PINNACLE
CONSULTING ENGINEERS

DB13, Profile Park, Grange Castle, Lucan, Co. Dublin

Engineering Planning Report

September 2022

P210501

Vantage Data Centers DUB11 Ltd

VANTAGE™
DATA CENTERS

Document No.: DUB13-RP-00-C001-V0-WS3-PIN

STRUCTURAL · CIVIL · DUE DILIGENCE · ENGINEERING MASTERPLANNING
FLOOD MANAGEMENT · INFRASTRUCTURE DESIGN
PRE-DEVELOPMENT ENGINEERING · BIM · TRANSPORTATION

CONTACT DETAILS

Name	Position	Email	Telephone	Mobile
S. O'Reilly	Associate	shaun.oreilly@iepinnacle.com	01-231 1044	087 6698575

APPROVALS

	Name	Signature	Position	Date
Prepared by	S. O'Reilly		Associate	01/11/2022
Reviewed by	J. Mayer		Director	01/11/2022
Approved by	J. Mayer		Director	01/11/2022

REVISIONS

Revision By	Date	Context

VERSIONS

Number	By	Date	Context
0	S. O'Reilly	08/09/2022	Planning Draft
1	Ronan Kearns	25/10/2022	Updated draft
2	Ronan Kearns	01/11/2022	Issued for planning

SOURCES OF DATA

Burns McDonnell	Land Survey Services Ltd.
Google	Marston Planning

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REPORT CONTENTS

Executive Summary

This report was prepared for South Dublin County Council in connection with the planning application for a data centre development and addresses the existing and proposed civil infrastructure, for the proposed development, located in Profile Park, Grange Castle Business Park, Lucan, Co. Dublin.

Vantage Data Centers DUB11 Ltd. are applying for permission for development at this site that includes a two storey residential property on lands to the south of the New Nangor Road (R134), Dublin 22; and on land within the townlands of Ballybane and Kilbride within Profile Park, Clondalkin, Dublin 22 on an overall site of 3.79hectares.

The development will consist of the demolition of the two storey dwelling (207.35sqm) and associated outbuildings and farm structures (348.36sqm); and the construction of 1 no. two storey data center with plant at roof level and associated ancillary development that will have a gross floor area of 12,893sqm that will consist of the following:

- 1 no. two storey data center (Building 13) with a gross floor area of 12,893sqm. It will include 13 no. emergency back-up generators of which 12 will be double stacked and one will be single stacked within a compound to the south-western side of the data center with associated flues that each will be 22.316m in height and 7 no. hot-air exhaust cooling vents that each will be 20.016m in height;
- the data center will include data storage rooms, associated electrical and mechanical plant rooms, loading bays, maintenance and storage spaces, office administration areas, and plant including PV panels at roof level as well as a separate house generator that will provide emergency power to the admin and ancillary spaces. Each generator will include a diesel tank and there will be a refuelling area to serve the proposed emergency generators;
- The data center will have a primary parapet height of 14.246m above ground level, with plant and screen around plus a plant room above at roof level. The plant room has an overall height of 21.571m;
- Construction of an internal road network and circulation areas, with a staff entrance off Falcon Avenue to the east, as well as a secondary vehicular access for service and delivery vehicles only across a new bridge over the Baldonnel Stream from the permitted entrance as granted under SDCC Planning Ref. SD21A/0241 from the south-west, both from within Profile Park that contains an access from the New Nangor Road (R134);
- Provision of 60 no. car parking spaces (to include 12 EV spaces and 3 disabled spaces), and 34 no. cycle parking spaces;
- Signage (5.7sqm) at first floor level at the northern end of the eastern elevation of the data center building; and
- Ancillary site development works, will include footpaths, attenuation ponds that will include an amendment to the permitted attenuation pond as granted to the north of the Baldonnel Stream under SDCC Planning Ref. SD21A/0241, as well as green walls and green roof. The installation and connection to the underground foul and storm water drainage network, and installation of utility ducts and cables, that will include the drilling and laying of ducts and cables under the internal road network within Profile Park. Other ancillary site development works will include hard and soft landscaping that will include an amendment to the permitted landscaping as granted under SDCC Planning Ref. SD21A/0241, lighting, fencing, signage, services road, entrance gates, and sprinkler tanks.

The development will be accessed from Falcon Avenue from within the Profile Park Business Park that contains an access from the New Nangor Road (R134).

The site is bounded to the south by an estate road known as Falcon Avenue, to the north by Nangor Road (R134), to the east by existing greenfield and to the west by existing commercial units and greenfield.

The report should be read in conjunction with our engineering planning drawings, and deals with existing foul, surface water and water mains present within the surrounding area, and the proposals for the site with regards to these services.

The report also discusses the ground conditions present on the site, the current proposals for achieving the development plateau and sustainability measures incorporated with the development.

1 Introduction

The development will consist of the demolition of the two storey dwelling (207.35sqm) and associated outbuildings and farm structures (348.36sqm); and the construction of 1 no. two storey data center with plant at roof level and associated ancillary development that will have a gross floor area of 12,893sqm.

The total subject site area extends to circa 3.79ha and is primarily a greenfield site. The site is bounded to the north by the New Nangor Road, to the south and east by Falcon Avenue and to the west primarily a greenfield site.

Based on currently available record maps, there is a watermain located with in the planning boundary. These watermains run along the northern boundary and eastern boundary. In addition, an existing foul network is located adjacent to the south-eastern boundary of the site and within Falcon Avenue.

The existing watermain network and foul network are within the red line application boundary, but outside of the development site.

This report has been prepared to outline the existing and proposed drainage, pollution control measures and water main infrastructure, in order to support the proposed development application.

The location of the site is indicated on the map extract below - Figure 1.

FIGURE 1 - Site Location (Source Google Maps)

2 Existing Drainage & Watermain Services

2.1 Existing Foul Drainage Networks

South Dublin County Council record drawings have identified a 225mm Ø mains network, located adjacent to the south-eastern boundary of the site & within Falcon Avenue. This line forms part of the reticulation network for Profile Park.

The existing foul drainage networks is within the red line application boundary, but outside of the development site.

The existing foul sewer reticulation network has adequate capacity to cater for the proposed effluent discharge from the subject site and there are no known issues noted with the sewer reticulation network.

2.2 Existing Surface Water Drainage Networks

The topographical survey as carried out has identified an open channel / stream which runs along a portion of the western boundary, up to the north, prior to discharging to the west into a culverted system beneath Grange Castle Motor Company. This ditch network is referred to as Baldonnel Stream.

The Baldonnel Stream then runs in a westerly direction via a tributary into the Camac River.

The Baldonnel Stream has been identified as having capacity to accommodate the proposed restricted discharge from the subject site.

2.3 Existing Water Main Network

South Dublin County Council record drawings have identified an existing 6" (160mm) Ø main located along the south-eastern boundary of the property, within Falcon Avenue adjacent to the subject site. 1No. 160mm Ø capped connection with sluice valves, has been left off the aforementioned water main, in order to facilitate development of these lands.

There is also an existing 700mm Ø trunk water main running parallel to the New Nangor Road adjacent to the northern boundary of the subject site.

The existing watermain network is within the red line application boundary, but outside of the development site.

From discussions with the South Dublin County Council, it is understood that there is adequate capacity within the existing watermain network to supply the anticipated demand of the proposed development.

3 Proposed Site Drainage & Water Supply

3.1 Proposed Foul Water Drainage

It is proposed to discharge foul water from the proposed development, via a 225mm Ø gravity foul sewer outfall, laid from MH FWMH 2.1 and discharging into the existing 225mm Ø laid along Falcon Avenue, which then runs in a southerly direction.

The administration section of the building contains 6 No. WC's, with a predicted maximum number of daily staff being in the region of circa 48 people, over a 24hr period. Based on Irish Water's Code of Practice of 150ltr/hd/day, the peak wastewater flow will not be in excess of circa 0.083l/s (@1DWF) & a peak discharge of 0.498l/s (@6DWF).

The proposed network connects into FW MH CON, with an invert level of 71.54m, prior to the ultimate outfall discharging into the Profile Park reticulation network, - refer Drawing No. DB13-DR-UG-C127-V2-WS3-PIN Rev. V2.

All on-site foul sewers have been designed to be a minimum 225mm Ø diameter pipes, with gradients designed to achieve self-cleansing velocities.

A Confirmation of Feasibility has been received from Irish Water in respect of both the foul sewer and water supply – Ref. No. CDS22006869, refer Appendix D.

3.2 Proposed Surface Water Drainage

Storm water from the proposed development has been designed in accordance with the GDSDS and ensures that Best Management Practice has been incorporated into the design.

In addition, the design has taken into account South Dublin Green Space Factor Guidance Note (August 2022). By ensuring that the development has reached a minimum Green Space Factor, the Applicant seeks to meet minimum standards for the provision of green infrastructure to secure a positive contribution to biodiversity, amenity, air quality, stormwater management, temperature regulation and other ecosystem services.

It should be noted that the subject site currently comprises a greenfield site and the proposed surface water measures are aimed at improving the general surface water management of the site, by introducing interceptors, attenuation measures and by restricting the ultimate discharge, etc.

Further to the above, the SDCC Sustainable Drainage Explanatory Design and Evaluation Guide has been taken into account, with sustainable measures being implemented as described below. In addition, the previous concrete pedestrianised footpath areas around the building to the west, north & east have now been replaced with permeable paving.

