the final details for firefighting will be confirmed during the Fire Certification application the general principles for firefighting for this stage of the project area as follows:

- A new 250mm∅ ring main.
- Fire hydrants at 90m centres.
- Fire water storage tank with 2 hour capacity – 2200m^3.
- Sprinkler feeds to the process building.

As stated above all details for firefighting and retention will be confirmed at the fire certification application stage.

3.2.4 External Site Lighting

The proposed external lighting will be carried out using a combination of both column and building mounted luminaires as follows:

- Type 1 Roads = 8m high 250W HPS-T high pressure sodium lamp.
- Type 2 Carpark = 8m high 400W HPS high pressure sodium lamp.
- Type 3 Yards = 8m high 400W flood lighting high pressure sodium lamp.

All column mounted lamps will be fed by a network of ducts dedicated to external lighting which will loop around the site.

Drawings C-000-040 to -041 details the external lighting for the development.

3.2.4.1 Design Criteria

The following is the design criteria used in the design of the proposed external lighting:

- BS EN 13201 – Road Lighting Part 2: Performance Requirements.
- BS EN 12464 – Light and Lighting – Lighting of Work Places. Part 2 outdoor work places.

3.3 Diversion of Existing Services

As part of the overall project including the upgrade of the L2545 public road a number of existing services will need to be diverted. We confirm that pre-planning discussions have taken place with the individual utility companies regarding the diversion of each service. The diverted services include:

- 300mm∅ 19 bar gasmain
- 125mm∅ 4 bar gasmain
- 10kV overhead ESB line
- 450mm∅ watermain
- Existing Eircom duct bank
- 450mm∅ surface water sewer

Drawing C-000-071 and C-000-031 detail the diversion of the existing services.

Discussions have taken place with Eirgrid and ESB Networks regarding the existing 220kV underground cables located along the southern edge of the public road. ESB Networks will be carrying out an assessment of the cable run over the extent of the road upgrade to determine if a diversion is required.

4 Proposed L2545 Public Road Upgrade

4.1 Design Criteria

The proposed road upgrade has been designed in accordance with the following design standards and guidelines:

- NRA HD 24/06 – Traffic Assessment
- NRA HD 25-26/10 – Pavement and Foundation Design
- NRA TD 9 – Road Link Design

- NRA TD 41-42 – Geometric Design of Major/Minor Priority Junctions and Vehicular Access to National Roads
- NRA HD 19 – Road Safety Audit
- NRA Specification for Road Works Series 600

4.2 Proposed Road Upgrade

4.2.1 Road Geometry and Cross Section

As part of the proposed development a section of the L2545 public road will be raised and existing surface water drainage network upgraded to alleviate possible flooding on the road due to extreme tidal and rainfall events. The maximum proposed level of the road is 3.45m OD at its centreline (3.35m OD at the kerblines) which is approximately 1m above existing road level, this is a result from design iteration to comply with vertical road alignment standards. The proposed road level has been set in accordance with the Flood Risk Assessment which was carried out for the proposed development.

The road will be raised over a length of approximately 185m in order to ensure a smooth transition down to existing road levels, in accordance with road design standards. It will commence immediately to the east of the National Maritime College of Ireland entrance and terminate at the entrance to the public car park adjacent to Gobby Beach.

The posted speed limit of the road is 50 kph and the design speed for the road upgrade was selected at 60 kph. The vertical and horizontal design was carried out in accordance with TD 9. Horizontal and vertical sightlines have been calculated in accordance with TD 41/42, for all entrances and the require distance of 90m has been achieved in all cases.

The proposed road cross section is an 8m carriageway way consisting of 2 x 3.5m lanes with 0.5m wide hard strip on each side. The recently constructed footpath on the northern side of the road will also be raised to match the new road level.

A minimum 2m wide grass verge will be provided on the southern side of the road. The cross section will taper back to existing road cross section at either end at a rate of 1 in 50. The road will have a standard 2.5% cross fall but will transition to super elevated cross section at each tie-in to match the existing road cross section.

An independent Stage 1 Road Safety Audit to HD 19/15 was carried out on the proposed design. The designers have accepted all the recommendations from the Stage 1 Road Safety Audit.

4.2.2 Road Pavement

The road will be raised to sub-formation level using selected graded capping material to the 600 series of the NRA Specification for Road Works. The road pavement will consist of a minimum of 150mm depth of clause 804 sub-base material and a 200mm total thickness of asphalt.

4.3 Proposed Services - L2545 Road Upgrade

4.3.1 Surface Water Drainage

The existing surface water network will also need to be upgraded as it currently does not have sufficient capacity to attenuate the flow when the outfall is tide locked during periods of extreme high tides.

Surface water attenuation will be provided under the road to attenuate the runoff from the current and future contributing areas to the sewer when the outfall to the sea is heavily surcharged.

As part of the assessment the full catchment area currently draining to the existing 450mm∅ sewer needed to be determined. This involved an analysis of the topographical surveys for the area and the survey records for the existing drainage network. We also liaised with relevant stakeholders and carried out a review of the local authority records for the neighbouring sites to determine the catchment for the existing 450mm∅ sewer.

Drawing C-000-015 shows the full existing and proposed catchment of the existing sewer.

To determine the design criteria for the attenuation volume in the public road discussions were held with the Cork County Council and the Arup Flood Management Group. It was agreed that the design would be based on the worst case scenario from the following two storm events:

- 100yr storm event coinciding with a mean high water tide level, 1.72m, in this area of Cork Harbour.
- 30yr storm event coinciding with a 200yr tide level, 2.73m water level.

We confirm that Scenario 2, 30 year storm event with 200yr tide is the worst case scenario of both options.

Due to the high water level of the 200 year design tide the outfall to Gobby Beach will be submerged for approximately 7 hours during the tidal event. It is proposed to construct a new surface water attenuation structure under the upgraded road to attenuate all runoff generated by the drainage catchment during the design scenario. The following attenuation volume is required during a 30yr storm event coinciding with a 200 year tidal level.

- Storage Volume = 660m^3.

It is proposed to provide the required storage in 2no. 1500mm∅ pipes approximately 190m in length which will be located under the raised section of the L2545.

Drawing C-000-014 details the upgrade of the existing surface water drainage network from the entrance of the Hammond Lane site eastwards to the outfall at Gobby Beach.

The current runoff from the section of the L2545 from the Hammond Lane Metal Company entrance to the western boundary of the Indaver site currently discharges into the Western Field area of the Indaver site.

As part of the works for the new development the runoff will now be intercepted in a new network of road gullies which will be located in a new 260 metre length of linear concrete surface water channel located on the southern edge of the road.

The new road gullies will discharge directly into the existing 450mm sewer which runs along the southern edge of the L2545 public road.

Drawing C-000-013 details the upgrade of the existing surface water drainage network from the western boundary of the Indaver site to the entrance of the Hammond Lane site.

Both the networks from the Main Site area of the Indaver site and the Public Road have been assessed for the 30 year rainfall event while also allowing for 10% for climate change. Appendix A gives the network details for the complete model while Appendix B gives the simulation results for the complete network.

4.3.2 Road Lighting

It is not proposed to provide additional lighting along the public road. However a number of the existing lamp standard along the northern road edge will need to be relocated to suit the new road level.

Appendix A

Surface Water Drainage Network

Proposed Drainage Catchment Summary

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.032	4-8	0.659	8-12	4.949	12-16	1.045	16-20	0.026

Total Area Contributing (ha) = 6.711

Total Pipe Volume (m^3) = 328.277

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Proposed Drainage Channel Sizes

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-39	MB5	100	328			0.161	0.026
-48	R23	200	350			0.309	0.062
-75	M51	150	215			0.231	0.030
-85	R15	100	345			0.166	0.030

Pipework 1.000 to 1.013 Inclusive of Branches = Process Building Side of Site
Pipework 1.014 to 1.015 = 2No. 1500mm L2545 Public Road Attenuation
Pipework 15.000 to 15.003 = Existing L2545 Public Road Drainage
Pipework 16.000 to 16.003 Inclusive of Branches = Hammond Lane Site
Pipework 19.000 to 19.005 Inclusive of Branches = Existing L2545 Public Road Drainage
Pipework 23.000 to 1.017 = Existing L2545 Public Road Drainage to Existing Outfall
Pipework 24.000 to 24.011 = Haulbowline Road Drainage

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Proposed Drainage Network Details

Network Details 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)
1.000	33.077	0.170	194.6	0.165	4.00	0.0	0.600	o	300
1.001	80.325	0.670	119.9	0.087	0.00	0.0	0.600	o	300
1.002	55.236	2.010	27.5	0.056	0.00	0.0	0.600	o	300
2.000	74.862	0.380	197.0	0.253	4.00	0.0	0.600	o	300
1.003	28.975	0.620	46.7	0.043	0.00	0.0	0.600	o	300
1.004	26.729	0.270	99.0	0.062	0.00	0.0	0.600	o	375
1.005	31.411	0.210	149.6	0.000	0.00	0.0	0.600	o	375
1.006	25.829	0.570	45.3	0.148	0.00	0.0	0.600	o	375
1.007	32.616	0.780	41.8	0.084	0.00	0.0	0.600	o	375
3.000	13.265	0.340	39.0	0.043	4.00	0.0	0.600	o	225
1.008	13.441	0.090	149.3	0.000	0.00	0.0	0.600	o	450
4.000	36.108	0.300	120.4	0.061	4.00	0.0	0.600	R15	-85
4.001	20.419	0.200	102.1	0.000	0.00	0.0	0.600	o	150
5.000	36.023	0.100	360.2	0.076	4.00	0.0	0.600	M51	-75
5.001	15.602	0.570	27.4	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	9.300	0.165	0.0	1.12	79.4
1.001	9.130	0.252	0.0	1.43	101.4
1.002	8.460	0.308	0.0	3.01	212.8
2.000	5.500	0.253	0.0	1.12	78.9
1.003	5.120	0.604	0.0	2.31	163.0
1.004	3.690	0.667	0.0	1.82	201.1
1.005	3.420	0.667	0.0	1.48	163.4
1.006	3.210	0.814	0.0	2.70	298.0
1.007	2.640	0.898	0.0	2.81	310.2
3.000	2.100	0.043	0.0	2.10	83.5
1.008	1.760	0.941	0.0	1.66	264.2
4.000	2.875	0.061	0.0	0.98	29.3
4.001	2.575	0.061	0.0	0.99	17.6
5.000	4.220	0.076	0.0	0.70	20.9
5.001	4.120	0.076	0.0	1.93	34.1

