

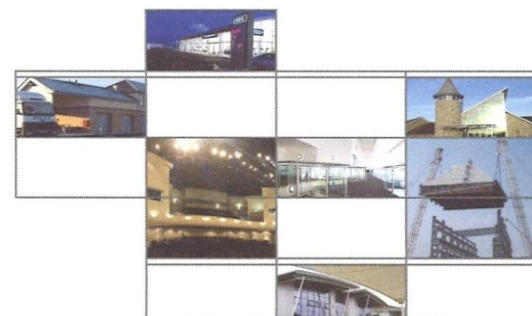
PRELIMINARY DRAINAGE STRATEGY REPORT

DEVELOPMENT SITE MARGAM PORT TALBOT

CLIENT:

Sandvik Osprey Ltd
Milland Road
NEATH
SA11 1NJ

JOB REF	ISSUE	PREPARED BY	CHECKED BY	APPROVED BY	DATE
20.62	1	KJ	TT	KJT	01.10.2021
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1.0 INTRODUCTION

1.1 BACKGROUND

James & Nicholas LLP have been engaged by Sandvik Osprey Ltd ('Sandvik') to prepare a drainage strategy for Sandvik's proposed new metal powders manufacturing facility in Margam, Port Talbot.

The proposed development comprises a new production unit (with associated warehousing, service area, substation and yard area) and new office and amenity blocks, parking spaces and other associated works.

1.2 SuDS LEGISLATION

Schedule 3 of the Floods and Water Management Act 2010 (FWMA 2010) was enacted in Wales in January 2019 and as a result, all proposed new developments with a construction area of more than 100 m² are required to incorporate (SuDS) in accordance with Welsh Government's SuDS Statutory Guidance. This guidance includes a requirement for the SuDS design to be approved by the local SuDS Approving Body (SAB) before construction works begin.

1.3 REFERENCES

Our proposed drainage strategy has been developed in accordance with and with reference to the following:-

- CIRIA SuDS Manual C753 published in 2015
- BS EN 12056-2:2000 Gravity drainage systems inside buildings - Part 2: sanitary pipework, layout and calculation.
- Sewers for Adoption 7th Edition by WRc plc
- Preliminary infiltration test results provided by Terra Firma (Wales) Ltd in advance of issue of their formal Geotechnical Site Investigation report.
- Flood Consequences Assessment Report ref. JBAU-XX-XX-RP-Z-0001-D3-C01 by JBA Consulting dated August 2021

1.4 DESIGNERS

Designed by: - Karl Jones BSc Civil Engineering (Hons) MSc

Checked by: - Kevin Tobin MSc DIC CEng MICE

Approved by: - Kevin Tobin MSc DIC CEng MICE

2.0 EXISTING SITE

2.1 SITE LOCATION

The site is located to the south of Port Talbot immediately adjacent to and to the west of Junction 38 of the M4 Motorway. It comprises approximately 9 hectares of previously undeveloped (greenfield) land currently occupied by fields and woodlands and sloping generally east-to-west (ref. Figure 1 below, site outlined in red).

There are 2 no. biomass energy plants located immediately to the west of the site and the Port Talbot Tata Steel plant and an industrial gas unit operated by BOC Ltd are also both located to the west of the site.



Figure 1 – Site Location Plan

2.2 SITE GEOLOGY

2.2.1 Site investigation works are currently being undertaken by Terra Firma (Wales) Ltd.

An initial Desk Top Study was carried out by Terra Firma (Wales) Ltd (report ref. 060521-16719-ISSUE dated May 2021) and we have been advised that subsequent trial pitting has indicated the ground profile to comprise the following:-

- Topsoil (0.3 – 0.5 m)
- Firm to stiff clay (1.0 – 2.0 m)
- Sands and Gravels to depth
- Middle Coal Measures

We have also been advised that infiltration tests undertaken by Terra Firma (Wales) Ltd indicate that the infiltration rates within the sands and gravels vary between 1.12×10^{-4} m/s to 9.77×10^{-5} m/s, i.e. the site appears to have a very good soakaway potential.