Storm water from the rear roof areas of the proposed building units, will be directed via rain water pipes into an on-site reticulation system. The outflow from this system will be connected into the surface water drainage network collecting run-off from the road areas and will be ultimately discharged into Attenuation Pond 1 - refer Drawing No. DB13-DR-UG-C127-V2-WS3-PIN Rev. V2.

The front roof areas of the buildings drain into the permeable paving sub-base, prior to the ultimate discharge into the ditch / stream to the west via Attenuation Pond 1.

Based on the contributing area for this current application, i.e. circa 14,300m^2 (1.43Ha), the total attenuation volume required has been calculated as being circa 1,084m^3, which will be provided for as mentioned above, in 2 No. storage ponds & permeable paving - Refer Appendix B for Surface Water Calculations.

The following volumes have been provided for within the storage elements:-

- Attenuation Pond 1 provides a storage volume of 900m^3
- Attenuation Pond 2 provides a storage volume of 70m^3
- Permeable paving sub-base provides a storage volume of 114m^3

It should be noted that Attenuation Pond 1 discharges directly into the aforementioned ditch / stream to the west. Attenuation Pond 2 outfalls into the existing 1400mm Ø network to the south. This network then runs north and connects into the aforementioned ditch / stream.

Storm water from all car park areas and access roads / delivery areas will be drained as follows:-

- A series of on-site gullies and channels draining into a separate system of below ground gravity storm water sewers
- Permeable Paving

Prior to discharging into the proposed ponds, the storm water from the car park and access roads, which is drained via the methods as described above, will be directed through an appropriately sized Conder Separators (or similar approved) petrol interceptor - refer Appendix A for Interceptor Details.

Site investigations have been carried out and the results have shown that the existing sub-soil would provide inadequate soil infiltration rates and thus it is not practical to install a soakaway system. The storm water drainage within the entire development has been designed to accommodate a 1:2 year storm frequency. The ponds and permeable paving sub-base areas have been designed to accommodate a 1:100 year storm event + 20% climate change.

The outflow from the proposed development, will be restricted by way of a Hydrobrake facility, which will limit the total discharge to 2.8l/s, which is the calculated QBAR greenfield run-off rate - refer Appendix B for Surface Water Calculations.

The surface water discharge for this application will incorporate the road areas, parking, service yard area and the roof water from the proposed data hall, which then ultimately feeds into the existing network as previously described. Refer Dwg. No. DB13-DR-SP-C130-V2-WS3-PIN Rev. V2 (External Works Layout), for a drawing indicating the various surface types of this application; all areas are hardstanding of various types, with the respective coefficients detailed below:-

- Access Road – Tarmac (2,395m^2) / c = 0.80
- Data Hall Roof Area (6,384m^2) / c = 1.00
- Yard Slab Area / Service Yard – Concrete (4,502m^2) / c = 0.80
- Open Space / Landscaping (15,305m^2) / c = 0.00
- Permeable Paving & Parking Areas (759m^2) / c = 0.60
- Concrete Footpath (394m^2) / c = 0.8

3.3 Proposed Water Mains

It is intended to serve the proposed development via connection off the aforementioned 160mm Ø PVC spur connection off the network, as located in Falcon Avenue - Refer Drawing No. DB13-DR-SP-C124-V2-WS3-PIN Rev. V2.

Hydrants will be installed in accordance with the Requirements of the Building Regulations and in accordance with the recommendations contained in the Technical Guidance Documents, Section B – Fire Safety, dated 2006, and these are detailed on our engineering drawings.

Water demand for the development has been based on Irish Water's criteria, i.e. 150 litres/hd/day = 7,200 litres/hd/day (based on 48 PE) = 0.083 litres/second.

Avg. Demand = 0.083 l/s x 1.25 = 0.104 litres/second

Peak Demand = 0.104 l/s x 5 = 0.520 litres/second

Water meters, sluice valves and hydrants, in line with Irish Water requirements and specifications, will be installed at the connections onto the aforementioned existing water mains, as required.

A Confirmation of Feasibility has been received from Irish Water in respect of both the foul sewer and water supply – Ref. No. CDS22006869, refer Appendix D.

3.4 Standard Drainage Details

All standard drainage details including manhole details, pipe bedding, channels, hydrants etc. have been included within the planning pack. Details of the types and construction methods will be agreed with the local authority prior to construction.

Drains generally will consist of PVC (to IS 123) or concrete spigot and socket pipes to (IS 6).

Drains shall be laid to comply with the Requirements of the Building Regulations 2016 and in accordance with the recommendations contained in the Technical Guidance Documents, Section H, Drainage & Waste Water Disposal..

Strict separation of surface water and foul sewerage will be imposed on the development. Drains will be laid out to minimise the risk of inadvertent connections of sinks, dishwashers etc. to the surface water system.

In order to minimise the risk of floating contamination of the surface water system, road gullies will be precast trapped gullies to BS5911:Part2:1982.

Concrete bed and surround to the pipe runs will be used where the cover to the pipes is less than 900mm, where the pipes are sufficiently close to the building, or where the pipe runs are below the ground floor slab.

All works are to be carried out in accordance with Irish Water's Code of Practice for Water Infrastructure, dated July 2020 : Document IW-CDS-5020-03 and any subsequent revisions thereof.

4 Surface & Groundwater Impacts

4.1 Construction Phase

Water pollution will be minimised by the implementation of good construction practices. Such practices will include adequate bunding for oil containers, wheel washers and dust suppression on site roads, and regular plant maintenance. The Construction Industry Research and Information Association provides guidance on the control and management of water pollution from construction sites in their publication Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors – C532 CIRIA Report (Masters-Williams *et al*, 2001), which provides information on these issues.

Pollutants can commonly include suspended solids, oil, chemicals, cement, cleaning materials and paints. These can enter controlled waters in various ways:

- directly into a watercourse
- via drains or public sewers
- via otherwise dry ditches
- in old field drains
- by seepage into groundwater systems
- through excavations into underlying aquifers
- by disturbance of an already contaminated site

The proximity of the site to streams, aquifers and water abstractions; potential sources, pathways and impacts of pollution; and the historical uses of the site and nearby areas should be examined early in project planning and design, to ensure that suitable redesign and mitigation measures are undertaken as necessary.

During construction, careful management and planning will help minimise water pollution. This may include adequate bunding of all oil tanks, wheel washers and dust suppression on haul roads, particular care to be taken near watercourses, and regular plant maintenance.

A contingency plan for pollution emergencies should also be developed and regularly updated, which would identify the actions to be taken in the event of a pollution incident.

The CIRIA document (2001), recommends that a contingency plan for pollution emergencies should address the following:

- containment measures
- emergency discharge routes
- list of appropriate equipment and clean-up materials
- maintenance schedule for equipment
- details of trained staff, location, and provision for 24-hour cover
- details of staff responsibilities
- notification procedures to inform the relevant environmental protection authority
- audit and review schedule

- telephone numbers of statutory water undertakers and local water company
- list of specialist pollution clean-up companies and their telephone numbers

4.2 Operational Phase

The sources of pollution that could potentially have an effect on surface or groundwater during the operational phase of the development will be oil and fuel leaks from parked cars, service vehicles, HGV delivery's etc. Hydrocarbon interceptors will be provided on storm water drainage sewers from car parking areas as required.

Storm water attenuation measures will be incorporated into the scheme as mentioned previously.

It is not anticipated that flooding of the site will occur, however, an independent Site Specific Flood Risk Assessment has been submitted as part of the planning submission pack.

4.3 Mitigation Measures

The construction management of the building project will incorporate protection measures to minimise as far as possible the risk of spillage that could lead to surface and groundwater contamination.

All appropriate methods will be utilised to ensure that surface water arising during the course of construction activities will contain minimum sediment, prior to the ultimate discharge to the proposed attenuation ponds and the existing stream.

Storm water attenuation measures will be incorporated into the scheme as mentioned previously. Hydrocarbon interceptors will be provided on storm water drainage sewers from service yard areas as necessary. Grease traps will be installed on foul sewers where necessary.

Best practice in design and construction will be employed for the installation of surface water and sanitary drainage.

5 Sustainability

5.1 Site Development

In order to minimize material export and import to the site and the impact of this on the surrounding road network, we are proposing to maintain existing on-site levels as far as is practical. Where this is not feasible, a terrain model has been produced, which will indicate the volumes of cut/fill material, based on the proposed levels and a levels balance will be struck across the site, thereby mitigating any import/export of material for site development.

5.2 Site Drainage

Storm water drainage proposals for the site have been designed in accordance with the GDSDS and incorporate on site storm water attenuation in order to limit discharge of storm water from the developed site to the equivalent Q-bar run-off rates.

The attenuation system proposed is in keeping with other similar developments within Grange Castle Business Park. The pond area not only provides flood storage, but also provides ecological benefits as well.

6 Conclusion

In conclusion, the proposed development of the site by the applicant, for use as a Data Centre development, is considered a suitable use of the site. Local infrastructure has the capacity to serve the proposed development.

The site will be developed in a sustainable manner, in order to minimise the impact of the development during construction and throughout the lifespan of the proposed development.

Accordingly, there are no reasons in relation to the drainage elements as to why this scheme should not be granted planning permission, and with this in mind, the Planning Authority is respectfully requested to recommend a grant of planning permission.