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Network Details 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)
6.000	48.477	0.100	484.8	0.046	4.00	0.0	0.600	M51	-75
6.001	8.339	0.570	14.6	0.000	0.00	0.0	0.600	o	150
1.009	17.893	0.180	99.4	0.000	0.00	0.0	0.600	o	600
1.010	5.292	0.050	105.8	0.000	0.00	0.0	0.600	o	600
1.011	43.913	0.430	102.1	0.000	0.00	0.0	0.600	o	600
7.000	33.547	0.330	101.7	0.200	4.00	0.0	0.600	o	300
8.000	37.155	0.250	148.6	0.073	4.00	0.0	0.600	o	225
8.001	11.737	0.120	97.8	0.094	0.00	0.0	0.600	o	225
8.002	30.928	0.610	50.7	0.006	0.00	0.0	0.600	o	225
8.003	13.910	0.250	55.6	0.010	0.00	0.0	0.600	o	225
8.004	34.578	0.720	48.0	0.042	0.00	0.0	0.600	o	225
8.005	73.560	0.440	167.2	0.111	0.00	0.0	0.600	o	300
7.001	24.082	0.240	100.3	0.000	0.00	0.0	0.600	o	450
7.002	28.803	0.290	99.3	0.000	0.00	0.0	0.600	o	450
9.000	8.945	0.050	178.9	0.016	4.00	0.0	0.600	MB5	-39
9.001	39.870	0.920	43.3	0.000	0.00	0.0	0.600	o	150
9.002	14.521	0.150	96.8	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
6.000	4.220	0.046	0.0	0.60	17.9
6.001	4.120	0.046	0.0	2.65	46.8
1.009	1.670	1.124	0.0	2.44	690.7
1.010	1.490	1.124	0.0	2.37	669.2
1.011	-0.070	1.124	0.0	2.41	681.4
7.000	3.270	0.200	0.0	1.56	110.2
8.000	8.500	0.073	0.0	1.07	42.6
8.001	8.250	0.167	0.0	1.32	52.6
8.002	6.510	0.172	0.0	1.84	73.2
8.003	4.700	0.182	0.0	1.76	69.9
8.004	3.820	0.224	0.0	1.89	75.2
8.005	3.100	0.335	0.0	1.21	85.8
7.001	2.660	0.535	0.0	2.03	322.8
7.002	2.140	0.535	0.0	2.04	324.5
9.000	2.970	0.016	0.0	0.79	20.4
9.001	2.920	0.016	0.0	1.53	27.1
9.002	2.000	0.016	0.0	1.33	52.8

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Network Details 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)
7.003	29.459	0.200	147.3	0.161	0.00	0.0	0.600	o	450
7.004	3.081	0.020	154.1	0.000	0.00	0.0	0.600	o	450
7.005	36.851	0.370	99.6	0.000	0.00	0.0	0.600	o	450
10.000	35.306	0.240	147.1	0.214	4.00	0.0	0.600	o	300
10.001	36.934	0.750	49.2	0.046	0.00	0.0	0.600	o	300
10.002	14.124	0.250	56.5	0.000	0.00	0.0	0.600	o	300
10.003	36.825	0.720	51.1	0.046	0.00	0.0	0.600	o	300
10.004	44.374	0.300	147.9	0.100	0.00	0.0	0.600	o	300
10.005	17.923	0.120	149.4	0.000	0.00	0.0	0.600	o	300
10.006	47.834	0.320	149.5	0.143	0.00	0.0	0.600	o	375
11.000	68.336	0.450	151.9	0.051	4.00	0.0	0.600	o	225
11.001	18.861	0.170	110.9	0.000	0.00	0.0	0.600	o	225
12.000	69.299	0.620	111.8	0.082	4.00	0.0	0.600	o	225
11.002	5.588	0.050	111.8	0.017	0.00	0.0	0.600	o	225
11.003	21.971	0.200	109.9	0.000	0.00	0.0	0.600	o	225
11.004	71.898	0.480	149.8	0.252	0.00	0.0	0.600	o	300
11.005	26.927	0.180	149.6	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
7.003	1.850	0.712	0.0	1.67	266.1
7.004	1.650	0.712	0.0	1.64	260.1
7.005	-0.130	0.712	0.0	2.04	324.0
10.000	8.500	0.214	0.0	1.29	91.5
10.001	6.650	0.260	0.0	2.25	158.8
10.002	4.700	0.260	0.0	2.10	148.2
10.003	3.820	0.306	0.0	2.20	155.8
10.004	3.100	0.407	0.0	1.29	91.2
10.005	2.800	0.407	0.0	1.28	90.8
10.006	2.680	0.550	0.0	1.48	163.4
11.000	9.500	0.051	0.0	1.06	42.1
11.001	9.050	0.051	0.0	1.24	49.3
12.000	9.500	0.082	0.0	1.24	49.1
11.002	5.600	0.149	0.0	1.24	49.1
11.003	5.550	0.149	0.0	1.25	49.6
11.004	5.350	0.401	0.0	1.28	90.6
11.005	4.870	0.401	0.0	1.28	90.7

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Network Details 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)
11.006	17.414	0.120	145.1	0.000	0.00	0.0	0.600	o	300
11.007	29.233	0.690	42.4	0.050	0.00	0.0	0.600	o	300
10.007	12.778	0.080	159.7	0.000	0.00	0.0	0.600	o	450
10.008	40.406	0.270	149.7	0.000	0.00	0.0	0.600	o	450
13.000	14.681	0.150	97.9	0.022	4.00	0.0	0.600	o	225
10.009	14.469	0.150	96.5	0.018	0.00	0.0	0.600	o	450
10.010	10.072	0.060	167.9	0.000	0.00	0.0	0.600	o	450
14.000	24.278	0.210	115.6	0.032	4.00	0.0	0.600	o	225
14.001	12.168	0.120	101.4	0.000	0.00	0.0	0.600	o	225
10.011	4.222	0.030	140.7	0.022	0.00	0.0	0.600	o	450
10.012	29.415	0.300	98.1	0.000	0.00	0.0	0.600	o	450
1.012	20.415	-2.500	-8.2	0.000	0.00	0.0	0.600	o	150
1.013	17.408	1.640	10.6	0.000	0.00	0.0	0.600	o	225
15.000	90.064	0.300	300.2	0.118	5.00	0.0	0.600	o	225
15.001	94.932	0.300	316.4	0.112	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
11.006	4.210	0.401	0.0	1.30	92.1
11.007	4.090	0.450	0.0	2.42	171.2
10.007	2.360	1.000	0.0	1.61	255.4
10.008	2.280	1.000	0.0	1.66	264.0
13.000	3.500	0.022	0.0	1.32	52.6
10.009	2.010	1.040	0.0	2.07	329.3
10.010	1.860	1.040	0.0	1.57	249.1
14.000	3.500	0.032	0.0	1.22	48.3
14.001	3.290	0.032	0.0	1.30	51.6
10.011	1.800	1.095	0.0	1.71	272.3
10.012	-0.200	1.095	0.0	2.05	326.6
1.012	-0.500	2.931	0.0	0.00	0.0
1.013	2.000	2.931	0.0	4.04	160.6
15.000	1.370	0.118	0.0	0.75	29.8
15.001	1.070	0.230	0.0	0.88	62.1

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Network Details 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)
15.002	89.811	0.300	299.4	0.071	0.00	0.0	0.600	o	300
16.000	7.170	0.020	358.5	0.016	4.00	0.0	0.600	o	150
17.000	7.992	0.089	89.8	0.128	4.00	0.0	0.600	o	150
17.001	10.005	0.220	45.5	0.128	0.00	0.0	0.600	o	150
17.002	46.040	0.520	88.5	0.128	0.00	0.0	0.600	o	150
17.003	11.817	0.000	0.0	0.000	0.00	0.0	0.600	o	150
16.001	6.600	0.120	55.0	0.384	0.00	0.0	0.600	o	150
16.002	23.020	0.040	575.5	0.000	0.00	0.0	0.600	o	150
18.000	120.136	3.300	36.4	0.445	5.00	0.0	0.600	R23	-48
18.001	86.118	3.560	24.2	0.000	0.00	0.0	0.600	R23	-48
16.003	5.782	0.693	8.3	0.000	0.00	0.0	0.600	o	450
19.000	13.891	0.160	86.8	0.214	5.00	0.0	0.600	o	225
20.000	14.923	0.160	93.3	0.214	5.00	0.0	0.600	o	225
19.001	50.103	0.470	106.6	0.214	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
15.002	0.770	0.301	0.0	0.90	63.9
16.000	0.920	0.016	0.0	0.53	9.3
17.000	3.400	0.128	0.0	1.06	18.8
17.001	3.300	0.256	0.0	1.50	26.4
17.002	3.080	0.384	0.0	1.07	18.9
17.003	0.000	0.384	0.0	0.00	0.0
16.001	0.900	0.784	0.0	1.36	24.0
16.002	0.780	0.784	0.0	0.41	7.3
18.000	9.130	0.445	0.0	2.66	165.1
18.001	5.830	0.445	0.0	3.27	202.7
16.003	0.740	1.229	0.0	7.07	1124.6
19.000	2.700	0.214	0.0	1.40	55.8
20.000	2.700	0.214	0.0	1.35	53.8
19.001	2.540	0.642	0.0	1.52	107.6

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Network Details 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)
21.000	15.350	0.630	24.4	0.214	5.00	0.0	0.600	o	225
22.000	16.588	0.630	26.3	0.214	5.00	0.0	0.600	o	225
19.002	42.138	0.410	102.8	0.215	0.00	0.0	0.600	o	450
19.003	34.036	0.300	113.5	0.215	0.00	0.0	0.600	o	450
19.004	20.611	0.360	57.3	0.000	0.00	0.0	0.600	o	450
19.005	27.366	0.530	51.6	0.000	0.00	0.0	0.600	o	450
15.003	46.568	0.110	423.3	0.066	0.00	0.0	0.600	o	450
1.014	88.591	0.166	533.7	0.197	0.00	0.0	0.600	o	450
1.015	99.293	0.167	594.6	0.000	0.00	0.0	0.600	o	450
23.000	102.776	0.470	218.7	0.000	5.00	0.0	0.600	o	450
23.001	98.340	0.110	894.0	0.051	0.00	0.0	0.600	o	450
23.002	31.119	0.094	331.1	0.047	0.00	0.0	0.600	o	450
23.003	3.665	0.043	85.2	0.000	0.00	0.0	0.600	o	450
24.000	42.313	0.410	103.2	0.067	5.00	0.0	0.600	o	225
24.001	62.653	0.680	92.1	0.063	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
21.000	2.700	0.214	0.0	2.66	105.8
22.000	2.700	0.214	0.0	2.56	101.8
19.002	2.070	1.285	0.0	2.01	318.9
19.003	1.660	1.500	0.0	1.91	303.5
19.004	1.360	1.500	0.0	2.69	428.0
19.005	1.000	1.500	0.0	2.83	450.8
15.003	0.470	3.096	0.0	0.98	156.1
1.014	0.336	6.224	0.0	0.87	138.9
1.015	0.170	6.224	0.0	0.83	131.5
23.000	0.740	0.000	0.0	1.37	218.0
23.001	0.270	0.051	0.0	0.67	106.9
23.002	0.160	0.098	0.0	1.11	176.8
23.003	0.066	0.098	0.0	2.20	350.4
24.000	3.900	0.067	0.0	1.29	51.2
24.001	3.490	0.130	0.0	1.36	54.2

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Network Details 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)
24.002	50.992	0.310	164.5	0.042	0.00	0.0	0.600	o	225
24.003	38.640	0.240	161.0	0.031	0.00	0.0	0.600	o	225
24.004	64.706	0.420	154.1	0.047	0.00	0.0	0.600	o	300
24.005	52.554	0.235	223.6	0.037	0.00	0.0	0.600	o	300
24.006	42.370	0.180	235.4	0.030	0.00	0.0	0.600	o	300
24.007	21.658	0.120	180.5	0.016	0.00	0.0	0.600	o	300
24.008	30.132	0.140	215.2	0.022	0.00	0.0	0.600	o	300
24.009	32.209	0.220	146.4	0.023	0.00	0.0	0.600	o	300
24.010	20.166	0.200	100.8	0.011	0.00	0.0	0.600	o	300
24.011	12.527	0.442	28.3	0.000	0.00	0.0	0.600	o	300
1.016	47.399	0.083	571.1	0.000	0.00	0.0	0.600	o	450
1.017	75.830	0.200	379.2	0.000	0.00	0.0	0.600	o	450