2.3 SITE FLOOD RISK

- 2.3.1 JBA Consulting have been commissioned by Sandvik to prepare a Flood Consequence Assessment (FCA) in accordance with Welsh Government ('WG') guidance on development and flood risk, as set out in Welsh Assembly Government Technical Advice Note 15 dated 2004..
- 2.3.2 JBA Consulting Flood Consequence Assessment report ref. GLR-JBAU-XX-XX-RP-Z-0001-D3-C01 dated August 2021 concluded that although a small part of the proposed development site falls within Zone C2 and Zone B of NRW's Development Advice Maps, no development is proposed in the very limited areas of Zone C2.

The assessment report notes that although a small part of the proposed site is shown to be at risk of flooding from fluvial and surface water and small watercourses flood risk sources according to the National Resources Wales Flood Risk Assessment Wales Maps, flood risk from groundwater, sewers and reservoirs is considered to be low and detailed assessment of tidal flood risk shows that the proposed development site and its access roads are predicted to be flood free during both the 2021 0.5% AEP and 0.1% AEP events and the 2096 0.5% AEP and 0.1% AEP flood events.

2.4 EXISTING DRAINAGE INFRASTRUCTURE

2.4.1 FOUL DRAINAGE

The site is not currently served by a dedicated foul sewerage system, however a 450 mm diameter vitrified clay combined adopted sewer ('the Combined Adopted Sewer') currently crosses the site running parallel to and within its eastern boundary (Ref. DCWW plan – copy included, ref. Appendix A).

The Combined Adopted Sewer runs northwards draining into a 525 mm diameter concrete pipe located within the roundabout on the A48 at its junction with Harbour Way.

2.4.2 SURFACE WATER DRAINAGE

The site is currently 'greenfield' and mostly comprised of grassland and it is not served by a piped surface water system.

An existing drainage ditch crosses the site running east-to-west and draining to a culvert (referred to as 'Culvert A' on James & Nicholas LLP drawings) located on the western boundary of the site. This culvert runs beneath the existing access road that serves the 2 no. two biomass energy plants located adjacent to the site and it drains into the Margam Moors drainage system (comprising Lower Mother, Middle Mother and Upper Mother ditches).

A second culvert (referred to as 'Culvert B' on James & Nicholas LLP drawings) is located at the north-west corner of the site. This culvert appears to serve nearby highways drainage and to eventually discharge to the Margam Moors drainage system via a balancing pond located outside the site to its north-west.

3.0 PROPOSED FOUL DRAINAGE DESIGN

3.1 PROPOSED FOUL DRAINAGE DESCRIPTION

Due to the topography of the site (which falls from east-to-west) it is not possible to connect directly to the existing Combined Adopted Sewer that runs along the eastern boundary of the site (ref. section 2.4.1, above).

It is therefore proposed to drain to a wet well and pumping station located at a low point adjacent to the western boundary of the site and to pump the effluent from the tank via a rising main prior to discharging it via a connection to the Combined Adopted Sewer.

The proposed foul drainage layout is illustrated on Drawing No. 20.62 C07 Rev A (Overall Proposed Foul Drainage Plan) by James & Nicholas LLP (copy appended, ref. Appendix B).

3.2 PROPOSED FOUL DRAINAGE CALCULATIONS

3.2.1 The design waste water flow rates for the 3 no. below-listed buildings have been calculated in accordance with Table 2 (Discharge Units) and Table 3 (Typical Frequency Factors (K)) of BS EN 12056-2:2000 Gravity drainage systems inside buildings – Part 2 (ref. Figures 2 and 3, below).