Appendix A

Conder Petrol Interceptor Details

Conder® OIL/WATER SEPARATORS

40 years OF PASSION

CONDER AQUA SOLUTIONS

A PREMIER TECH AND EPS JOINT COMPANY

THE PARTNER OF CHOICE

The Conder Range of Oil Separators are for installation on surface water drainage systems and are designed to prevent hydrocarbons (e.g. diesel, petrol, engine oil) from mixing with surface water and entering our drainage systems.

Pollution prevention is a critical part of sustainable drainage systems and statutory regulations are in force to control the discharge of hydrocarbons, with severe penalties imposed for non-compliance.

Compliance

The Conder Range of Oil Separators fully conform to both the Environment Agency's latest PPG guidelines and European standard BSEN-858-1-2 and are proven to effectively separate oil and water. Under test, the Conder Bypass performed to less than 1 mg/l and in doing so guarantees minimal environmental impact and ensures public safety.

Classes of Separator

There are two classes of separator which are defined by performance.

Class 1	Class 2*
Class 1 Separators are designed to achieve a concentration of less than 5mg/l of oil under standard test conditions. These conditions are required for discharges to surface water drains and the water environment.	Class 2 Separators are 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 such as discharges to the foul sewer.

*Class 2 available in forecourt separators only.

Selecting the Right Separator

Conder offers a full range of Separators for varying use and application:

- Bypass Separator
- Full Retention Separator
- Forecourt Separator
- Wash Down and Silt Separators

If you're unsure of what type of Conder Oil Separator you require please use the below chart to help you identify the most suitable product for your project.

The guidance given is for the use of separators in surface water drainage systems that discharge to rivers and soakways.

Is there a risk of oil contaminating the drainage from the site?

YES → Risk of infrequent light contamination and potential for small spills only e.g. car park. → YES → Source control SUDS must be considered and incorporated where suitable. → IF NOT SUITABLE → By-pass separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.

YES → Risk of regular contamination of surface water run off with oil and/ or risk of larger spills e.g. vehicle maintenance area, goods vehicle parking or vehicle manoeuvring. → YES → Full retention separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.

YES → Risk of regular Drainage will also contain dissolved oils, detergents or degreasers such as vehicle wash water and trade effluents e.g. industrial sites. → YES → Trade effluents must be directed to the foul sewer. It may need to pass through a separator before discharge to sewer to remove.

YES → Fuel oils are delivered to and dispensed on site e.g. retail fuel forecourts. → YES → Full retention 'forecourt' separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.

NO → Very low risk of oil contamination e.g. roofwater. → YES → Separator not required. → Clean water should not be passed through the separator unless the size of the unit increased accordingly.

The use of SUDS should be considered at all sites and they should be incorporated where suitable. SUDS can be used to polish the effluent from these separators before it enters the environment.

Source control SUDS should be considered where possible.

Separator Alarms

All oil separators are required by legislation to be fitted with an oil level alarm system with recommendations that the alarm is installed, tested, commissioned and regularly serviced by a qualified technician.

The alarm indicates when the separator is in need of immediate maintenance in order for it to continue to work effectively. Conder Aqua Solutions can offer a full technical and service package for a variety of alarm options.

The Conder Range of Bypass Separators

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

Typical Application

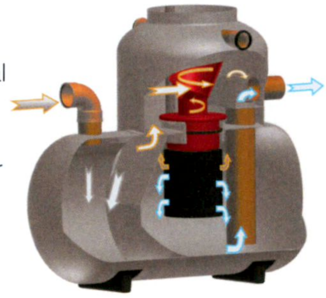
- Car parks
- Roadways and major trunk roads
- Light industrial and goods yards

Features and Benefits

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

Performance

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



How it Works

Step 1

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

Step 2

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

Step 3

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

Specification

Larger models up to CNSB 1000 are available.

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

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

The Conder Range of Full Retention Separators

The Conder Range of Full Retention Separators are designed to treat the full flow that can be delivered by a drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr. Full Retention Separators are used where there is a risk of regular contamination with oil and a foreseeable risk of significant spillages.

Typical Application

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

Features and Benefits

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

Performance

All Conder Full Retention Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all PPG3 compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.

How it Works

Step 1

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

Step 2

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

Step 3

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

Specification

Larger models available upon request.

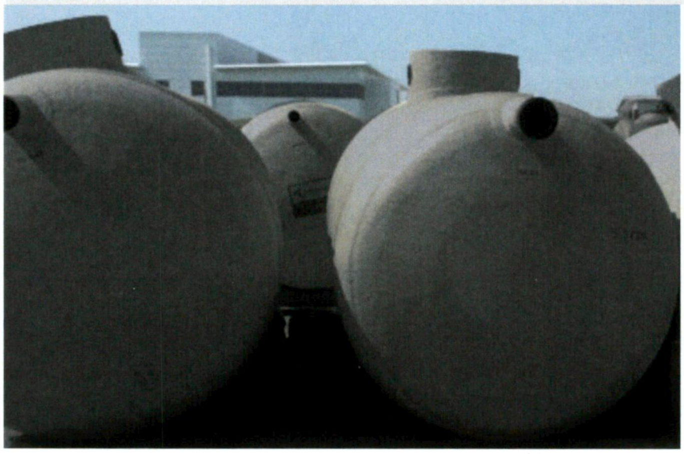
Area Drained (m^2)	Tank code Incl. Silt	Length including Silt (mm)	Slit Capacity (L)	Oil Storage Capacity	Diameter (mm)	Height (mm)	Base to inlet Invert (mm)	Base to outlet Invert (mm)
222	CNS4s/11	2319	400	40	1026	1655	1295	1245
333	CNS6s/11	3414	600	60	1026	1655	1295	1245
444	CNS8s/11	3197	800	80	1210	1855	1480	1430
556	CNS10s/11	3957	1000	100	1210	1855	1480	1430
833	CNS15s/11	3870	1500	150	1510	2180	1780	1730
1111	CNS20s/11	5060	2000	200	1510	2180	1780	1730
1667	CNS30s/11	5369	3000	300	1880	2560	2030	1980
2222	CNS40s/11	7059	4000	400	1880	2560	2030	1980
2778	CNS50s/11	4080	5000	500	2600	3315	2730	2680
3333	CNS60s/11	4805	6000	600	2600	3315	2730	2680
3889	CNS70s/11	5529	7000	700	2600	3315	2730	2680
4444	CNS80s/11	6254	8000	800	2600	3315	2730	2680
5556	CNS100s/11	6751	10,000	1,000	2600	3315	2730	2680

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

Conder Range of Forecourt Separators

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

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



Application Areas

- Petrol forecourts
- Refuelling facilities
- Fuel storage depot

Features and Benefits

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

Performance

All Conder Forecourt Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all PPG3 compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.

How it Works

Step 1

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

Step 2

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

Step 3

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

Specification

Tank Code	Volume (L)	Length (mm)	Diameter (mm)	Height (mm)	Base to inlet (mm)	Base to outlet (mm)	Access (mm)
ANO/11*	10000	4250	1800	2100	1600	1550	750
ANT/12**	10000	4250	1800	2100	1600	1550	750
LNO/11***	10000	4250	1800	2100	1600	1550	750

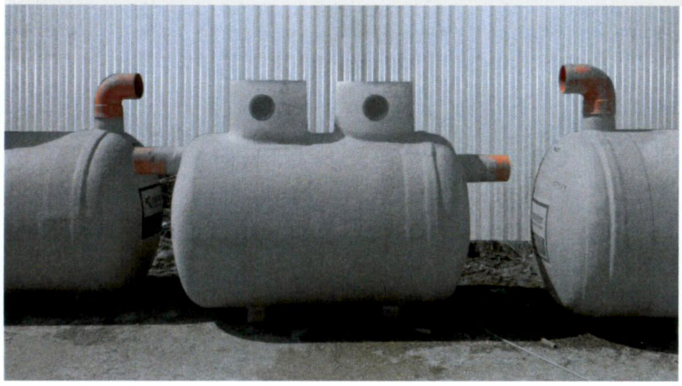
*Class 1 Forecourt Separator suitable for discharging to surface water drains

**Class 2 Forecourt Separator suitable for discharging to foul drains only

*** Class 1 Forecourt Separator suitable for installation in granular materials

Conder Range of Washdown and Silt Separators

Conder Washdown and Silt Separators are for use in areas such as car washes, pressure wash facilities or other cleaning facilities and must be discharged to the foul water drainage system in accordance with PPG13.



Application Areas

- Car wash facilities
- Tool hire depots
- Pressure washer facilities

Features and Benefits

- Available in 1,2 and 3 stage options
- Efficient silt and hydrocarbon removal

Performance

The Environment Agency's PPG13 requires that discharge from pressure washers must discharge to a foul drainage system. Where there is no foul drainage available, the effluent must be contained within a sealed drainage system or catchpit for disposal by a licenced waste contractor.

Silt build-up is the primary concern with washdown facilities and so the Conder range of washdown and silt separators are used to remove the silt and will allow some separation of hydrocarbons.

Detergents that are used in wash down areas will break down and disperse hydrocarbons (hindering the separation process). Therefore it is important to remember the main function of wash down separators is to remove silt.

How it Works

Step 1

Contaminated wash down water enters the unit where the heavier solids, silts, settle to the bottom of the tank.

Step 2

The lighter liquids, hydrocarbons, will rise to the surface and be retained within the tank.

Step 3

Treated water will exit the separator via the dipped outlet.

Specification

Although it is recognised that single stage separators give the most efficient separation, 2 and 3 chamber Conder Washdown and Silt Separators are available on request.