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
24.002	2.810	0.173	0.0	1.02	40.4
24.003	2.500	0.204	0.0	1.03	40.9
24.004	2.260	0.250	0.0	1.26	89.4
24.005	1.765	0.287	0.0	1.05	74.0
24.006	1.530	0.317	0.0	1.02	72.1
24.007	1.350	0.333	0.0	1.17	82.5
24.008	1.230	0.355	0.0	1.07	75.5
24.009	1.090	0.378	0.0	1.30	91.7
24.010	0.870	0.389	0.0	1.57	110.7
24.011	0.670	0.389	0.0	2.96	209.6
1.016	0.003	6.711	0.0	0.84	134.2
1.017	-0.080	6.711	0.0	1.04	165.1

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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)
1.000	o	300	1	10.800	9.300	1.200	Open Manhole	1200
1.001	o	300	2	10.800	9.130	1.370	Open Manhole	1200
1.002	o	300	3	9.960	8.460	1.200	Open Manhole	1200
2.000	o	300	4	7.000	5.500	1.200	Open Manhole	1200
1.003	o	300	5	7.630	5.120	2.210	Open Manhole	1200
1.004	o	375	6	6.080	3.690	2.015	Open Manhole	1200
1.005	o	375	7	5.150	3.420	1.355	Open Manhole	1200
1.006	o	375	8	5.100	3.210	1.515	Open Manhole	1200
1.007	o	375	9	4.350	2.640	1.335	Open Manhole	1200
3.000	o	225	10	3.600	2.100	1.275	Open Manhole	1200
1.008	o	450	11	3.700	1.760	1.490	Open Manhole	1500
4.000	R15	-85	12	3.300	2.875	0.080	Junction	
4.001	o	150	13	3.000	2.575	0.275	Junction	
5.000	M51	-75	14	4.550	4.220	0.115	Junction	
5.001	o	150	15	4.550	4.120	0.280	Junction	

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)
1.000	33.077	194.6	2	10.800	9.130	1.370	Open Manhole	1200
1.001	80.325	119.9	3	9.960	8.460	1.200	Open Manhole	1200
1.002	55.236	27.5	5	7.630	6.450	0.880	Open Manhole	1200
2.000	74.862	197.0	5	7.630	5.120	2.210	Open Manhole	1200
1.003	28.975	46.7	6	6.080	4.500	1.280	Open Manhole	1200
1.004	26.729	99.0	7	5.150	3.420	1.355	Open Manhole	1200
1.005	31.411	149.6	8	5.100	3.210	1.515	Open Manhole	1200
1.006	25.829	45.3	9	4.350	2.640	1.335	Open Manhole	1200
1.007	32.616	41.8	11	3.700	1.860	1.465	Open Manhole	1500
3.000	13.265	39.0	11	3.700	1.760	1.715	Open Manhole	1500
1.008	13.441	149.3	18	4.900	1.670	2.780	Open Manhole	1500
4.000	36.108	120.4	13	3.000	2.575	0.080	Junction	
4.001	20.419	102.1	18	4.900	2.375	2.375	Open Manhole	1500
5.000	36.023	360.2	15	4.550	4.120	0.215	Junction	
5.001	15.602	27.4	18	4.900	3.550	1.200	Open Manhole	1500

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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)
6.000	M51	-75	16	4.550	4.220	0.115	Junction	
6.001	o	150	17	4.550	4.120	0.280	Junction	
1.009	o	600	18	4.900	1.670	2.630	Open Manhole	1500
1.010	o	600	19	4.750	1.490	2.660	Open Manhole	1500
1.011	o	600	20	4.600	-0.070	4.070	Open Manhole	1500
7.000	o	300	21	4.770	3.270	1.200	Open Manhole	1200
8.000	o	225	22	10.000	8.500	1.275	Open Manhole	1200
8.001	o	225	23	10.000	8.250	1.525	Open Manhole	1200
8.002	o	225	24	10.000	6.510	3.265	Open Manhole	1200
8.003	o	225	25	7.450	4.700	2.525	Open Manhole	1200
8.004	o	225	26	6.100	3.820	2.055	Open Manhole	1200
8.005	o	300	27	4.900	3.100	1.500	Open Manhole	1200
7.001	o	450	28	4.770	2.660	1.660	Open Manhole	1500
7.002	o	450	29	5.000	2.140	2.410	Open Manhole	1500
9.000	MB5	-39	30	3.300	2.970	0.002	Junction	

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)
6.000	48.477	484.8	17	4.550	4.120	0.215	Junction	
6.001	8.339	14.6	18	4.900	3.550	1.200	Open Manhole	1500
1.009	17.893	99.4	19	4.750	1.490	2.660	Open Manhole	1500
1.010	5.292	105.8	20	4.600	1.440	2.560	Open Manhole	1500
1.011	43.913	102.1	61	4.600	-0.500	4.500	Open Manhole	1500
7.000	33.547	101.7	28	4.770	2.940	1.530	Open Manhole	1500
8.000	37.155	148.6	23	10.000	8.250	1.525	Open Manhole	1200
8.001	11.737	97.8	24	10.000	8.130	1.645	Open Manhole	1200
8.002	30.928	50.7	25	7.450	5.900	1.325	Open Manhole	1200
8.003	13.910	55.6	26	6.100	4.450	1.425	Open Manhole	1200
8.004	34.578	48.0	27	4.900	3.100	1.575	Open Manhole	1200
8.005	73.560	167.2	28	4.770	2.660	1.810	Open Manhole	1500
7.001	24.082	100.3	29	5.000	2.420	2.130	Open Manhole	1500
7.002	28.803	99.3	33	3.500	1.850	1.200	Open Manhole	1500
9.000	8.945	178.9	31	3.250	2.920	0.002	Junction	

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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)
9.001	o	150	31	3.250	2.920	0.180	Junction	
9.002	o	225	32	3.400	2.000	1.175	Junction	
7.003	o	450	33	3.500	1.850	1.200	Open Manhole	1500
7.004	o	450	34	4.900	1.650	2.800	Open Manhole	1500
7.005	o	450	35	4.800	-0.130	4.480	Open Manhole	1500
10.000	o	300	36	10.000	8.500	1.200	Open Manhole	1200
10.001	o	300	37	10.000	6.650	3.050	Open Manhole	1200
10.002	o	300	38	7.450	4.700	2.450	Open Manhole	1200
10.003	o	300	39	6.100	3.820	1.980	Open Manhole	1200
10.004	o	300	40	4.820	3.100	1.420	Open Manhole	1200
10.005	o	300	41	5.000	2.800	1.900	Open Manhole	1200
10.006	o	375	42	5.000	2.680	1.945	Open Manhole	1200
11.000	o	225	43	11.000	9.500	1.275	Open Manhole	1200
11.001	o	225	44	11.000	9.050	1.725	Open Manhole	1200
12.000	o	225	45	11.000	9.500	1.275	Open Manhole	1200
11.002	o	225	46	11.000	5.600	5.175	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.001	39.870	43.3	32	3.400	2.000	1.250	Junction	
9.002	14.521	96.8	33	3.500	1.850	1.425	Open Manhole	1500
7.003	29.459	147.3	34	4.900	1.650	2.800	Open Manhole	1500
7.004	3.081	154.1	35	4.800	1.630	2.720	Open Manhole	1500
7.005	36.851	99.6	61	4.600	-0.500	4.650	Open Manhole	1500
10.000	35.306	147.1	37	10.000	8.260	1.440	Open Manhole	1200
10.001	36.934	49.2	38	7.450	5.900	1.250	Open Manhole	1200
10.002	14.124	56.5	39	6.100	4.450	1.350	Open Manhole	1200
10.003	36.825	51.1	40	4.820	3.100	1.420	Open Manhole	1200
10.004	44.374	147.9	41	5.000	2.800	1.900	Open Manhole	1200
10.005	17.923	149.4	42	5.000	2.680	2.020	Open Manhole	1200
10.006	47.834	149.5	52	4.900	2.360	2.165	Open Manhole	1500
11.000	68.336	151.9	44	11.000	9.050	1.725	Open Manhole	1200
11.001	18.861	110.9	46	11.000	8.880	1.895	Open Manhole	1200
12.000	69.299	111.8	46	11.000	8.880	1.895	Open Manhole	1200
11.002	5.588	111.8	47	7.000	5.550	1.225	Open Manhole	1200

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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)
11.003	o	225	47	7.000	5.550	1.225	Open Manhole	1200
11.004	o	300	48	7.000	5.350	1.350	Open Manhole	1200
11.005	o	300	49	7.600	4.870	2.430	Open Manhole	1200
11.006	o	300	50	7.100	4.210	2.590	Open Manhole	1200
11.007	o	300	51	5.780	4.090	1.390	Open Manhole	1200
10.007	o	450	52	4.900	2.360	2.090	Open Manhole	1500
10.008	o	450	53	5.000	2.280	2.270	Open Manhole	1500
13.000	o	225	54	5.000	3.500	1.275	Open Manhole	1200
10.009	o	450	55	5.000	2.010	2.540	Open Manhole	1500
10.010	o	450	56	4.800	1.860	2.490	Open Manhole	1500
14.000	o	225	57	5.000	3.500	1.275	Open Manhole	1200
14.001	o	225	58	5.000	3.290	1.485	Open Manhole	1200
10.011	o	450	59	4.800	1.800	2.550	Open Manhole	1500
10.012	o	450	60	4.700	-0.200	4.450	Open Manhole	1500
1.012	o	150	61	4.600	-0.500	4.950	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)
11.003	21.971	109.9	48	7.000	5.350	1.425	Open Manhole	1200
11.004	71.898	149.8	49	7.600	4.870	2.430	Open Manhole	1200
11.005	26.927	149.6	50	7.100	4.690	2.110	Open Manhole	1200
11.006	17.414	145.1	51	5.780	4.090	1.390	Open Manhole	1200
11.007	29.233	42.4	52	4.900	3.400	1.200	Open Manhole	1500
10.007	12.778	159.7	53	5.000	2.280	2.270	Open Manhole	1500
10.008	40.406	149.7	55	5.000	2.010	2.540	Open Manhole	1500
13.000	14.681	97.9	55	5.000	3.350	1.425	Open Manhole	1500
10.009	14.469	96.5	56	4.800	1.860	2.490	Open Manhole	1500
10.010	10.072	167.9	59	4.800	1.800	2.550	Open Manhole	1500
14.000	24.278	115.6	58	5.000	3.290	1.485	Open Manhole	1200
14.001	12.168	101.4	59	4.800	3.170	1.405	Open Manhole	1500
10.011	4.222	140.7	60	4.700	1.770	2.480	Open Manhole	1500
10.012	29.415	98.1	61	4.600	-0.500	4.650	Open Manhole	1500
1.012	20.415	-8.2	62	4.550	2.000	2.400	Open Manhole	1500

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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)
1.013	o	225	62	4.550	2.000	2.325	Open Manhole	1500
15.000	o	225	11	2.820	1.370	1.225	Open Manhole	1200
15.001	o	300	12	2.800	1.070	1.430	Open Manhole	1200
15.002	o	300	13	2.800	0.770	1.730	Open Manhole	1200
16.000	o	150	19	4.000	0.920	2.930	Open Manhole	1200
17.000	o	150	4	7.100	3.400	3.550	Open Manhole	1200
17.001	o	150	16	7.100	3.300	3.650	Open Manhole	1200
17.002	o	150	4	5.000	3.080	1.770	Open Manhole	1200
17.003	o	150	5	4.340	0.000	4.190	Open Manhole	1200
16.001	o	150	7	4.000	0.900	2.950	Open Manhole	1200
16.002	o	150	6	3.700	0.780	2.770	Open Manhole	1200
18.000	R23	-48	24	9.600	9.130	0.120	Open Manhole	1200
18.001	R23	-48	26	6.270	5.830	0.090	Open Manhole	1200
16.003	o	450	7	2.740	0.740	1.550	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)
1.013	17.408	10.6	12	2.900	0.360	2.315	Open Manhole	4200 x 1500
15.000	90.064	300.2	12	2.800	1.070	1.505	Open Manhole	1200
15.001	94.932	316.4	13	2.800	0.770	1.730	Open Manhole	1200
15.002	89.811	299.4	14	2.800	0.470	2.030	Open Manhole	1500
16.000	7.170	358.5	7	4.000	0.900	2.950	Open Manhole	1200
17.000	7.992	89.8	16	7.100	3.311	3.639	Open Manhole	1200
17.001	10.005	45.5	4	5.000	3.080	1.770	Open Manhole	1200
17.002	46.040	88.5	5	4.340	2.560	1.630	Open Manhole	1200
17.003	11.817	0.0	7	4.000	0.000	3.850	Open Manhole	1200
16.001	6.600	55.0	6	3.700	0.780	2.770	Open Manhole	1200
16.002	23.020	575.5	7	2.740	0.740	1.850	Open Manhole	1500
18.000	120.136	36.4	26	6.270	5.830	0.090	Open Manhole	1200
18.001	86.118	24.2	7	2.740	2.270	0.120	Open Manhole	1500
16.003	5.782	8.3	14	2.800	0.047	2.303	Open Manhole	1500