Table 2 — Discharge units (DU)

Appliance	System I	System II	System III	System IV
	DU l/s	DU l/s	DU l/s	DU l/s
Wash basin, bidet	0,5	0,3	0,3	0,3
Shower without plug	0,6	0,4	0,4	0,4
Shower with plug	0,8	0,5	1,3	0,5
Single urinal with cistern	0,8	0,5	0,4	0,5
Urinal with flushing valve	0,5	0,3	-	0,3
Slab urinal	0,2*	0,2*	0,2*	0,2*
Bath	0,8	0,6	1,3	0,5
Kitchen sink	0,8	0,6	1,3	0,5
Dishwasher (household)	0,8	0,6	0,2	0,5
Washing machine up to 6 kg	0,8	0,6	0,6	0,5
Washing machine up to 12 kg	1,5	1,2	1,2	1,0
WC with 4,0 l cistern	**	1,8	**	**
WC with 6,0 l cistern	2,0	1,8	1,2 to 1,7***	2,0
WC with 7,5 l cistern	2,0	1,8	1,4 to 1,8***	2,0
WC with 9,0 l cistern	2,5	2,0	1,6 to 2,0***	2,5
Floor gully DN 50	0,8	0,9	-	0,6
Floor gully DN 70	1,5	0,9	-	1,0
Floor gully DN 100	2,0	1,2	-	1,3
* Per person. ** Not permitted. *** Depending upon type (valid for WC's with siphon flush cistern only). - Not used or no data.				

Figure 2 - Table 2 of BS EN 12056-2:2000 Gravity drainage systems inside buildings – Part 2

Table 3 — Typical frequency factors (K)

Usage of appliances	K
Intermittent use, e.g. in dwelling, guesthouse, office	0,5
Frequent use, e.g. in hospital, school, restaurant, hotel	0,7
Congested use, e.g. in toilets and/or showers open to public	1,0
Special use, e.g. laboratory	1,2

Figure 3 – Table 3 of BS EN 12056-2:2000 Gravity drainage systems inside buildings – Part 2

In accordance with BS EN 12056-2:2000 Gravity drainage systems inside buildings – Part 2 the waste water flow rate is calculated as follows: -

$$Q_{ww} = K \sqrt{\sum DU}$$

Where:

Q_{ww} = Waste water flow rate (l/s)

K = Frequency Factor

$\sum DU$ = Sum of Discharge Units

The proposed installations will be System II and comprise WCs up to 4.0 l cistern, wash basins, single urinals with cistern, showers with plugs and kitchen sinks.

The applicable frequency factor (K) for an office or similar is 0.5 (intermittent use).

3.2.2 OFFICE BLOCK WASTE WATER FLOW RATE

The total flow rate for the proposed office block is 35.8 l/s, calculated as shown below: -

Appliance Type	No. of Appliances	Discharge Rate (DU) (l/s)	$\sum DU$ (l/s)
WC	15	1.8	27
Wash Basin	15	0.3	4.5
Urinal	4	0.5	2
Shower	1	0.5	0.5
Kitchen Sink	3	0.6	1.8
Total Flow Rate (l/s)			35.8

The waste water flow rate for the proposed office block ($Q_{wwOffice}$) is therefore 3.0 l/s, calculated as below:

$$Q_{wwOffice} = K \sqrt{\sum DU} \text{ l/s}$$

$$Q_{wwOffice} = 0.5 \sqrt{35.8} \text{ l/s}$$

$$Q_{wwOffice} = 3.0 \text{ l/s}$$

3.2.3 AMENITY BLOCK WASTE WATER FLOW RATE

The total flow rate for the proposed amenity block is 20.9 l/s, calculated as shown below: -

Appliance Type	No of Appliances	Discharge Rate (DU) (l/s)	ΣDU (l/s)
W/C	6	1.8	10.8
Wash Basin	8	0.3	2.4
Urinals	4	0.5	2
Shower	9	0.5	4.5
Kitchen Sinks	2	0.6	1.2
Total Flow Rate (l/s)			20.9

The waste water flow rate for the proposed amenity block ($Q_{ww}Amenity$) is therefore 2.29 l/s, calculated as below:

$$Q_{ww}Amenity = K\sqrt{\Sigma DU} \text{ l/s}$$

$$Q_{ww}Amenity = 0.5\sqrt{20.9} \text{ l/s}$$

$$Q_{ww}Amenity = 2.29 \text{ l/s}$$

3.2.4 PRODUCTION UNIT WASTE WATER FLOW RATE

The total flow rate for the proposed production unit (with associated warehousing, service area, substation and yard area) is 18.0 l/s, calculated as shown below.