Tank Code	Capacity (L)	Silt Storage	Diameter (mm)	Length (mm)	Access Diameter (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)
CWS2/12	2000	1000	1000	2713	600	1290	1240
CWS3/12	3000	1500	1200	2853	600	1475	1425
CWS4/12	4000	2000	1200	3737	600	1475	1425
CWS6/12	6000	3000	1500	3636	600	1775	1725
CWS8/12	8000	4000	1800	3443	600	2030	1980
CWS10/12	10000	5000	1800	4250	600	2030	1980

FST Silt Trap

Large quantities of silt can be associated with washdown areas. The Conder FST silt trap is ideal for easy removal of silt either manually or by a waste disposal contractor.

The FST range of silt traps are available with varying grades of covers from B125 up to E600 to allow installation in all types of vehicle or plant washdown facilities.

Conder Range of Alarm Systems

All separators must be fitted with an alarm in order to provide visual and audible warning when the level of oil reaches 90% of its storage volume, as required by The Environment Agency's PPG3.

The alarm system will then be triggered to indicate that the separator is in need of immediate emptying, in order to continue effective operation.

Features and Benefits

- Option for installation at a remote supervisory point
- Audible and visual
- Eliminates unnecessary waste management visits
- Easy installation
- Audible, visual and text message alert alarm systems available

Mains Powered System

Mains powered alarm systems are best suited to new build situations or sites where installation of the necessary cabling and ducting is straight forward and economical. The probe located in the separator will, when surrounded by floating hydrocarbons, activate an alarm condition on the remote panel to advise that the unit requires emptying.

Solar Powered System (Flashing Beacon)

This option requires no mains power supply or any significant cabling and ducting, making it extremely economical for large sites and retro fitting alarms to existing oil separators. A High Intensity Beacon will flash when a problem is detected.

Solar GSM Alarm

The Solar GSM alarm sends a status report on your separator to a mobile phone number of your choice. The status of the GSM alarm can also be tested at any time by simply sending a pre-recorded text message, via your directed mobile phone, for added peace of mind.

Peripherals

Coalescing Filters

The Conder Coalescing Filter is designed to separate residual oil in already separated oil/water and ensures a discharge quality of less than 5mg/litre of oil in water.

Features and Benefits

- Handle for easy removal and cleaning
- Flashing beacons (with option of siren kit)
- Kiosks
- Probe brackets
- Bas 1000 intrinsically safe junction box
- High level probe
- Silt level probe
- Oil level probe

Servicing

The Environmental Agency's PPG3 guidelines stipulate that every 6 months, and in accordance with manufacturer's instructions, experienced personnel should carry out maintenance to both the separator and alarm.

Conder and our service partners can offer a full technical and service package including separator and alarm installation, commissioning, oil and silt removal and route service contracts.

CONDER
AQUA SOLUTIONS
A PREMIER TECH AND EPS JOINT COMPANY

2 Whitehouse Way, South West Industrial Estate, Peterlee, Co Durham, SR8 2RA UNITED KINGDOM.
+44 (0) 8702 640004 Email: sales@conderproducts.com **www.conderaqua.com**

Appendix B

Surface Water Calculations

Met Eireann

Return Period Rainfall Depths for sliding Durations

Irish Grid: Easting: 304087, Northing: 230773,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.4,	4.1,	5.0,	5.7,	6.2,	8.0,	10.0,	11.4,	13.4,	15.2,	16.6,	18.8,	20.6,	22.1,	N/A ,
10 mins	3.2,	4.8,	5.7,	7.0,	7.9,	8.7,	11.1,	14.0,	15.9,	18.7,	21.2,	23.2,	26.3,	28.7,	30.7,	N/A ,
15 mins	3.8,	5.7,	6.7,	8.3,	9.3,	10.2,	13.1,	16.4,	18.7,	22.0,	24.9,	27.3,	30.9,	33.8,	36.2,	N/A ,
30 mins	5.0,	7.4,	8.7,	10.7,	12.0,	13.1,	16.7,	20.9,	23.7,	27.7,	31.4,	34.2,	38.7,	42.2,	45.1,	N/A ,
1 hours	6.6,	9.6,	11.2,	13.7,	15.5,	16.8,	21.3,	26.5,	30.0,	35.0,	39.4,	42.9,	48.4,	52.6,	56.2,	N/A ,
2 hours	8.6,	12.5,	14.6,	17.7,	19.9,	21.6,	27.2,	33.7,	38.0,	44.1,	49.6,	53.9,	60.5,	65.7,	70.0,	N/A ,
3 hours	10.1,	14.6,	17.0,	20.6,	23.1,	25.0,	31.4,	38.7,	43.6,	50.5,	56.7,	61.5,	69.0,	74.8,	79.7,	N/A ,
4 hours	11.4,	16.2,	18.9,	22.9,	25.6,	27.7,	34.7,	42.7,	48.1,	55.6,	62.3,	67.6,	75.7,	82.0,	87.3,	N/A ,
6 hours	13.3,	18.9,	22.0,	26.6,	29.7,	32.1,	40.1,	49.2,	55.2,	63.7,	71.3,	77.2,	86.3,	93.4,	99.3,	N/A ,
9 hours	15.6,	22.1,	25.6,	30.8,	34.4,	37.2,	46.2,	56.5,	63.3,	72.9,	81.5,	88.1,	98.4,	106.4,	113.0,	N/A ,
12 hours	17.5,	24.7,	28.5,	34.3,	38.2,	41.2,	51.2,	62.4,	69.8,	80.3,	89.6,	96.8,	108.0,	116.6,	123.8,	N/A ,
18 hours	20.5,	28.8,	33.2,	39.8,	44.3,	47.7,	59.0,	71.8,	80.2,	92.0,	102.5,	110.6,	123.1,	132.8,	140.8,	N/A ,
24 hours	23.0,	32.1,	37.0,	44.2,	49.1,	52.9,	65.3,	79.3,	88.4,	101.3,	112.7,	121.5,	135.1,	145.6,	154.3,	184.7,
2 days	28.9,	39.2,	44.6,	52.5,	57.8,	61.9,	75.1,	89.6,	99.1,	112.2,	123.7,	132.5,	146.0,	156.4,	164.9,	194.5,
3 days	33.6,	44.9,	50.7,	59.2,	64.9,	69.2,	83.0,	98.2,	108.0,	121.4,	133.2,	142.2,	155.9,	166.3,	174.9,	204.4,
4 days	37.8,	49.9,	56.1,	65.1,	71.0,	75.6,	90.0,	105.7,	115.8,	129.6,	141.6,	150.8,	164.7,	175.3,	183.9,	213.6,
6 days	45.1,	58.5,	65.4,	75.2,	81.7,	86.6,	102.0,	118.7,	129.3,	143.8,	156.3,	165.8,	180.1,	191.0,	199.9,	230.1,
8 days	51.6,	66.2,	73.5,	84.1,	91.0,	96.2,	112.5,	130.0,	141.1,	156.2,	169.1,	178.9,	193.7,	204.8,	213.9,	244.7,
10 days	57.5,	73.2,	81.0,	92.1,	99.4,	104.9,	122.0,	140.2,	151.7,	167.3,	180.7,	190.8,	205.9,	217.3,	226.6,	257.9,
12 days	63.1,	79.6,	87.9,	99.6,	107.2,	112.9,	130.7,	149.6,	161.5,	177.6,	191.3,	201.7,	217.1,	228.8,	238.3,	270.2,
16 days	73.5,	91.6,	100.6,	113.3,	121.5,	127.7,	146.7,	166.8,	179.4,	196.3,	210.7,	221.5,	237.6,	249.7,	259.5,	292.4,
20 days	83.0,	102.7,	112.3,	125.9,	134.6,	141.1,	161.3,	182.4,	195.5,	213.2,	228.1,	239.3,	256.0,	268.5,	278.6,	312.4,
25 days	94.3,	115.5,	125.9,	140.4,	149.7,	156.6,	178.0,	200.3,	214.1,	232.5,	248.1,	259.8,	277.1,	290.0,	300.4,	335.2,

NOTES:

N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

Qbar Calculation
Using IOH Report 124 for Sites < 25 km^2

Catchment Name
DUB 13

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km^2 using the 3 variable equation

SITE AREA =	1.43	Ha	Overall Redline Area
CATCHMENT AREA =	1.43	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.014	km^2	Area of the Catchment (km^2)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	2.4
QBAR	1	2.9
10	1.67	4.8
30	2.1	6.0
50	2.33	6.6
100	2.6	7.4
200	2.85	8.1
1000	3.5	10.0

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 4.71 l/s
(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha
$Q_{bar[rural]}$ =	**2.9**	**l/s**

Catchment Characteristics			
DUB 13	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs & Balconies - Type 1 (Draining to gullies)	-	1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)	-	0.90	0.0
Green Roofs	-	0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	-	0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	-	0.70	0.0
Paved Areas	-	0.80	0.0
Permeable Paving	-	0.70	0.0
Grass over Basement	-	0.70	0.0
Parks (contributing)	-	0.30	0.0
Public Open Space (non-contributing)	-	0.00	0.0

Include Public Open Space in Effective Catchment Area? no — Assumed open space area does not drain to surface water network