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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)
19.000	o	225	14	4.200	2.700	1.275	Open Manhole	1200
20.000	o	225	15	4.200	2.700	1.275	Open Manhole	1200
19.001	o	300	15	4.200	2.540	1.360	Open Manhole	1200
21.000	o	225	17	4.200	2.700	1.275	Open Manhole	1200
22.000	o	225	18	4.200	2.700	1.275	Open Manhole	1200
19.002	o	450	16	4.000	2.070	1.480	Open Manhole	1500
19.003	o	450	17	3.750	1.660	1.640	Open Manhole	1500
19.004	o	450	18	3.500	1.360	1.690	Open Manhole	1500
19.005	o	450	19	3.000	1.000	1.550	Open Manhole	1500
15.003	o	450	14	2.800	0.470	1.880	Open Manhole	1500
1.014	o	450	12	2.900	0.336	2.114	Open Manhole	4200 x 1500
1.015	o	450	16	3.280	0.170	2.660	Open Manhole	4200 x 1500
23.000	o	450	17	2.740	0.740	1.550	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
19.000	13.891	86.8	15	4.200	2.540	1.435	Open Manhole	1200
20.000	14.923	93.3	15	4.200	2.540	1.435	Open Manhole	1200
19.001	50.103	106.6	16	4.000	2.070	1.630	Open Manhole	1500
21.000	15.350	24.4	16	4.000	2.070	1.705	Open Manhole	1500
22.000	16.588	26.3	16	4.000	2.070	1.705	Open Manhole	1500
19.002	42.138	102.8	17	3.750	1.660	1.640	Open Manhole	1500
19.003	34.036	113.5	18	3.500	1.360	1.690	Open Manhole	1500
19.004	20.611	57.3	19	3.000	1.000	1.550	Open Manhole	1500
19.005	27.366	51.6	14	2.800	0.470	1.880	Open Manhole	1500
15.003	46.568	423.3	12	2.900	0.360	2.090	Open Manhole	4200 x 1500
1.014	88.591	533.7	16	3.280	0.170	2.660	Open Manhole	4200 x 1500
1.015	99.293	594.6	13	2.730	0.003	2.277	Open Manhole	4200 x 1500
23.000	102.776	218.7	8	2.900	0.270	2.180	Open Manhole	1500

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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)
23.001	o	450	8	2.900	0.270	2.180	Open Manhole	1500
23.002	o	450	9	2.460	0.160	1.850	Open Manhole	1500
23.003	o	450	12	2.720	0.066	2.204	Open Manhole	1500
24.000	o	225	34	4.810	3.900	0.685	Open Manhole	1200
24.001	o	225	35	4.740	3.490	1.025	Open Manhole	1200
24.002	o	225	36	4.070	2.810	1.035	Open Manhole	1200
24.003	o	225	37	3.780	2.500	1.055	Open Manhole	1200
24.004	o	300	38	3.710	2.260	1.150	Open Manhole	1200
24.005	o	300	39	3.720	1.765	1.655	Open Manhole	1200
24.006	o	300	40	3.680	1.530	1.850	Open Manhole	1200
24.007	o	300	41	3.580	1.350	1.930	Open Manhole	1200
24.008	o	300	42	3.450	1.230	1.920	Open Manhole	1200
24.009	o	300	43	3.260	1.090	1.870	Open Manhole	1200
24.010	o	300	44	3.040	0.870	1.870	Open Manhole	1200
24.011	o	300	45	2.830	0.670	1.860	Open Manhole	1200
1.016	o	450	13	2.730	0.003	2.277	Open Manhole	4200 x 1500
1.017	o	450	10	2.780	-0.080	2.410	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)
23.001	98.340	894.0	9	2.460	0.160	1.850	Open Manhole	1500
23.002	31.119	331.1	12	2.720	0.066	2.204	Open Manhole	1500
23.003	3.665	85.2	13	2.730	0.023	2.257	Open Manhole	4200 x 1500
24.000	42.313	103.2	35	4.740	3.490	1.025	Open Manhole	1200
24.001	62.653	92.1	36	4.070	2.810	1.035	Open Manhole	1200
24.002	50.992	164.5	37	3.780	2.500	1.055	Open Manhole	1200
24.003	38.640	161.0	38	3.710	2.260	1.225	Open Manhole	1200
24.004	64.706	154.1	39	3.720	1.840	1.580	Open Manhole	1200
24.005	52.554	223.6	40	3.680	1.530	1.850	Open Manhole	1200
24.006	42.370	235.4	41	3.580	1.350	1.930	Open Manhole	1200
24.007	21.658	180.5	42	3.450	1.230	1.920	Open Manhole	1200
24.008	30.132	215.2	43	3.260	1.090	1.870	Open Manhole	1200
24.009	32.209	146.4	44	3.040	0.870	1.870	Open Manhole	1200
24.010	20.166	100.8	45	2.830	0.670	1.860	Open Manhole	1200
24.011	12.527	28.3	13	2.730	0.228	2.202	Open Manhole	4200 x 1500
1.016	47.399	571.1	10	2.780	-0.080	2.410	Open Manhole	1500
1.017	75.830	379.2		0.220	-0.280	0.050	Open Manhole	0

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Appendix B

Surface Water Simulation Results

B1 2 Year Surface Water Simulation Results

Proposed Simulation Results - 2 Year Storm Event

2 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	10.000
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	4
Number of Online Controls	3	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	0.220
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 240, 360, 480, 720, 960, 1440
Return Period(s) (years)	2, 30
Climate Change (%)	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)
1.000	1	15 Winter	2	+10%					9.428
1.001	2	15 Winter	2	+10%					9.262
1.002	3	15 Winter	2	+10%					8.555
2.000	4	15 Winter	2	+10%					5.661
1.003	5	15 Winter	2	+10%	30/15 Summer				5.288
1.004	6	15 Winter	2	+10%	30/15 Summer				3.889
1.005	7	15 Winter	2	+10%	30/15 Summer				3.644
1.006	8	15 Winter	2	+10%					3.383
1.007	9	15 Winter	2	+10%					2.815
3.000	10	15 Winter	2	+10%					2.147
1.008	11	15 Winter	2	+10%	30/15 Summer				2.053
4.000	12	15 Winter	2	+10%					3.034
4.001	13	15 Winter	2	+10%					2.654
5.000	14	15 Winter	2	+10%	30/15 Summer				4.364
5.001	15	15 Winter	2	+10%					4.181
6.000	16	15 Winter	2	+10%					4.334
6.001	17	15 Winter	2	+10%					4.159
1.009	18	15 Winter	2	+10%					1.919
1.010	19	15 Winter	2	+10%					1.774

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2 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
1.000	1	-0.172	0.000	0.38		27.3	OK	
1.001	2	-0.168	0.000	0.38		37.0	OK	
1.002	3	-0.205	0.000	0.22		43.9	OK	
2.000	4	-0.139	0.000	0.52		39.5	OK	
1.003	5	-0.132	0.000	0.60		87.9	OK	
1.004	6	-0.176	0.000	0.54		95.3	OK	
1.005	7	-0.151	0.000	0.66		95.6	OK	
1.006	8	-0.202	0.000	0.44		112.8	OK	
1.007	9	-0.200	0.000	0.44		122.2	OK	
3.000	10	-0.178	0.000	0.10		7.2	OK	
1.008	11	-0.157	0.000	0.75		126.4	OK	
4.000	12	-0.186	0.000	0.33		9.6	FLOOD RISK*	
4.001	13	-0.071	0.000	0.55		9.6	OK*	
5.000	14	-0.071	0.000	0.56		11.8	FLOOD RISK*	
5.001	15	-0.089	0.000	0.34		11.6	OK*	
6.000	16	-0.101	0.000	0.39		7.0	FLOOD RISK*	
6.001	17	-0.111	0.000	0.15		7.0	OK*	
1.009	18	-0.351	0.000	0.36		153.3	OK	
1.010	19	-0.316	0.000	0.45		153.8	OK	

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2 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.	Water Level (m)
1.011	20	960 Winter	2	+10%	30/240 Winter				0.196
7.000	21	15 Winter	2	+10%					3.389
8.000	22	15 Winter	2	+10%					8.585
8.001	23	15 Winter	2	+10%	30/15 Summer				8.369
8.002	24	15 Winter	2	+10%					6.605
8.003	25	15 Winter	2	+10%					4.804
8.004	26	15 Winter	2	+10%	30/15 Winter				3.926
8.005	27	15 Winter	2	+10%	30/15 Summer				3.261
7.001	28	15 Winter	2	+10%					2.818
7.002	29	15 Winter	2	+10%					2.295
9.000	30	15 Winter	2	+10%					3.052
9.001	31	15 Winter	2	+10%					2.952
9.002	32	15 Winter	2	+10%					2.058
7.003	33	15 Winter	2	+10%					2.053
7.004	34	15 Winter	2	+10%	30/15 Summer				1.947
7.005	35	960 Winter	2	+10%	30/240 Summer				0.197
10.000	36	15 Winter	2	+10%					8.636
10.001	37	15 Winter	2	+10%					6.759
10.002	38	15 Winter	2	+10%					4.821
10.003	39	15 Winter	2	+10%					3.940
10.004	40	15 Winter	2	+10%	30/15 Summer				3.289
10.005	41	15 Winter	2	+10%	30/15 Summer				2.998
10.006	42	15 Winter	2	+10%	30/15 Summer				2.870
11.000	43	15 Winter	2	+10%					9.569
11.001	44	15 Winter	2	+10%					9.114
12.000	45	15 Winter	2	+10%					9.582
11.002	46	15 Winter	2	+10%	30/15 Summer				5.747
11.003	47	15 Winter	2	+10%	30/15 Summer				5.666
11.004	48	15 Winter	2	+10%	30/15 Summer				5.527
11.005	49	15 Winter	2	+10%	30/15 Summer				5.049
11.006	50	15 Winter	2	+10%	30/15 Summer				4.394
11.007	51	15 Winter	2	+10%					4.219
10.007	52	15 Winter	2	+10%	30/15 Summer				2.665
10.008	53	15 Winter	2	+10%	30/15 Summer				2.525
13.000	54	15 Summer	2	+10%					3.542
10.009	55	15 Winter	2	+10%	30/15 Summer				2.269
10.010	56	15 Winter	2	+10%	30/15 Summer				2.190
14.000	57	15 Winter	2	+10%					3.552
14.001	58	15 Winter	2	+10%					3.342
10.011	59	15 Winter	2	+10%	30/15 Summer				2.153
10.012	60	960 Winter	2	+10%	30/60 Winter				0.201
1.012	61	960 Winter	2	+10%	2/15 Summer				0.195
1.013	62	480 Summer	2	+10%	30/960 Summer				2.053
15.000	11	1440 Winter	2	+10%	2/960 Summer				1.941
15.001	12	1440 Winter	2	+10%	2/720 Summer				1.935
15.002	13	1440 Winter	2	+10%	2/240 Winter				1.932
16.000	19	1440 Winter	2	+10%	2/30 Winter				1.723
17.000	4	30 Winter	2	+10%	2/15 Summer				4.600