NB For the production unit, 'other flows' of 3.0 l/s have been included to allow for any water discharge from the machinery that may occur (this value is believed to be a conservative estimate and it will be subject to alteration once the actual flow rates from machinery are known): -

Appliance Type	No of Appliances	Discharge Rate (DU) (l/s)	ΣDU (l/s)
W/C	6	1.8	10.8
Wash Basin	9	0.3	2.7
Urinals	3	0.5	1.5
Other Flows	-	-	3
Total Flow Rate (l/s)			18.0

The waste water flow rate for the proposed Production Unit ($Q_{ww}Production$) is therefore 2.12 l/s, calculated as below:

$$Q_{ww}Production = K\sqrt{\Sigma DU} \text{ l/s}$$

$$Q_{ww}Production = 0.5\sqrt{18.0} \text{ l/s}$$

$$Q_{ww}Production = 2.12 \text{ l/s}$$

3.2.5 TOTAL WASTE WATER FLOW RATE

$$\text{Total waste water flow rate (l/s)} = Q_{ww}Office + Q_{ww}Amenity + Q_{ww}Production$$

$$\text{Total waste water flow rate (l/s)} = 3.0 + 2.29 + 2.12$$

$$\text{Total waste water flow rate (l/s)} = 7.4 \text{ l/s}$$

It is therefore proposed that the pumping station will pump waste water at a rate of 7.4 l/s into the existing Combined Adopted Sewer located on the eastern boundary of the site.

DCWW will be consulted to ensure that this proposed additional waste water flow can be accommodated within their existing system.

4.0 SuDS STANDARDS

4.1.1 DESIGN GUIDANCE OVERVIEW

Welsh Government's 2019 Sustainable Urban Drainage Systems (SuDS) Statutory Guidance requires that all new developments where the construction area exceeds 100m² are required to incorporate SuDS complying with six standards numbered S1 to S6, as follows: -

- S1 – Runoff destination
- S2 – Hydraulic control
- S3 – Water quality
- S4 – Amenity
- S5 – Biodiversity
- S6 – Construction, operation and maintenance

The overall proposed surface water drainage layout is illustrated on Drawing No. 20.62 C09 (Proposed Surface Drainage Masterplan) by James & Nicholas LLP (copy appended, ref. Appendix C).

Given the large scale of the proposed development, the site has been split into 5 no. sub-catchment surface water drainage areas, as follows:-

- Area 1 – Office Block and North Car Park

This area comprises the office block and the north car park serving the office block along with its adjacent access road.

It is proposed that this area will be served by an attenuation pond.

- Area 2 – Office Block South Car Park

This area comprises the south car park serving the office block along with its adjacent access road.

It is proposed that this area will be served by a cellular soakaway.

- Area 3 – Main Car Park

This area comprises the main car park along with its adjacent access roads.

It is proposed that this area will be served by an infiltration basin.

- Area 4 – Production Unit (West)

This area comprises the western portion of the production unit, the service area, the substation and the adjacent access roads.

It is proposed that this area will be served by an attenuation tank.

- Area 5 – Production Unit (East)

This area comprises the eastern portion of the production unit and its adjacent yard area and the amenity block.

It is proposed that this area will be served by a cellular soakaway.

- Area 6 – HGV Access Road

This area comprises the access road that will enter the site from the Northern boundary of the site and providing access to and from the Production Unit and its associated service buildings.

It is proposed that the access road will be served by an infiltration filter strip that will run along the length of the western perimeter of the road.

The above sub-catchment areas and associated proposed surface water drainage will be discussed in further detail in the SuDS Drainage Design section (ref. Section 5.0, below).

Each of the Welsh Government SuDS standards has been addressed within the proposed designs, as described in Sections 4.2 to 4.6, below.

4.2 S1 – RUNOFF DESTINATION

4.2.1 Priority Level 1 – Collection of rainwater for use

There is a potential opportunity to collect rainwater to reuse for the cooling tower required for the furnace. The feasibility of doing this is currently being investigated/assessed by Sandvik.