Effective Catchment Area **0.0** m^2

Effective Catchment Runoff Coefficient **0.00**

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	20	Minimum Velocity (m/s)	0.70
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	1.200
Ratio-R	0.270	Preferred Cover Depth (m)	0.800
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	15.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWMH1.10	0.022	15.00	73.720	1200	696959.009	732946.994	1.060
SWMH1.9	0.072	15.00	73.620	1200	696956.927	732963.878	1.160
SWMH1.8 (PERM PAV1)	0.130	15.00	73.620	1200	696940.159	732974.402	1.310
SWMH1.7	0.387	15.00	73.620	1200	696922.175	732985.074	1.510
SWMH1.6			73.620	1350	696895.331	732999.770	1.650
SWMH1.5			73.660	1350	696887.648	733000.634	1.720
SWMH1.4			73.630	1350	696880.637	732997.465	1.720
SWMH1.3			73.630	1350	696867.715	732974.491	1.780
SWMH1.2			73.500	1350	696863.639	732976.680	1.700
SWMH1.1			73.000	1350	696858.431	732979.624	1.300
SWMH3.1		15.00	73.640	1200	696856.332	732955.546	1.390
SWMH2.8 (PERM PAV2)	0.089	15.00	73.500	1200	696911.177	732873.033	1.100
SWMH2.7			73.430	1200	696906.098	732864.385	1.080
SWMH2.6			73.400	1200	696894.118	732864.082	1.120
SWMH2.5	0.641	15.00	73.370	1200	696865.526	732880.746	1.255
SWMH2.4			73.370	1350	696835.796	732897.691	1.395
SWMH2.3			73.520	1350	696831.875	732949.222	1.753
SWMH2.2			73.500	1350	696832.621	732953.619	1.740
SWMH2.1			73.000	1350	696834.619	732960.933	1.300
SWMH CON			74.000	1200	696875.947	732787.013	2.360
SWMH5.1			73.500	1200	696868.547	732802.333	1.650
SWMH 5.2 (POND2)			73.200	1200	696866.652	732806.231	1.300
SWMH6.1			73.200	1200	696860.282	732811.430	1.200
SWMH6.2			73.400	1200	696858.243	732815.621	1.300
OIL 2			73.400	1200	696861.811	732817.886	1.250
SWMH6.3			73.400	1200	696865.662	732819.642	1.200
SWMH6.4			73.500	1200	696862.321	732825.645	1.200
SWMH7.1	0.033	15.00	73.500	1200	696848.956	732818.056	1.100
SWMH6.5	0.060	15.00	73.500	1200	696880.647	732835.391	1.100
SWMH 4.3 (POND1)			73.000	1350	696832.127	732977.277	1.800
SWMH4.2			73.000	1200	696827.964	732977.362	1.450
SWMH4.1			72.500	1200	696825.075	732977.362	1.000

Links

US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/h
SWMH2.1	SWMH 4.3 (POND1)	16.533	0.600	71.700	71.200	0.500	33.1	450	17.55	50
SWMH2.8 (PERM PAV2)	SWMH2.7	10.029	0.600	72.400	72.350	0.050	200.6	225	15.18	50
SWMH2.7	SWMH2.6	11.984	0.600	72.350	72.280	0.070	171.2	225	15.38	50
SWMH2.6	SWMH2.5	33.094	0.600	72.280	72.115	0.165	200.6	225	15.98	50
SWMH1.1	SWMH 4.3 (POND1)	26.408	0.600	71.700	71.600	0.100	264.1	300	17.46	50
SWMH2.5	SWMH2.4	34.220	0.600	72.115	71.975	0.140	244.4	300	16.55	50
SWMH2.4	SWMH2.3	51.680	0.600	71.975	71.767	0.208	248.5	375	17.30	50
SWMH2.3	SWMH2.2	4.460	0.600	71.767	71.760	0.007	637.1	450	17.40	50
SWMH2.2	SWMH2.1	7.582	0.600	71.760	71.700	0.060	126.4	450	17.47	50
SWMH3.1	SWMH1.3	22.102	0.600	72.250	71.850	0.400	55.3	150	15.27	50
SWMH1.3	SWMH1.2	4.627	0.600	71.850	71.800	0.050	92.5	450	16.97	50
SWMH1.2	SWMH1.1	5.983	0.600	71.800	71.700	0.100	59.8	450	17.00	50
SWMH 4.3 (POND1)	SWMH4.2	4.164	0.600	71.600	71.550	0.050	83.3	225	17.59	50
SWMH4.2	SWMH4.1	2.889	0.600	71.550	71.500	0.050	57.8	225	17.62	50
SWMH 5.2 (POND2)	SWMH5.1	4.334	0.600	71.900	71.850	0.050	86.7	225	15.74	50
SWMH5.1	SWMH CON	17.014	0.600	71.850	71.640	0.210	81.0	225	15.94	50
SWMH7.1	SWMH6.4	15.369	0.600	72.400	72.300	0.100	153.7	225	15.24	50
SWMH6.4	SWMH6.3	6.870	0.600	72.300	72.200	0.100	68.7	225	15.46	50
SWMH6.3	OIL 2	4.232	0.600	72.200	72.150	0.050	84.6	225	15.50	50
OIL 2	SWMH6.2	4.226	0.600	72.150	72.100	0.050	84.5	225	15.55	50
SWMH6.2	SWMH6.1	4.661	0.600	72.100	72.000	0.100	46.6	225	15.59	50
SWMH6.5	SWMH6.4	20.756	0.600	72.400	72.300	0.100	207.6	225	15.38	50
SWMH1.10	SWMH1.9	17.012	0.600	72.660	72.460	0.200	85.1	225	15.20	50
SWMH1.9	SWMH1.8 (PERM PAV1)	19.797	0.600	72.460	72.310	0.150	132.0	225	15.49	50

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.1	3.545	563.7	118.7	0.850	1.350	0.730	0.0	139	2.834
2.7	0.919	36.6	14.5	0.875	0.855	0.089	0.0	98	0.866
2.6	0.996	39.6	14.5	0.855	0.895	0.089	0.0	94	0.918
2.5	0.919	36.6	14.5	0.895	1.030	0.089	0.0	98	0.866
1.1	0.963	68.0	99.4	1.000	1.100	0.611	0.0	300	0.975
2.4	1.001	70.8	118.7	0.955	1.095	0.730	0.0	300	1.014
2.3	1.145	126.4	118.7	1.020	1.378	0.730	0.0	290	1.294
2.2	0.798	126.9	118.7	1.303	1.290	0.730	0.0	348	0.902
2.0	1.807	287.4	118.7	1.290	0.850	0.730	0.0	201	1.722
3.0	1.356	24.0	0.0	1.240	1.630	0.000	0.0	0	0.000
1.3	2.114	336.2	99.4	1.330	1.250	0.611	0.0	167	1.852
1.2	2.632	418.6	99.4	1.250	0.850	0.611	0.0	148	2.170
4.2	1.434	57.0	218.1	1.175	1.225	1.341	0.0	225	1.460
4.1	1.724	68.5	218.1	1.225	0.775	1.341	0.0	225	1.755
5.2	1.405	55.9	15.1	1.075	1.425	0.093	0.0	80	1.196
5.1	1.454	57.8	15.1	1.425	2.135	0.093	0.0	79	1.231
7.1	1.052	41.8	5.4	0.875	0.975	0.033	0.0	54	0.726
6.4	1.580	62.8	15.1	0.975	0.975	0.093	0.0	75	1.307
6.3	1.422	56.5	15.1	0.975	1.025	0.093	0.0	80	1.211
Oil 2	1.423	56.6	15.1	1.025	1.075	0.093	0.0	80	1.212
6.2	1.921	76.4	15.1	1.075	0.975	0.093	0.0	67	1.499
6.5	0.904	35.9	9.8	0.875	0.975	0.060	0.0	80	0.769
1.10	1.418	56.4	3.6	0.835	0.935	0.022	0.0	38	0.799
1.9	1.136	45.2	15.3	0.935	1.085	0.094	0.0	90	1.029

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rai (mm/
1.8	SWMH1.8 (PERM PAV1)	SWMH1.7	20.912	0.600	72.310	72.110	0.200	104.6	225	15.76	5
1.7	SWMH1.7	SWMH1.6	30.603	0.600	72.110	71.970	0.140	218.6	300	16.24	5
1.6	SWMH1.6	SWMH1.5	7.731	0.600	71.970	71.940	0.030	257.7	375	16.36	5
1.5	SWMH1.5	SWMH1.4	7.694	0.600	71.940	71.910	0.030	256.5	375	16.47	5
1.4	SWMH1.4	SWMH1.3	26.359	0.600	71.910	71.850	0.060	439.3	450	16.93	5
6.1	SWMH6.1	SWMH 5.2 (POND2)	8.222	0.600	72.000	71.900	0.100	82.2	225	15.69	5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.8	1.278	50.8	36.4	1.085	1.285	0.224	0.0	141	1.386
1.7	1.059	74.9	99.4	1.210	1.350	0.611	0.0	300	1.073
1.6	1.124	124.1	99.4	1.275	1.345	0.611	0.0	255	1.243
1.5	1.126	124.4	99.4	1.345	1.345	0.611	0.0	255	1.246
1.4	0.963	153.2	99.4	1.270	1.330	0.611	0.0	264	1.022
6.1	1.443	57.4	15.1	0.975	1.075	0.093	0.0	79	1.222