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2 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
1.011	20	-0.334	0.000	0.04		23.0	OK	
7.000	21	-0.181	0.000	0.33		33.6	OK	
8.000	22	-0.140	0.000	0.30		11.9	OK	
8.001	23	-0.106	0.000	0.54		24.3	OK	
8.002	24	-0.130	0.000	0.37		25.3	OK	
8.003	25	-0.121	0.000	0.44		26.5	OK	
8.004	26	-0.119	0.000	0.45		31.7	OK	
8.005	27	-0.139	0.000	0.54		44.1	OK	
7.001	28	-0.292	0.000	0.27		72.8	OK	
7.002	29	-0.295	0.000	0.26		72.0	OK	
9.000	30	-0.246	0.000	0.13		2.7	FLOOD RISK*	
9.001	31	-0.118	0.000	0.10		2.6	FLOOD RISK*	
9.002	32	-0.167	0.000	0.05		2.5	OK*	
7.003	33	-0.247	0.000	0.42		94.8	OK	
7.004	34	-0.153	0.000	0.76		93.3	OK	
7.005	35	-0.123	0.000	0.05		14.5	OK	
10.000	36	-0.164	0.000	0.43		35.9	OK	
10.001	37	-0.191	0.000	0.29		41.9	OK	
10.002	38	-0.179	0.000	0.34		42.0	OK	
10.003	39	-0.180	0.000	0.33		48.1	OK	
10.004	40	-0.111	0.000	0.70		59.5	OK	
10.005	41	-0.102	0.000	0.77		60.0	OK	
10.006	42	-0.185	0.000	0.50		75.1	OK	
11.000	43	-0.156	0.000	0.19		7.9	OK	
11.001	44	-0.161	0.000	0.18		8.0	OK	
12.000	45	-0.143	0.000	0.29		13.7	OK	
11.002	46	-0.078	0.000	0.76		23.9	OK	
11.003	47	-0.109	0.000	0.52		23.7	OK	
11.004	48	-0.123	0.000	0.62		54.2	OK	
11.005	49	-0.121	0.000	0.66		53.7	OK	
11.006	50	-0.116	0.000	0.68		53.9	OK	
11.007	51	-0.171	0.000	0.38		59.4	OK	
10.007	52	-0.145	0.000	0.80		134.7	OK	
10.008	53	-0.205	0.000	0.57		133.5	OK	
13.000	54	-0.183	0.000	0.08		3.7	OK	
10.009	55	-0.191	0.000	0.63		137.0	OK	
10.010	56	-0.120	0.000	0.80		135.3	OK	
14.000	57	-0.173	0.000	0.12		5.4	OK	
14.001	58	-0.173	0.000	0.12		5.3	OK	
10.011	59	-0.097	0.000	0.97		139.8	OK	
10.012	60	-0.049	0.000	0.08		22.3	OK	
1.012	61	0.545	0.000	4.37		18.0	SURCHARGED	
1.013	62	-0.172	0.000	0.13		18.0	OK	
15.000	11	0.346	0.000	0.07		2.1	SURCHARGED	
15.001	12	0.565	0.000	0.08		4.7	SURCHARGED	
15.002	13	0.862	0.000	0.12		7.1	SURCHARGED	
16.000	19	0.653	0.000	0.03		0.2	SURCHARGED	

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2 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
17.000	4	1.050	0.000	0.69		11.2	SURCHARGED	

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2 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.
17.001	16	30 Winter	2	+10%	2/15 Summer			
17.002	4	30 Winter	2	+10%	2/15 Summer	30/15 Summer		
17.003	5	1440 Winter	2	+10%	2/15 Summer			
16.001	7	1440 Winter	2	+10%	2/30 Summer			
16.002	6	1440 Winter	2	+10%	2/240 Summer			
18.000	24	15 Winter	2	+10%				
18.001	26	15 Winter	2	+10%				
16.003	7	1440 Winter	2	+10%	2/480 Summer			
19.000	14	15 Winter	2	+10%	30/15 Summer			
20.000	15	15 Winter	2	+10%	30/15 Summer			
19.001	15	15 Winter	2	+10%	30/15 Summer			
21.000	17	15 Winter	2	+10%	30/15 Winter			
22.000	18	15 Winter	2	+10%	30/15 Winter			
19.002	16	15 Winter	2	+10%	30/15 Summer			
19.003	17	15 Winter	2	+10%	30/15 Summer			
19.004	18	1440 Winter	2	+10%	30/240 Winter			
19.005	19	1440 Winter	2	+10%	2/360 Winter			
15.003	14	1440 Winter	2	+10%	2/240 Summer			
1.014	12	1440 Winter	2	+10%	2/60 Summer			
1.015	16	1440 Winter	2	+10%	2/60 Summer			
23.000	17	1440 Winter	2	+10%	2/480 Summer			
23.001	8	1440 Winter	2	+10%	2/60 Summer			
23.002	9	1440 Winter	2	+10%	2/60 Summer	30/960 Winter		
23.003	12	1440 Winter	2	+10%	2/30 Summer			
24.000	34	15 Winter	2	+10%				
24.001	35	15 Winter	2	+10%				
24.002	36	15 Winter	2	+10%	30/15 Summer			
24.003	37	15 Winter	2	+10%	30/15 Summer			
24.004	38	15 Winter	2	+10%	30/1440 Summer			
24.005	39	1440 Winter	2	+10%	30/960 Summer			
24.006	40	1440 Winter	2	+10%	2/1440 Summer			
24.007	41	1440 Winter	2	+10%	2/960 Winter			
24.008	42	1440 Winter	2	+10%	2/960 Summer			
24.009	43	1440 Winter	2	+10%	2/720 Summer			
24.010	44	1440 Winter	2	+10%	2/480 Summer			
24.011	45	1440 Winter	2	+10%	2/240 Winter			
1.016	13	1440 Winter	2	+10%	2/15 Winter			
1.017	10	1440 Winter	2	+10%	2/15 Summer			

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
17.001	16	4.568	1.118	0.000	0.93		21.9	SURCHARGED	
17.002	4	4.386	1.156	0.000	1.80		33.0	SURCHARGED	6
17.003	5	1.728	1.578	0.000	1.17		6.1	SURCHARGED	
16.001	7	1.723	0.673	0.000	0.12		2.5	SURCHARGED	

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2 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 (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
16.002	6	1.907	0.977	0.000	0.40		2.7	SURCHARGED	
18.000	24	9.321	-0.159	0.000	0.41		65.1	FLOOD RISK	
18.001	26	5.995	-0.185	0.000	0.34		66.0	FLOOD RISK	
16.003	7	1.930	0.740	0.000	0.02		8.2	SURCHARGED	
19.000	14	2.846	-0.079	0.000	0.68		33.0	OK	
20.000	15	2.850	-0.075	0.000	0.70		33.0	OK	
19.001	15	2.769	-0.071	0.000	0.92		93.7	OK	
21.000	17	2.794	-0.131	0.000	0.36		33.5	OK	
22.000	18	2.795	-0.130	0.000	0.37		33.5	OK	
19.002	16	2.337	-0.183	0.000	0.65		185.8	OK	
19.003	17	1.968	-0.142	0.000	0.80		211.8	OK	
19.004	18	1.762	-0.048	0.000	0.07		24.1	OK	
19.005	19	1.757	0.307	0.000	0.02		8.0	SURCHARGED	
15.003	14	1.930	1.010	0.000	0.16		23.1	SURCHARGED	
1.014	12	1.932	1.146	0.000	0.34		44.1	SURCHARGED	
1.015	16	1.920	1.300	0.000	0.88		109.4	SURCHARGED	
23.000	17	1.909	0.719	0.000	0.01		1.2	SURCHARGED	
23.001	8	1.909	1.189	0.000	0.27		27.6	SURCHARGED	
23.002	9	1.909	1.299	0.000	0.26		39.9	SURCHARGED	3
23.003	12	1.909	1.393	0.000	0.27		45.0	SURCHARGED	
24.000	34	3.971	-0.154	0.000	0.21		10.3	OK	
24.001	35	3.583	-0.132	0.000	0.35		18.1	OK	
24.002	36	2.937	-0.098	0.000	0.59		22.9	OK	
24.003	37	2.637	-0.088	0.000	0.67		26.1	OK	
24.004	38	2.385	-0.175	0.000	0.36		30.3	OK	
24.005	39	1.921	-0.144	0.000	0.07		4.6	OK	
24.006	40	1.915	0.085	0.000	0.11		7.5	SURCHARGED	
24.007	41	1.909	0.259	0.000	0.12		8.5	SURCHARGED	
24.008	42	1.905	0.375	0.000	0.13		9.0	SURCHARGED	
24.009	43	1.901	0.511	0.000	0.11		9.6	SURCHARGED	
24.010	44	1.902	0.732	0.000	0.10		9.9	SURCHARGED	
24.011	45	1.906	0.936	0.000	0.15		25.6	SURCHARGED	
1.016	13	1.910	1.457	0.000	1.08		130.6	SURCHARGED	
1.017	10	1.910	1.540	0.000	0.86		132.6	SURCHARGED	

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B2 30 Year Surface Water Simulation Results

Proposed Simulation Results - 30 Year Storm Event

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	10.000
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	4
Number of Online Controls	3	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	0.220
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 240, 360, 480, 720, 960, 1440
Return Period(s) (years)	2, 30
Climate Change (%)	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)
1.000	1	15 Winter	30	+10%					9.485
1.001	2	15 Winter	30	+10%					9.332
1.002	3	15 Winter	30	+10%					8.598
2.000	4	15 Winter	30	+10%					5.786
1.003	5	15 Winter	30	+10%	30/15 Summer				5.495
1.004	6	15 Winter	30	+10%	30/15 Summer				4.110
1.005	7	15 Winter	30	+10%	30/15 Summer				3.853
1.006	8	15 Winter	30	+10%					3.459
1.007	9	15 Winter	30	+10%					2.893
3.000	10	15 Winter	30	+10%					2.289
1.008	11	15 Winter	30	+10%	30/15 Summer				2.267
4.000	12	15 Winter	30	+10%					3.115
4.001	13	15 Winter	30	+10%					2.698
5.000	14	15 Winter	30	+10%	30/15 Summer				4.446
5.001	15	15 Winter	30	+10%					4.207
6.000	16	15 Winter	30	+10%					4.397
6.001	17	15 Winter	30	+10%					4.174
1.009	18	15 Winter	30	+10%					2.024
1.010	19	15 Winter	30	+10%					1.908

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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
1.000	1	-0.115	0.000	0.69		50.2	OK	
1.001	2	-0.098	0.000	0.75		72.8	OK	
1.002	3	-0.162	0.000	0.43		87.4	OK	
2.000	4	-0.014	0.000	0.94		70.9	OK	
1.003	5	0.075	0.000	1.07		157.6	SURCHARGED	
1.004	6	0.045	0.000	0.97		169.4	SURCHARGED	
1.005	7	0.058	0.000	1.16		168.7	SURCHARGED	
1.006	8	-0.126	0.000	0.76		195.7	OK	
1.007	9	-0.122	0.000	0.77		213.4	OK	
3.000	10	-0.036	0.000	0.17		11.9	OK	
1.008	11	0.057	0.000	1.34		226.0	SURCHARGED	
4.000	12	-0.105	0.000	0.60		17.7	FLOOD RISK*	
4.001	13	-0.027	0.000	1.00		17.5	OK*	
5.000	14	0.011	0.000	1.05		21.9	FLOOD RISK*	
5.001	15	-0.063	0.000	0.64		21.9	OK*	
6.000	16	-0.038	0.000	0.72		13.0	FLOOD RISK*	
6.001	17	-0.096	0.000	0.27		12.8	OK*	
1.009	18	-0.246	0.000	0.65		277.3	OK	
1.010	19	-0.182	0.000	0.82		278.9	OK	

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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.	Water Level (m)
1.011	20	1440 Winter	30	+10%	30/240 Winter				0.879
7.000	21	15 Winter	30	+10%					3.439
8.000	22	15 Winter	30	+10%					8.620
8.001	23	15 Winter	30	+10%	30/15 Summer				8.494
8.002	24	15 Winter	30	+10%					6.653
8.003	25	15 Winter	30	+10%					4.862
8.004	26	15 Winter	30	+10%	30/15 Winter				4.067
8.005	27	15 Winter	30	+10%	30/15 Summer				3.493
7.001	28	15 Winter	30	+10%					2.893
7.002	29	15 Winter	30	+10%					2.368
9.000	30	15 Winter	30	+10%					3.087
9.001	31	15 Winter	30	+10%					2.963
9.002	32	15 Winter	30	+10%					2.225
7.003	33	15 Winter	30	+10%					2.272
7.004	34	15 Winter	30	+10%	30/15 Summer				2.155
7.005	35	1440 Winter	30	+10%	30/240 Summer				0.879
10.000	36	15 Winter	30	+10%					8.701
10.001	37	15 Winter	30	+10%					6.808
10.002	38	15 Winter	30	+10%					4.877
10.003	39	15 Winter	30	+10%					4.025
10.004	40	15 Winter	30	+10%	30/15 Summer				3.762
10.005	41	15 Winter	30	+10%	30/15 Summer				3.375
10.006	42	15 Winter	30	+10%	30/15 Summer				3.217
11.000	43	15 Winter	30	+10%					9.596
11.001	44	15 Winter	30	+10%					9.139
12.000	45	15 Winter	30	+10%					9.616
11.002	46	15 Winter	30	+10%	30/15 Summer				6.164
11.003	47	15 Winter	30	+10%	30/15 Summer				6.073
11.004	48	15 Winter	30	+10%	30/15 Summer				5.898
11.005	49	15 Winter	30	+10%	30/15 Summer				5.236
11.006	50	15 Winter	30	+10%	30/15 Summer				4.562
11.007	51	15 Winter	30	+10%					4.272
10.007	52	15 Winter	30	+10%	30/15 Summer				3.045
10.008	53	15 Winter	30	+10%	30/15 Summer				2.896
13.000	54	15 Winter	30	+10%					3.557
10.009	55	15 Winter	30	+10%	30/15 Summer				2.666
10.010	56	15 Winter	30	+10%	30/15 Summer				2.514
14.000	57	15 Winter	30	+10%					3.572
14.001	58	15 Winter	30	+10%					3.362
10.011	59	15 Winter	30	+10%	30/15 Summer				2.360
10.012	60	1440 Winter	30	+10%	30/60 Winter				0.880
1.012	61	1440 Winter	30	+10%	2/15 Summer				0.877
1.013	62	1440 Summer	30	+10%	30/960 Summer				2.621
15.000	11	1440 Summer	30	+10%	2/960 Summer				2.629
15.001	12	1440 Summer	30	+10%	2/720 Summer				2.616
15.002	13	1440 Summer	30	+10%	2/240 Winter				2.604
16.000	19	1440 Winter	30	+10%	2/30 Winter				2.228
17.000	4	15 Winter	30	+10%	2/15 Summer				6.466

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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
1.011	20	0.349	0.000	0.05		28.2	SURCHARGED	
7.000	21	-0.131	0.000	0.61		61.6	OK	
8.000	22	-0.105	0.000	0.54		21.9	OK	
8.001	23	0.019	0.000	1.09		48.7	SURCHARGED	
8.002	24	-0.082	0.000	0.73		50.2	OK	
8.003	25	-0.063	0.000	0.86		52.4	OK	
8.004	26	0.022	0.000	0.88		62.4	SURCHARGED	
8.005	27	0.093	0.000	1.08		88.6	SURCHARGED	
7.001	28	-0.217	0.000	0.53		143.3	OK	
7.002	29	-0.222	0.000	0.51		141.8	OK	
9.000	30	-0.211	0.000	0.24		5.0	FLOOD RISK*	
9.001	31	-0.107	0.000	0.18		4.9	FLOOD RISK*	
9.002	32	0.000	0.000	0.09		4.7	SURCHARGED*	
7.003	33	-0.028	0.000	0.77		175.8	OK	
7.004	34	0.055	0.000	1.42		174.6	SURCHARGED	
7.005	35	0.559	0.000	0.06		17.9	SURCHARGED	
10.000	36	-0.099	0.000	0.78		65.9	OK	
10.001	37	-0.142	0.000	0.54		79.8	OK	
10.002	38	-0.123	0.000	0.64		78.9	OK	
10.003	39	-0.095	0.000	0.64		91.8	OK	
10.004	40	0.362	0.000	1.24		106.2	SURCHARGED	
10.005	41	0.275	0.000	1.29		100.4	SURCHARGED	
10.006	42	0.162	0.000	0.82		123.4	SURCHARGED	
11.000	43	-0.129	0.000	0.35		14.5	OK	
11.001	44	-0.136	0.000	0.33		14.6	OK	
12.000	45	-0.109	0.000	0.53		25.1	OK	
11.002	46	0.339	0.000	1.36		42.8	SURCHARGED	
11.003	47	0.298	0.000	0.95		43.2	SURCHARGED	
11.004	48	0.248	0.000	1.16		100.8	SURCHARGED	
11.005	49	0.066	0.000	1.20		98.1	SURCHARGED	
11.006	50	0.052	0.000	1.24		97.9	SURCHARGED	
11.007	51	-0.118	0.000	0.67		104.4	OK	
10.007	52	0.235	0.000	1.30		219.2	SURCHARGED	
10.008	53	0.166	0.000	0.92		217.1	SURCHARGED	
13.000	54	-0.168	0.000	0.15		6.8	OK	
10.009	55	0.206	0.000	1.01		220.6	SURCHARGED	
10.010	56	0.204	0.000	1.30		219.5	SURCHARGED	
14.000	57	-0.153	0.000	0.22		9.8	OK	
14.001	58	-0.153	0.000	0.22		9.8	OK	
10.011	59	0.110	0.000	1.55		224.8	SURCHARGED	
10.012	60	0.630	0.000	0.10		27.6	SURCHARGED	
1.012	61	1.227	0.000	4.37		18.0	SURCHARGED	
1.013	62	0.396	0.000	0.13		18.5	SURCHARGED	
15.000	11	1.034	0.000	0.13		3.7	FLOOD RISK	
15.001	12	1.246	0.000	0.12		7.2	FLOOD RISK	
15.002	13	1.534	0.000	0.15		9.4	FLOOD RISK	
16.000	19	1.158	0.000	0.05		0.3	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
17.000	4	2.916	0.000	1.67		27.2	SURCHARGED	

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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.
17.001	16	15 Winter	30	+10%	2/15 Summer			
17.002	4	30 Winter	30	+10%	2/15 Summer	30/15 Summer		
17.003	5	1440 Winter	30	+10%	2/15 Summer			
16.001	7	1440 Winter	30	+10%	2/30 Summer			
16.002	6	1440 Summer	30	+10%	2/240 Summer			
18.000	24	15 Winter	30	+10%				
18.001	26	15 Winter	30	+10%				
16.003	7	1440 Summer	30	+10%	2/480 Summer			
19.000	14	15 Winter	30	+10%	30/15 Summer			
20.000	15	15 Winter	30	+10%	30/15 Summer			
19.001	15	15 Winter	30	+10%	30/15 Summer			
21.000	17	15 Winter	30	+10%	30/15 Winter			
22.000	18	15 Winter	30	+10%	30/15 Winter			
19.002	16	15 Winter	30	+10%	30/15 Summer			
19.003	17	15 Winter	30	+10%	30/15 Summer			
19.004	18	1440 Winter	30	+10%	30/240 Winter			
19.005	19	1440 Winter	30	+10%	2/360 Winter			
15.003	14	1440 Summer	30	+10%	2/240 Summer			
1.014	12	1440 Summer	30	+10%	2/60 Summer			
1.015	16	1440 Summer	30	+10%	2/60 Summer			
23.000	17	1440 Summer	30	+10%	2/480 Summer			
23.001	8	1440 Summer	30	+10%	2/60 Summer			
23.002	9	1440 Summer	30	+10%	2/60 Summer	30/960 Winter		
23.003	12	1440 Winter	30	+10%	2/30 Summer			
24.000	34	15 Winter	30	+10%				
24.001	35	15 Winter	30	+10%				
24.002	36	15 Winter	30	+10%	30/15 Summer			
24.003	37	15 Winter	30	+10%	30/15 Summer			
24.004	38	1440 Summer	30	+10%	30/1440 Summer			
24.005	39	1440 Summer	30	+10%	30/960 Summer			
24.006	40	1440 Summer	30	+10%	2/1440 Summer			
24.007	41	1440 Summer	30	+10%	2/960 Winter			
24.008	42	1440 Summer	30	+10%	2/960 Summer			
24.009	43	1440 Summer	30	+10%	2/720 Summer			
24.010	44	1440 Summer	30	+10%	2/480 Summer			
24.011	45	1440 Summer	30	+10%	2/240 Winter			
1.016	13	1440 Winter	30	+10%	2/15 Winter			
1.017	10	1440 Summer	30	+10%	2/15 Summer			

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
17.001	16	6.216	2.766	0.000	2.31		54.3	SURCHARGED	
17.002	4	5.015	1.785	14.715	2.11		38.7	FLOOD	6
17.003	5	2.234	2.084	0.000	1.83		9.6	SURCHARGED	
16.001	7	2.228	1.178	0.000	0.16		3.2	SURCHARGED	

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
16.002	6	2.562	1.632	0.000	0.47		3.2	SURCHARGED	
18.000	24	9.421	-0.059	0.000	0.75		120.2	FLOOD RISK	
18.001	26	6.077	-0.103	0.000	0.62		121.4	FLOOD RISK	
16.003	7	2.591	1.401	0.000	0.03		13.7	FLOOD RISK	
19.000	14	3.779	0.854	0.000	1.01		49.0	SURCHARGED	
20.000	15	3.787	0.862	0.000	1.03		48.9	SURCHARGED	
19.001	15	3.625	0.785	0.000	1.38		139.4	SURCHARGED	
21.000	17	2.936	0.011	0.000	0.63		58.4	SURCHARGED	
22.000	18	2.949	0.024	0.000	0.64		57.8	SURCHARGED	
19.002	16	2.722	0.202	0.000	1.02		292.0	SURCHARGED	
19.003	17	2.287	0.177	0.000	1.28		338.2	SURCHARGED	
19.004	18	2.229	0.419	0.000	0.11		37.0	SURCHARGED	
19.005	19	2.226	0.776	0.000	0.02		9.0	SURCHARGED	
15.003	14	2.589	1.669	0.000	0.18		26.1	FLOOD RISK	
1.014	12	2.583	1.797	0.000	0.37		48.1	SURCHARGED	
1.015	16	2.553	1.933	0.000	0.88		110.1	SURCHARGED	
23.000	17	2.489	1.299	0.000	0.01		2.0	FLOOD RISK	
23.001	8	2.489	1.769	0.000	0.29		29.2	SURCHARGED	
23.002	9	2.490	1.880	29.546	0.22		32.9	FLOOD	3
23.003	12	2.516	2.000	0.000	0.22		37.4	FLOOD RISK	
24.000	34	3.999	-0.126	0.000	0.39		18.9	OK	
24.001	35	3.634	-0.081	0.000	0.70		36.5	OK	
24.002	36	3.166	0.131	0.000	1.07		41.7	SURCHARGED	
24.003	37	2.810	0.085	0.000	1.17		45.4	SURCHARGED	
24.004	38	2.611	0.051	0.000	0.10		8.7	SURCHARGED	
24.005	39	2.600	0.535	0.000	0.15		10.5	SURCHARGED	
24.006	40	2.588	0.758	0.000	0.17		11.5	SURCHARGED	
24.007	41	2.575	0.925	0.000	0.17		12.1	SURCHARGED	
24.008	42	2.565	1.035	0.000	0.19		12.9	SURCHARGED	
24.009	43	2.554	1.164	0.000	0.16		13.7	SURCHARGED	
24.010	44	2.542	1.372	0.000	0.15		14.3	SURCHARGED	
24.011	45	2.534	1.564	0.000	0.15		25.6	FLOOD RISK	
1.016	13	2.530	2.077	0.000	1.14		138.1	FLOOD RISK	
1.017	10	2.533	2.163	0.000	0.86		133.4	FLOOD RISK	

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Appendix C

Hydrocarbon Interceptor

Kingspan Klargester

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

ADVANCED ROTOMOULDED CONSTRUCTION ON SELECTED MODELS!