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.1	16.533	33.1	450	Circular	73.000	71.700	0.850	73.000	71.200	1.350
2.7	10.029	200.6	225	Circular	73.500	72.400	0.875	73.430	72.350	0.855
2.6	11.984	171.2	225	Circular	73.430	72.350	0.855	73.400	72.280	0.895
2.5	33.094	200.6	225	Circular	73.400	72.280	0.895	73.370	72.115	1.030
1.1	26.408	264.1	300	Circular	73.000	71.700	1.000	73.000	71.600	1.100
2.4	34.220	244.4	300	Circular	73.370	72.115	0.955	73.370	71.975	1.095
2.3	51.680	248.5	375	Circular	73.370	71.975	1.020	73.520	71.767	1.378
2.2	4.460	637.1	450	Circular	73.520	71.767	1.303	73.500	71.760	1.290
2.0	7.582	126.4	450	Circular	73.500	71.760	1.290	73.000	71.700	0.850
3.0	22.102	55.3	150	Circular	73.640	72.250	1.240	73.630	71.850	1.630
1.3	4.627	92.5	450	Circular	73.630	71.850	1.330	73.500	71.800	1.250
1.2	5.983	59.8	450	Circular	73.500	71.800	1.250	73.000	71.700	0.850
4.2	4.164	83.3	225	Circular	73.000	71.600	1.175	73.000	71.550	1.225
4.1	2.889	57.8	225	Circular	73.000	71.550	1.225	72.500	71.500	0.775

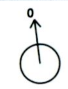
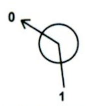
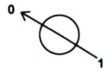
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.1	SWMH2.1	1350	Manhole	Adoptable	SWMH 4.3 (POND1)	1350	Manhole	Adoptable
2.7	SWMH2.8 (PERM PAV2)	1200	Manhole	Adoptable	SWMH2.7	1200	Manhole	Adoptable
2.6	SWMH2.7	1200	Manhole	Adoptable	SWMH2.6	1200	Manhole	Adoptable
2.5	SWMH2.6	1200	Manhole	Adoptable	SWMH2.5	1200	Manhole	Adoptable
1.1	SWMH1.1	1350	Manhole	Adoptable	SWMH 4.3 (POND1)	1350	Manhole	Adoptable
2.4	SWMH2.5	1200	Manhole	Adoptable	SWMH2.4	1350	Manhole	Adoptable
2.3	SWMH2.4	1350	Manhole	Adoptable	SWMH2.3	1350	Manhole	Adoptable
2.2	SWMH2.3	1350	Manhole	Adoptable	SWMH2.2	1350	Manhole	Adoptable
2.0	SWMH2.2	1350	Manhole	Adoptable	SWMH2.1	1350	Manhole	Adoptable
3.0	SWMH3.1	1200	Manhole	Adoptable	SWMH1.3	1350	Manhole	Adoptable
1.3	SWMH1.3	1350	Manhole	Adoptable	SWMH1.2	1350	Manhole	Adoptable
1.2	SWMH1.2	1350	Manhole	Adoptable	SWMH1.1	1350	Manhole	Adoptable
4.2	SWMH 4.3 (POND1)	1350	Manhole	Adoptable	SWMH4.2	1200	Manhole	Adoptable
4.1	SWMH4.2	1200	Manhole	Adoptable	SWMH4.1	1200	Manhole	Adoptable

Pipeline Schedule

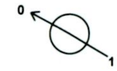
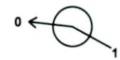
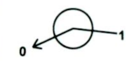
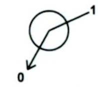
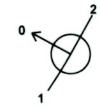
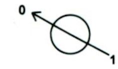
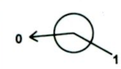
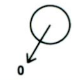
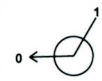
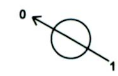
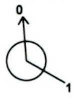
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.2	4.334	86.7	225	Circular	73.200	71.900	1.075	73.500	71.850	1.425
5.1	17.014	81.0	225	Circular	73.500	71.850	1.425	74.000	71.640	2.135
7.1	15.369	153.7	225	Circular	73.500	72.400	0.875	73.500	72.300	0.975
6.4	6.870	68.7	225	Circular	73.500	72.300	0.975	73.400	72.200	0.975
6.3	4.232	84.6	225	Circular	73.400	72.200	0.975	73.400	72.150	1.025
Oil 2	4.226	84.5	225	Circular	73.400	72.150	1.025	73.400	72.100	1.075
6.2	4.661	46.6	225	Circular	73.400	72.100	1.075	73.200	72.000	0.975
6.5	20.756	207.6	225	Circular	73.500	72.400	0.875	73.500	72.300	0.975
1.10	17.012	85.1	225	Circular	73.720	72.660	0.835	73.620	72.460	0.935
1.9	19.797	132.0	225	Circular	73.620	72.460	0.935	73.620	72.310	1.085
1.8	20.912	104.6	225	Circular	73.620	72.310	1.085	73.620	72.110	1.285
1.7	30.603	218.6	300	Circular	73.620	72.110	1.210	73.620	71.970	1.350
1.6	7.731	257.7	375	Circular	73.620	71.970	1.275	73.660	71.940	1.345
1.5	7.694	256.5	375	Circular	73.660	71.940	1.345	73.630	71.910	1.345
1.4	26.359	439.3	450	Circular	73.630	71.910	1.270	73.630	71.850	1.330
6.1	8.222	82.2	225	Circular	73.200	72.000	0.975	73.200	71.900	1.075

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.2	SWMH 5.2 (POND2)	1200	Manhole	Adoptable	SWMH5.1	1200	Manhole	Adoptable
5.1	SWMH5.1	1200	Manhole	Adoptable	SWMH CON	1200	Manhole	Adoptable
7.1	SWMH7.1	1200	Manhole	Adoptable	SWMH6.4	1200	Manhole	Adoptable
6.4	SWMH6.4	1200	Manhole	Adoptable	SWMH6.3	1200	Manhole	Adoptable
6.3	SWMH6.3	1200	Manhole	Adoptable	OIL 2	1200	Manhole	Adoptable
Oil 2	OIL 2	1200	Manhole	Adoptable	SWMH6.2	1200	Manhole	Adoptable
6.2	SWMH6.2	1200	Manhole	Adoptable	SWMH6.1	1200	Manhole	Adoptable
6.5	SWMH6.5	1200	Manhole	Adoptable	SWMH6.4	1200	Manhole	Adoptable
1.10	SWMH1.10	1200	Manhole	Adoptable	SWMH1.9	1200	Manhole	Adoptable
1.9	SWMH1.9	1200	Manhole	Adoptable	SWMH1.8 (PERM PAV1)	1200	Manhole	Adoptable
1.8	SWMH1.8 (PERM PAV1)	1200	Manhole	Adoptable	SWMH1.7	1200	Manhole	Adoptable
1.7	SWMH1.7	1200	Manhole	Adoptable	SWMH1.6	1350	Manhole	Adoptable
1.6	SWMH1.6	1350	Manhole	Adoptable	SWMH1.5	1350	Manhole	Adoptable
1.5	SWMH1.5	1350	Manhole	Adoptable	SWMH1.4	1350	Manhole	Adoptable
1.4	SWMH1.4	1350	Manhole	Adoptable	SWMH1.3	1350	Manhole	Adoptable
6.1	SWMH6.1	1200	Manhole	Adoptable	SWMH 5.2 (POND2)	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH1.10	696959.009	732946.994	73.720	1.060	1200		0	1.10	72.660	225
SWMH1.9	696956.927	732963.878	73.620	1.160	1200		1	1.10	72.460	225
							0	1.9	72.460	225
SWMH1.8 (PERM PAV1)	696940.159	732974.402	73.620	1.310	1200		1	1.9	72.310	225
							0	1.8	72.310	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH1.7	696922.175	732985.074	73.620	1.510	1200	 1	1.8	72.110	225
						0	1.7	72.110	300
SWMH1.6	696895.331	732999.770	73.620	1.650	1350	 1	1.7	71.970	300
						0	1.6	71.970	375
SWMH1.5	696887.648	733000.634	73.660	1.720	1350	 1	1.6	71.940	375
						0	1.5	71.940	375
SWMH1.4	696880.637	732997.465	73.630	1.720	1350	 1	1.5	71.910	375
						0	1.4	71.910	450
SWMH1.3	696867.715	732974.491	73.630	1.780	1350	 1	3.0	71.850	150
						2	1.4	71.850	450
						0	1.3	71.850	450
SWMH1.2	696863.639	732976.680	73.500	1.700	1350	 1	1.3	71.800	450
						0	1.2	71.800	450
SWMH1.1	696858.431	732979.624	73.000	1.300	1350	 1	1.2	71.700	450
						0	1.1	71.700	300
SWMH3.1	696856.332	732955.546	73.640	1.390	1200				
						0	3.0	72.250	150
SWMH2.8 (PERM PAV2)	696911.177	732873.033	73.500	1.100	1200				
						0	2.7	72.400	225
SWMH2.7	696906.098	732864.385	73.430	1.080	1200	 1	2.7	72.350	225
						0	2.6	72.350	225
SWMH2.6	696894.118	732864.082	73.400	1.120	1200	 1	2.6	72.280	225
						0	2.5	72.280	225
SWMH2.5	696865.526	732880.746	73.370	1.255	1200	 1	2.5	72.115	225
						0	2.4	72.115	300
SWMH2.4	696835.796	732897.691	73.370	1.395	1350	 1	2.4	71.975	300
						0	2.3	71.975	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH2.3	696831.875	732949.222	73.520	1.753	1350	1	2.3	71.767	375
						0	2.2	71.767	450
SWMH2.2	696832.621	732953.619	73.500	1.740	1350	1	2.2	71.760	450
						0	2.0	71.760	450
SWMH2.1	696834.619	732960.933	73.000	1.300	1350	1	2.0	71.700	450
						0	2.1	71.700	450
SWMH CON	696875.947	732787.013	74.000	2.360	1200	1	5.1	71.640	225
SWMH5.1	696868.547	732802.333	73.500	1.650	1200	1	5.2	71.850	225
						0	5.1	71.850	225
SWMH 5.2 (POND2)	696866.652	732806.231	73.200	1.300	1200	1	6.1	71.900	225
						0	5.2	71.900	225
SWMH6.1	696860.282	732811.430	73.200	1.200	1200	1	6.2	72.000	225
						0	6.1	72.000	225
SWMH6.2	696858.243	732815.621	73.400	1.300	1200	1	Oil 2	72.100	225
						0	6.2	72.100	225
OIL 2	696861.811	732817.886	73.400	1.250	1200	1	6.3	72.150	225
						0	Oil 2	72.150	225
SWMH6.3	696865.662	732819.642	73.400	1.200	1200	1	6.4	72.200	225
						0	6.3	72.200	225
SWMH6.4	696862.321	732825.645	73.500	1.200	1200	1	7.1	72.300	225
						2	6.5	72.300	225
						0	6.4	72.300	225
SWMH7.1	696848.956	732818.056	73.500	1.100	1200	0	7.1	72.400	225
SWMH6.5	696880.647	732835.391	73.500	1.100	1200	0	6.5	72.400	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH 4.3 (POND1)	696832.127	732977.277	73.000	1.800	1350	1	1.1	71.600	300
						2	2.1	71.200	450
						0	4.2	71.600	225
SWMH4.2	696827.964	732977.362	73.000	1.450	1200	1	4.2	71.550	225
						0	4.1	71.550	225
SWMH4.1	696825.075	732977.362	72.500	1.000	1200	1	4.1	71.500	225

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	1440
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	0.0
M5-60 (mm)	16.800	Check Discharge Rate(s)	✓
Ratio-R	0.270	1 year (l/s)	2.4
Summer CV	0.750	30 year (l/s)	5.6
Winter CV	0.840	100 year (l/s)	7.1
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year 1440 minute (m³)	442

Storm Durations

1440

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	1.434	Betterment (%)	0
SAAR (mm)	754	QBar	2.9
Soil Index	2	Q 1 year (l/s)	2.4
SPR	0.30	Q 30 year (l/s)	5.6
Region	11	Q 100 year (l/s)	7.1
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.434	Storm Duration (mins)	1440
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.346
CWI	116.148	Runoff Volume (m³)	442

Node SWMH1.8 (PERM PAV1) Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	72.310	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node SWMH2.8 (PERM PAV2) Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	72.400	Product Number	CTL-SHE-0048-1000-0900-1000
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node SWMH4.2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	71.550	Product Number	CTL-SHE-0074-2700-1300-2700
Design Depth (m)	1.300	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.7	Min Node Diameter (mm)	1200

Node SWMH5.1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	71.850	Product Number	CTL-SHE-0028-4000-1100-4000
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

Node SWMH 4.3 (POND1) Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	71.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	900.0	0.0	1.200	900.0	0.0

Node SWMH 5.2 (POND2) Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	71.900
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	400.0	0.0	1.300	400.0	0.0

Node SWMH1.8 (PERM PAV1) Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	73.000	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	750	Depth (m)	0.350
Safety Factor	1.0	Width (m)	12.000	Inf Depth (m)	
Porosity	0.33	Length (m)	83.000		

Node SWMH2.8 (PERM PAV2) Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	73.000	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	360	Depth (m)	0.350
Safety Factor	1.0	Width (m)	12.000	Inf Depth (m)	0.350
Porosity	0.33	Length (m)	83.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 1440 minute summer	16.607	4.451	100 year +20% CC 1440 minute winter	11.161	4.451

Results for 100 year +20% CC 1440 minute summer. 2880 minute analysis at 30 minute timestep. Mass balance: 80.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	SWMH1.10	990	73.298	0.638	0.8	0.7221	0.0000	SURCHARGED
1440 minute summer	SWMH1.9	990	73.298	0.838	3.3	0.9483	0.0000	SURCHARGED
1440 minute summer	SWMH1.8 (PERM PAV1)	990	73.298	0.988	7.8	71.9380	0.0000	SURCHARGED
1440 minute summer	SWMH1.7	1440	72.498	0.388	15.1	0.4388	0.0000	SURCHARGED
1440 minute summer	SWMH1.6	1350	72.496	0.526	15.1	0.7532	0.0000	SURCHARGED
1440 minute summer	SWMH1.5	1350	72.498	0.558	14.9	0.7987	0.0000	SURCHARGED
1440 minute summer	SWMH1.4	1350	72.501	0.591	18.4	0.8463	0.0000	SURCHARGED
1440 minute summer	SWMH1.3	1650	72.523	0.673	235.3	0.9637	0.0000	SURCHARGED
1440 minute summer	SWMH1.2	1350	72.631	0.831	283.2	1.1885	0.0000	SURCHARGED
1440 minute summer	SWMH1.1	1650	72.548	0.848	190.8	1.2128	0.0000	SURCHARGED
1440 minute summer	SWMH3.1	1350	72.460	0.210	2.1	0.2380	0.0000	SURCHARGED
1440 minute summer	SWMH2.8 (PERM PAV2)	930	73.154	0.754	3.1	24.3842	0.0000	SURCHARGED
1440 minute summer	SWMH2.7	1440	72.525	0.175	6.8	0.1979	0.0000	OK
1440 minute summer	SWMH2.6	1440	72.528	0.248	12.0	0.2810	0.0000	SURCHARGED
1440 minute summer	SWMH2.5	1440	72.550	0.435	23.1	0.4925	0.0000	SURCHARGED
1440 minute summer	SWMH2.4	1440	72.563	0.588	23.1	0.8408	0.0000	SURCHARGED
1440 minute summer	SWMH2.3	1050	72.525	0.758	79.2	1.0854	0.0000	SURCHARGED
1440 minute summer	SWMH2.2	1020	72.639	0.879	189.9	1.2578	0.0000	SURCHARGED
1440 minute summer	SWMH2.1	1050	72.506	0.806	40.2	1.1531	0.0000	SURCHARGED
1440 minute summer	SWMH CON	750	71.651	0.011	0.3	0.0000	0.0000	OK
1440 minute summer	SWMH5.1	1440	72.037	0.187	1.1	0.2112	0.0000	OK
1440 minute summer	SWMH 5.2 (POND2)	1440	72.037	0.137	3.5	54.8455	0.0000	OK
1440 minute summer	SWMH6.1	1290	72.038	0.038	3.2	0.0430	0.0000	OK
1440 minute summer	SWMH6.2	750	72.133	0.033	3.2	0.0371	0.0000	OK
1440 minute summer	OIL 2	750	72.189	0.039	3.2	0.0440	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
0 minute summer	SWMH1.10	1.10	SWMH1.9	0.9	0.183	0.016	0.6766	
0 minute summer	SWMH1.9	1.9	SWMH1.8 (PERM PAV1)	3.3	0.082	0.072	0.7873	
0 minute summer	SWMH1.8 (PERM PAV1)	1.8	SWMH1.7	4.8	0.352	0.095	0.7945	
0 minute summer	SWMH1.7	1.7	SWMH1.6	15.1	0.747	0.202	2.1550	
0 minute summer	SWMH1.6	1.6	SWMH1.5	14.9	0.619	0.120	0.8527	
0 minute summer	SWMH1.5	1.5	SWMH1.4	14.7	0.624	0.118	0.8486	
0 minute summer	SWMH1.4	1.4	SWMH1.3	17.5	0.632	0.114	4.1764	
0 minute summer	SWMH1.3	1.3	SWMH1.2	-182.5	-1.152	-0.543	0.7331	
0 minute summer	SWMH1.2	1.2	SWMH1.1	159.2	1.005	0.380	0.9480	
0 minute summer	SWMH1.1	1.1	SWMH 4.3 (POND1)	17.0	0.241	0.249	1.8596	
0 minute summer	SWMH3.1	3.0	SWMH1.3	2.6	0.148	0.109	0.3891	
0 minute summer	SWMH2.8 (PERM PAV2)	2.7	SWMH2.7	6.8	0.398	0.187	0.2598	
0 minute summer	SWMH2.7	2.6	SWMH2.6	12.0	0.401	0.302	0.4366	
0 minute summer	SWMH2.6	2.5	SWMH2.5	13.9	0.351	0.381	1.3162	
0 minute summer	SWMH2.5	2.4	SWMH2.4	23.1	0.943	0.326	2.4097	
0 minute summer	SWMH2.4	2.3	SWMH2.3	22.9	0.553	0.181	5.7002	
0 minute summer	SWMH2.3	2.2	SWMH2.2	74.1	0.571	0.584	0.7067	
0 minute summer	SWMH2.2	2.0	SWMH2.1	-48.0	0.668	-0.167	1.2013	
0 minute summer	SWMH2.1	2.1	SWMH 4.3 (POND1)	22.2	0.142	0.039	2.6195	
0 minute summer	SWMH5.1	5.1	SWMH CON	0.3	0.363	0.004	0.0117	38.9
0 minute summer	SWMH 5.2 (POND2)	5.2	SWMH5.1	1.1	0.125	0.019	0.1311	
0 minute summer	SWMH6.1	6.1	SWMH 5.2 (POND2)	3.2	0.653	0.056	0.1214	
0 minute summer	SWMH6.2	6.2	SWMH6.1	3.2	0.840	0.042	0.0178	
0 minute summer	OIL 2	Oil 2	SWMH6.2	3.2	0.789	0.057	0.0172	