Let us help!
Free professional site visit with friendly support and advice.
helpingyou@klargester.com
to make the right decision
or call 028 302 66799

Kingspan Environmental

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Get in touch for a **FREE** professional site visit and a representative will contact you within 5 working days to arrange a visit.
helpingyou@klargester.com to make the right decision or call **028 302 66799**

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention or bypass separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

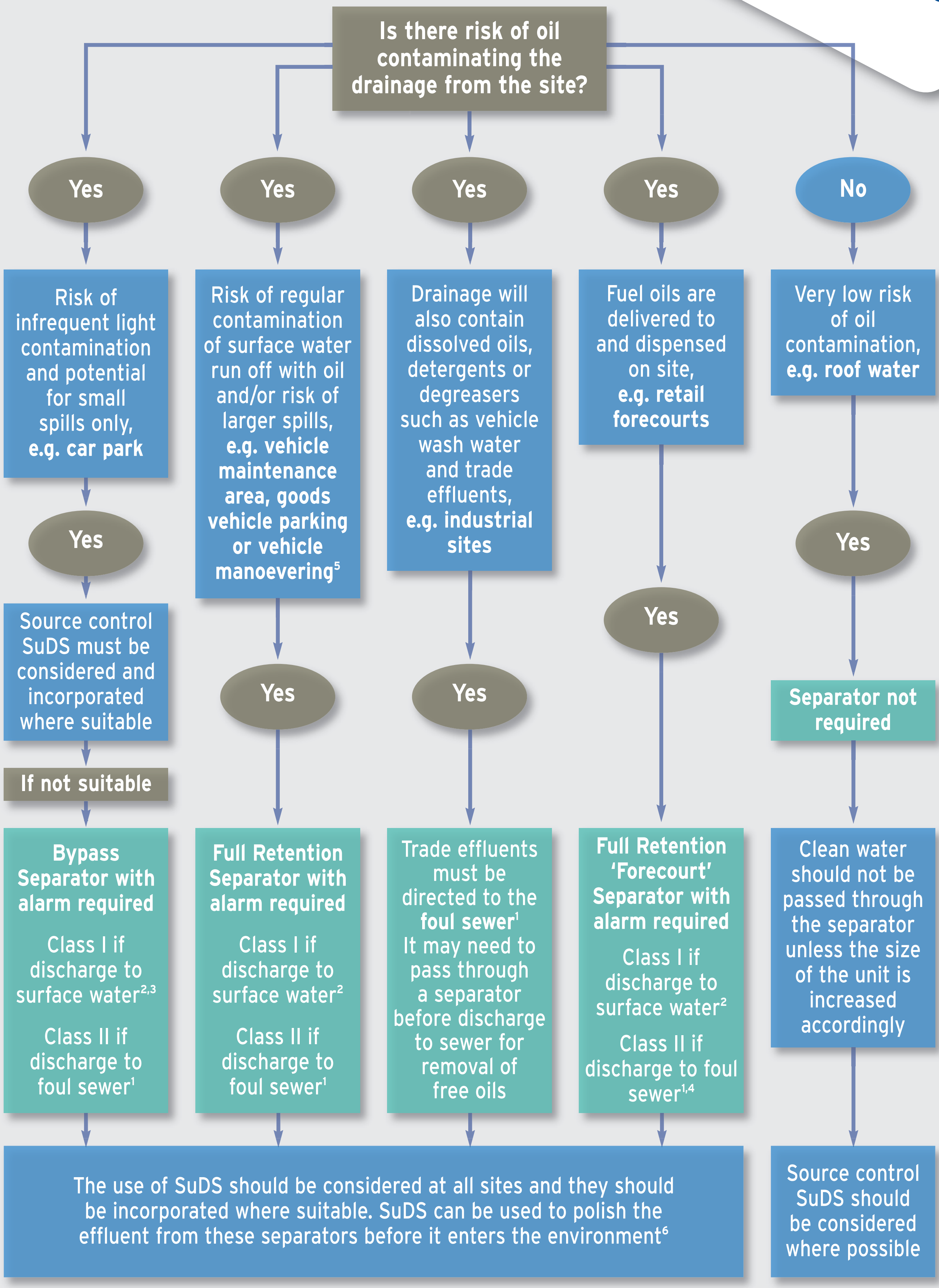
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 *You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.*
2 *You must seek prior permission from the relevant environmental body before you decide which separator to install.*
3 *In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.*
4 *In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.*
5 *Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.*
6 *In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.*

Full Retention NSF RANGE

Kingspan Klargester

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

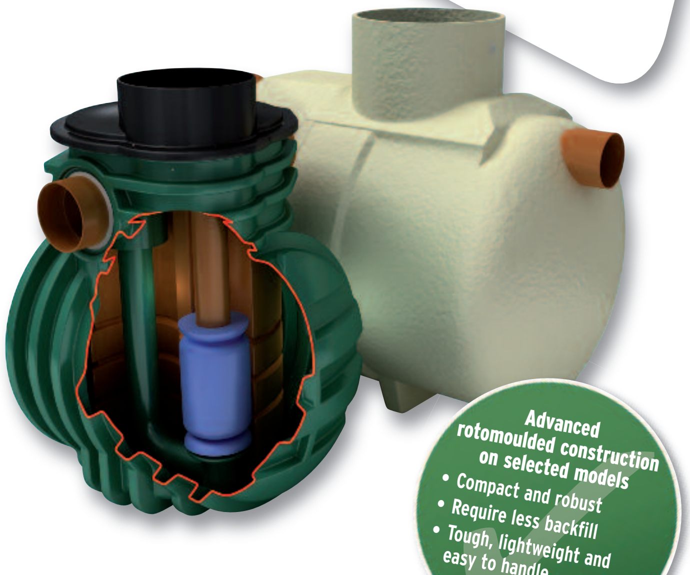
Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Automatic closure device.
- Oil storage volume.
- Coalescer (Class I units only).

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.



- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size full retention separator, the following information is needed:-

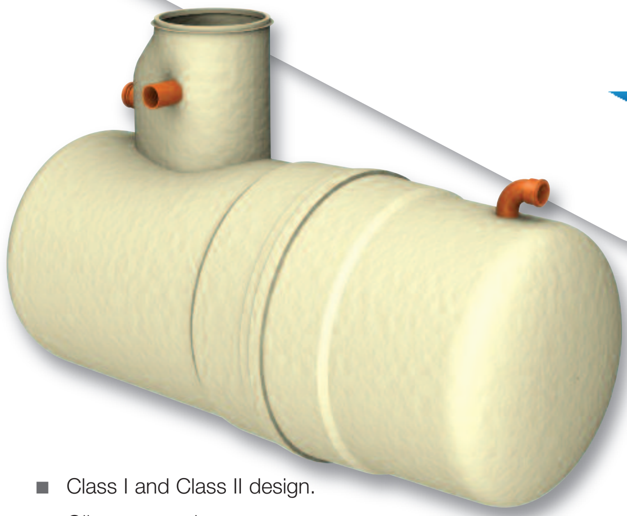
- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m^2) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

Rotomoulded chamber construction *GRP chamber construction*

Forecourt



APPLICATION

The forecourt separator is designed for installation in petrol filling station forecourts and similar applications. The function of the separator is to intercept hydrocarbon pollutants such as petroleum and oil and prevent their entry to the drainage system, thus protecting the environment against hydrocarbon contaminated surface water run-off and gross spillage.

PERFORMANCE

Operation ensures that the flow cannot exit the unit without first passing through the coalescer assembly.

In normal operation, the forecourt separator has sufficient capacity to provide storage for separated pollutants within the main chamber, but is also able to contain up to 7,600 litres of pollutant arising from the spillage of a fuel delivery tanker compartment on the petrol forecourt. The separator has been designed to ensure that oil cannot exit the separator in the event of a major spillage, subsequently the separator should be emptied immediately.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- Class I and Class II design.
- Oil storage volume.
- Coalescer (Class I unit only).
- Automatic closure device.
- Oil alarm system available.

INSTALLATION

The unit should be installed on a suitable concrete base slab and surrounded with a concrete backfill. Structural grade units can also be supplied suitable for installation within a granular backfill (i.e. pea gravel). Please specify unit required when ordering.

If the separator is to be installed within a trafficked area, then a suitable cover slab must be designed to ensure that loads are not transmitted to the unit.

The separator should be installed and vented in accordance with Health and Safety Guidance Note HS(G)41 for filling stations, subject to Local Authority requirements.

SIZES AND SPECIFICATIONS

ENVIROCEPTOR CLASS	BACKFILL TYPE	TOTAL CAP. (litres)	DRAINAGE AREA (m^2)	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STD. FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STD. PIPEWORK (mm)	EMPTY WEIGHT (kg)
I	CONCRETE	10000	720	15	3915	2020	600	2180	2130	50	600	160	620
II	CONCRETE	10000	720	15	3915	2020	600	2180	2130	50	600	160	620

Alarm Systems

British European Standard EN 858-1 and Environment Agency Pollution Prevention Guideline PPG3 requires that all separators are to be fitted with an oil level alarm system and that it should be installed and calibrated by a suitably qualified technician so that it will respond to an alarm condition when the separator requires emptying.

- Easily fitted to existing tanks.
- Excellent operational range.
- Visual and audible alarm.
- Additional telemetry option.

PROFESSIONAL INSTALLERS

Klargester Accredited Installers

Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.

Services include :

- Site survey to establish ground conditions and soil types
- Advice on system design and product selection
- Assistance on gaining environmental consents and building approvals
- Tank and drainage system installation
- Connection to discharge point and electrical networks
- Waste emptying and disposal

Discover more about the Accredited Installers and locate your local expert online.

www.klargester.com/installers

Kingspan Klargester Accredited Installer

CARE & MAINTENANCE

Kingspan Environmental Services

Who better to look after your treatment plant than the people who designed and built it?

Kingspan Environmental have a dedicated service division providing maintenance for wastewater products.

Factory trained engineers are available for site visits as part of a planned maintenance contract or on a one-off call out basis.