Results for 100 year +20% CC 1440 minute summer. 2880 minute analysis at 30 minute timestep. Mass balance: 80.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	SWMH6.3	750	72.239	0.039	3.2	0.0439	0.0000	OK
1440 minute summer	SWMH6.4	750	72.336	0.036	3.2	0.0402	0.0000	OK
1440 minute summer	SWMH7.1	750	72.425	0.025	1.1	0.0284	0.0000	OK
1440 minute summer	SWMH6.5	750	72.437	0.037	2.1	0.0423	0.0000	OK
1440 minute summer	SWMH 4.3 (POND1)	1410	72.447	1.247	35.2	674.9095	0.0000	SURCHARGED
1440 minute summer	SWMH4.2	1410	72.447	0.897	4.7	1.0147	0.0000	SURCHARGED
1440 minute summer	SWMH4.1	630	71.529	0.029	2.5	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	SWMH6.3	6.3	OIL 2	3.2	0.702	0.057	0.0193	
1440 minute summer	SWMH6.4	6.4	SWMH6.3	3.2	0.747	0.051	0.0294	
1440 minute summer	SWMH7.1	7.1	SWMH6.4	1.1	0.346	0.026	0.0493	
1440 minute summer	SWMH6.5	6.5	SWMH6.4	2.1	0.504	0.058	0.0865	
1440 minute summer	SWMH 4.3 (POND1)	4.2	SWMH4.2	4.7	0.175	0.082	0.1656	
1440 minute summer	SWMH4.2	4.1	SWMH4.1	2.5	0.775	0.036	0.0092	370.6

Results for 100 year +20% CC 1440 minute winter. 2880 minute analysis at 30 minute timestep. Mass balance: 98.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	SWMH1.10	1080	73.340	0.680	0.6	0.7695	0.0000	SURCHARGED
1440 minute winter	SWMH1.9	1080	73.340	0.880	2.5	0.9957	0.0000	FLOOD RISK
1440 minute winter	SWMH1.8 (PERM PAV1)	1080	73.340	1.030	5.9	85.7627	0.0000	FLOOD RISK
1440 minute winter	SWMH1.7	1560	72.736	0.626	12.4	0.7076	0.0000	SURCHARGED
1440 minute winter	SWMH1.6	1560	72.739	0.769	13.7	1.1007	0.0000	SURCHARGED
1440 minute winter	SWMH1.5	1950	72.729	0.789	15.1	1.1294	0.0000	SURCHARGED
1440 minute winter	SWMH1.4	1950	72.748	0.838	23.3	1.1995	0.0000	SURCHARGED
1440 minute winter	SWMH1.3	2340	72.816	0.966	165.0	1.3824	0.0000	SURCHARGED
1440 minute winter	SWMH1.2	1680	72.932	1.132	251.0	1.6205	0.0000	SURCHARGED
1440 minute winter	SWMH1.1	2340	72.725	1.025	113.4	1.4667	0.0000	FLOOD RISK
1440 minute winter	SWMH3.1	1950	72.710	0.460	3.2	0.5207	0.0000	SURCHARGED
1440 minute winter	SWMH2.8 (PERM PAV2)	1020	73.163	0.763	2.3	27.2137	0.0000	SURCHARGED
1440 minute winter	SWMH2.7	1530	72.856	0.506	5.0	0.5720	0.0000	SURCHARGED
1440 minute winter	SWMH2.6	1530	72.855	0.575	7.2	0.6506	0.0000	SURCHARGED
1440 minute winter	SWMH2.5	1530	72.853	0.738	17.6	0.8352	0.0000	SURCHARGED
1440 minute winter	SWMH2.4	1530	72.858	0.883	18.6	1.2629	0.0000	SURCHARGED
1440 minute winter	SWMH2.3	1320	72.720	0.953	25.2	1.3633	0.0000	SURCHARGED
1440 minute winter	SWMH2.2	1530	72.938	1.177	61.1	1.6850	0.0000	SURCHARGED
1440 minute winter	SWMH2.1	1260	72.652	0.952	76.1	1.3627	0.0000	SURCHARGED
1440 minute winter	SWMH CON	720	71.651	0.011	0.3	0.0000	0.0000	OK
1440 minute winter	SWMH5.1	1410	72.064	0.214	1.0	0.2420	0.0000	OK
1440 minute winter	SWMH 5.2 (POND2)	1410	72.064	0.164	2.7	65.7618	0.0000	OK
1440 minute winter	SWMH6.1	1350	72.064	0.064	2.5	0.0726	0.0000	OK
1440 minute winter	SWMH6.2	750	72.129	0.029	2.5	0.0326	0.0000	OK
1440 minute winter	OIL 2	750	72.184	0.034	2.5	0.0388	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
40 minute winter	SWMH1.10	1.10	SWMH1.9	1.0	0.183	0.017	0.6766	
40 minute winter	SWMH1.9	1.9	SWMH1.8 (PERM PAV1)	2.5	0.076	0.055	0.7873	
40 minute winter	SWMH1.8 (PERM PAV1)	1.8	SWMH1.7	5.8	0.352	0.114	0.8317	
40 minute winter	SWMH1.7	1.7	SWMH1.6	13.7	0.706	0.184	2.1550	
40 minute winter	SWMH1.6	1.6	SWMH1.5	15.1	0.597	0.121	0.8527	
40 minute winter	SWMH1.5	1.5	SWMH1.4	21.9	0.599	0.176	0.8486	
40 minute winter	SWMH1.4	1.4	SWMH1.3	27.2	0.598	0.177	4.1764	
40 minute winter	SWMH1.3	1.3	SWMH1.2	159.5	1.007	0.475	0.7331	
40 minute winter	SWMH1.2	1.2	SWMH1.1	98.7	0.623	0.236	0.9480	
40 minute winter	SWMH1.1	1.1	SWMH 4.3 (POND1)	23.1	0.328	0.340	1.8596	
40 minute winter	SWMH3.1	3.0	SWMH1.3	-2.8	-0.159	-0.117	0.3891	
40 minute winter	SWMH2.8 (PERM PAV2)	2.7	SWMH2.7	3.3	0.398	0.091	0.3989	
40 minute winter	SWMH2.7	2.6	SWMH2.6	6.6	0.401	0.166	0.4766	
40 minute winter	SWMH2.6	2.5	SWMH2.5	10.4	0.261	0.284	1.3162	
40 minute winter	SWMH2.5	2.4	SWMH2.4	18.6	0.850	0.262	2.4097	
40 minute winter	SWMH2.4	2.3	SWMH2.3	24.9	0.572	0.197	5.7002	
40 minute winter	SWMH2.3	2.2	SWMH2.2	61.1	0.596	0.481	0.7067	
40 minute winter	SWMH2.2	2.0	SWMH2.1	76.1	0.738	0.265	1.2013	
40 minute winter	SWMH2.1	2.1	SWMH 4.3 (POND1)	60.7	0.383	0.108	2.6195	
40 minute winter	SWMH5.1	5.1	SWMH CON	0.3	0.363	0.004	0.0117	39.1
40 minute winter	SWMH 5.2 (POND2)	5.2	SWMH5.1	1.0	0.138	0.018	0.1517	
40 minute winter	SWMH6.1	6.1	SWMH 5.2 (POND2)	2.6	0.677	0.045	0.1653	
40 minute winter	SWMH6.2	6.2	SWMH6.1	2.5	0.784	0.033	0.0236	
40 minute winter	OIL 2	Oil 2	SWMH6.2	2.5	0.740	0.044	0.0143	

Results for 100 year +20% CC 1440 minute winter. 2880 minute analysis at 30 minute timestep. Mass balance: 98.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	SWMH6.3	750	72.234	0.034	2.5	0.0386	0.0000	OK
1440 minute winter	SWMH6.4	750	72.331	0.031	2.5	0.0355	0.0000	OK
1440 minute winter	SWMH7.1	750	72.423	0.023	0.9	0.0258	0.0000	OK
1440 minute winter	SWMH6.5	750	72.433	0.033	1.6	0.0370	0.0000	OK
1440 minute winter	SWMH 4.3 (POND1)	1470	72.648	1.448	60.7	855.8874	0.0000	SURCHARGED
1440 minute winter	SWMH4.2	1470	72.648	1.098	3.9	1.2419	0.0000	SURCHARGED
1440 minute winter	SWMH4.1	1470	71.529	0.029	2.5	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	SWMH6.3	6.3	OIL 2	2.5	0.660	0.044	0.0160	
1440 minute winter	SWMH6.4	6.4	SWMH6.3	2.5	0.702	0.040	0.0245	
1440 minute winter	SWMH7.1	7.1	SWMH6.4	0.9	0.334	0.022	0.0418	
1440 minute winter	SWMH6.5	6.5	SWMH6.4	1.6	0.464	0.045	0.0716	
1440 minute winter	SWMH 4.3 (POND1)	4.2	SWMH4.2	3.9	0.143	0.068	0.1656	
1440 minute winter	SWMH4.2	4.1	SWMH4.1	2.5	0.776	0.036	0.0092	404.4