To find out more about protecting your investment and ensuring peace of mind, call us on:

0844 846 0500

or visit us online:

www.kingspanenvservice.com

Kingspan Environmental Services

Kingspan Klargester

COMMERCIAL WASTEWATER SOLUTIONS

- **BIODISC®, BIOTEC™ & ENVIROSAFE** HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- **HILLMASTER** PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- STORMWATER ATTENUATION SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

Kingspan Water

NEW BUILD & RETROFIT SOLUTIONS

- BELOW GROUND RAINWATER HARVESTING SYSTEMS
- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

Klargester

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Visit our website **www.klargester.com**, or our company website **www.kingspanenv.com**

Part of Kingspan Environmental

BSI UKAS Quality Management 003 — *Certificate No. FM 563603*

BSI UKAS Management Systems Health and Safety 003 — *Certificate No. OHS 563604*

RIBA CPD Providers Network

BRITISH WATER

UK GREEN BUILDING COUNCIL Founding Member

FSC www.fsc.org MIX Paper from responsible sources FSC® C015655

In keeping with Company policy of continuing research and development and in order to offer our clients the most advanced products, Kingspan Environmental reserves the right to alter specifications and drawings without prior notice.

Issue No. 18: April 2013

Appendix D

Waste Water Treatment Facility

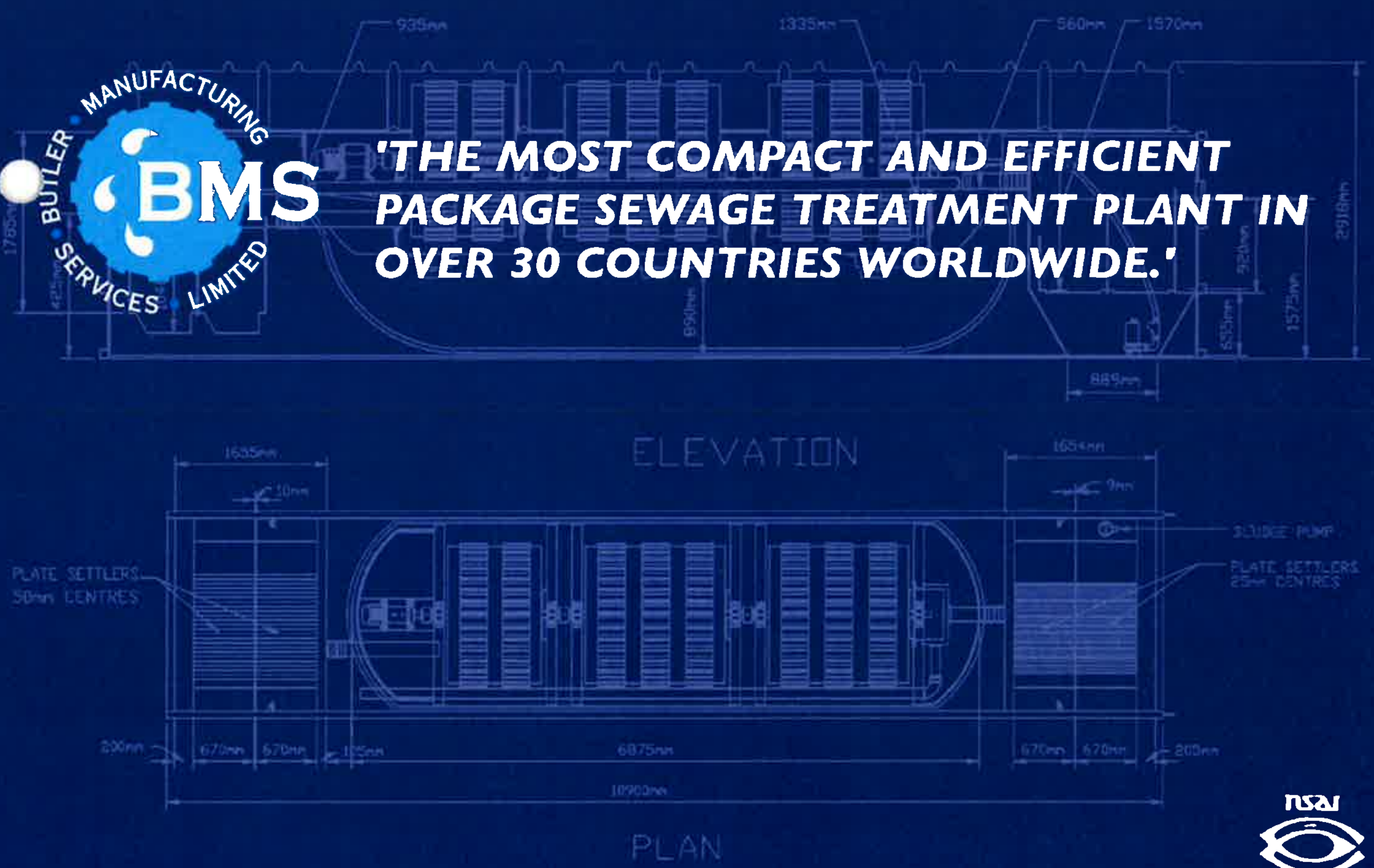
PACKAGE SEWAGE TREATMENT PLANT

www.butlerms.com

THE BMS BLIVET

BUTLER MANUFACTURING SERVICES LIMITED — BMS

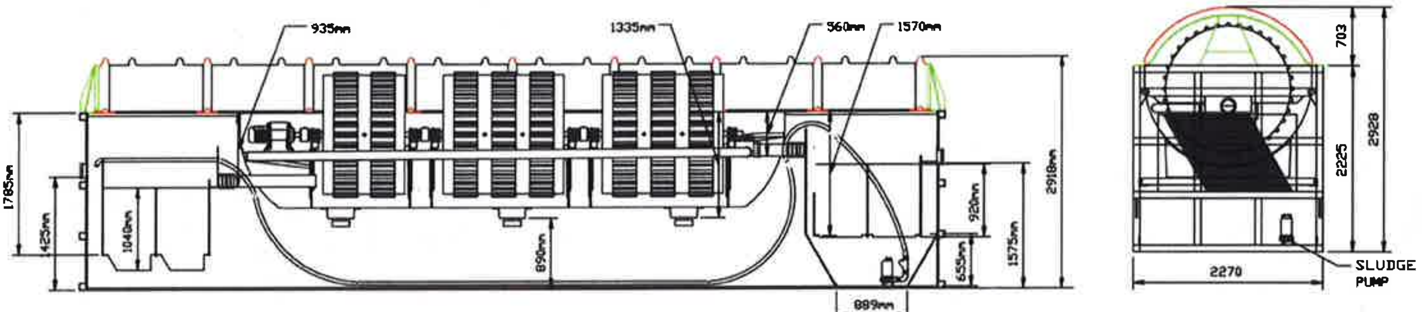
'THE MOST COMPACT AND EFFICIENT PACKAGE SEWAGE TREATMENT PLANT IN OVER 30 COUNTRIES WORLDWIDE.'



nsai
I.S EN ISO 9001:2000

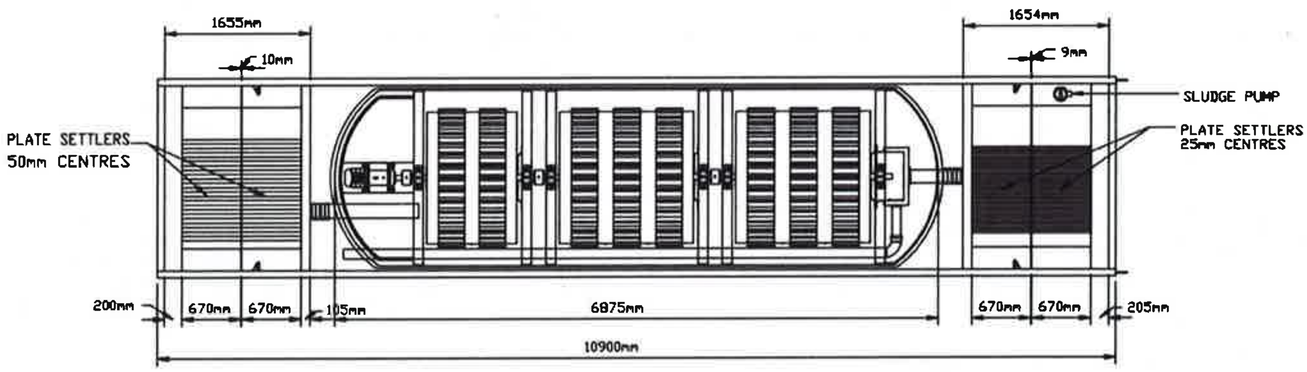
THE BMS BLIVET - PACKAGE SEWAGE TREATMENT PLANT

Since 1985 BMS has been the leading Irish manufacturer of Package Sewage Treatment Plant. BMS is the OEM of the Blivet, with over 500 units working in over 30 countries and Licensed Production in Asia, India and North America. The BMS Blivet has proven itself in varied climatic conditions and serving Population Equivalents (P.E.s) from 20 to 8,000.



ELEVATION

END VIEW



PLAN

APPLICATIONS

- Villages
- Holiday Resorts
- Hotels
- Golf Clubs
- Condominiums
- Military Installations
- Housing Schemes
- Campsites
- Caravan Parks
- Mobile Applications
- Temporary or Emergency Use
- Existing Plant Upgrades
- Factories
- Marinas
- Mine Camps
- Schools
- Visitor Centres
- Pubs & Restaurants

DISCHARGES

- To Percolation/Ground Soakage
- Direct Discharge to Receiving Waters
- UV Disinfection
- Irrigation/Reuse

WASTE WATE

THE BMS BLIVET

BACKGROUND

Since its inception, BMS has been a Research & Development led organisation. In 1986 it launched the BMS Aerotor as a unique, patented, combined active aeration & fixed film bio-reactor. From this successful product, the need to eliminate in-situ tank construction was identified. Further R & D led to the first BMS Blivet in 1989 - The first 'All in One' package sewage treatment concept.

CUSTOMER BASE

BMS supplies directly to developers, local authorities, leading multi national companies and civil engineering contractors. In recent years BMS has become involved in a number of successful Design, Build and Installation/Operation schemes in temporary and permanent installations.

THE TECHNOLOGY

The BMS Blivet consists of the following main features:

- Primary Settlement - Lamella Plate Settler
- Aerobic Treatment - BMS Aerotor
- Final Settlement - Lamella Plate Settler
- Sludge Storage - Minimum 3 months
- Minimum Maintenance - Typically 1 man hr/month
- Low Power Usage - Largest unit consumes only 4,950Kwhr/year
- Above or below ground - All purpose GRP Steel Reinforced Tank
- Security - Lock down covers provide protection & safety
- Net Hydraulic Lift - Outlet is 150mm higher than inlet
- Modularity - Units can be expanded in parallel
- Flexibility - Units can be operated in series for nitrification/denitrification

R TREATMENT

MODEL	LENGTH	WEIGHT*	LITRES/DAY	HEIGHT & WIDTH
BL300	2.75m	1.5t	4,000 - 5,000	2.86m x 2.75m
BL500	4.9m	3t	10,000 - 12,500	}
BL1000	5.37m	3.35t	20,000 - 25,000	} All Models
BL1500	6.4m	4.0t	30,000 - 37,500	} 2.928m high
BL2000	7.5m	4.7t	40,000 - 50,000	} 2.27m wide
BL3000	9.285m	5.8t	50,000 - 62,500	}
BL3500	10.075m	6.3t	65,000 - 81,250	}
BL4000	10.9m	7.0t	80,000 – 100,000	}

* Transport weight without operating load

All BMS Products are Manufactured under ISO 9001:2000 NSAI

NSAI
I.S EN ISO 9001:2000

BUTLER • MANUFACTURING SERVICES • LIMITED
BMS

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