4.2.2 Priority Level 2 – Surface water runoff infiltrated to ground

The preliminary results of infiltration testing carried out on site indicate that the site has very good soakaway potential. It is therefore proposed that a significant portion of the surface water runoff will either directly infiltrate into the ground or will be collected and infiltrated into the ground via an infiltration basin and cellular soakaways.

4.2.3 Priority Level 3 – Surface water runoff discharged to watercourse

An existing drainage ditch crosses the site running east-to-west draining to a culvert located on the western boundary of the site. This culvert (referred to as 'Culvert A' on James & Nicholas LLP drawings) then runs beneath the existing access road that serves the two adjacent biomass plants and drains into the Margam Moors drainage system (comprising Lower, Middle and Upper Mother ditches). It is proposed that the existing drainage ditch will be used to dispose of a portion of the surface water runoff (i.e. the surface water runoff from Area 4) to Culvert A, via an attenuation tank.

A second culvert (referred to as 'Culvert B' on James & Nicholas LLP drawings) is located at the north-west corner of the site. This culvert appears to discharge to the Margam Moors drainage system via a balancing pond located outside the site to its north-west. It is proposed to use Culvert B to dispose of a portion of the surface water runoff (i.e. the surface water runoff from Area 1) via an attenuation pond.

4.3 S2 – HYDRAULIC CONTROL

4.3.1 Hydraulic control of surface water runoff will be achieved utilising generally-accepted methods, primarily infiltration and attenuation.

4.3.2 The underlying soil profile of the site appears to present a very good opportunity for infiltration and this should prevent runoff from occurring following a 'first flush' 5 mm rainfall event. It is

proposed that the natural infiltration processes will be encouraged by use of an attenuation pond located in the north of the site and an infiltration basin located in the east of the site.

- 4.3.3 It is proposed that the rates of surface water runoff will be controlled in all events including the 1 in 100 year return period via a hydrobrake or an orifice plate chamber prior to discharge from the proposed attenuation pond and proposed attenuation tank to the receiving surface water bodies. This should mitigate any potential negative impacts to the morphology and ecology of the existing downstream drainage system (Margam Moors) which might otherwise occur.
- 4.3.4 Preliminary hydraulic calculations have been undertaken to determine the required sizing of the proposed attenuation pond and proposed attenuation tank and the discharge rates will be restricted to the 1 in 100 year greenfield runoff rate (Q_{BAR} 1:100). Soakaways and storage capacity will be sized to ensure they have sufficient volume to store a 1 in 100 year return period storm + 40% climate change. Further detail is included in Section 5.0, below.
- 4.3.5 Site levels will be designed so that the exceedance routes will direct runoff towards the low-lying areas of the site. This should ensure that surface water will remain on site in the event of any failure of the local drainage system and/or any storms in excess of those considered within the HR Wallingford calculations.

4.4 S3 – WATER QUALITY

- 4.4.1 Surface water quality for site runoff will be managed through the construction of new SuDS features.
- 4.4.2 A water quality risk assessment has been carried out using the SuDS manual mitigation indices in accordance with Chapter 26 of the CIRIA C753 SuDS Manual (CIRIA, 2015).

Under this assessment the proposed development (i.e. development of a new industrial site where chemicals are delivered and stored) is shown to present high pollution hazard risks (see Figure 4, below).

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Figure 4 – CIRIA 2015 SuDS Pollution Hazard Levels Indices

4.4.3 It can be seen from Figure 4 that the pollution indices are as follows:-

- Total Suspended Solids (TSS) – 0.8
- Metals – 0.8
- Hydrocarbons – 0.9

It is proposed to mitigate the potential pollution hazard by means of the following: -

- Infiltration
- Attenuation
- Use of separators to car parking and yard areas.

4.5 S4 & S5 – AMENITY AND BIODIVERSITY

4.5.1 The proposed new SuDS features will be designed in accordance with CIRIA 2015 to maximize the multiple benefits of SuDS including amenity and biodiversity.

4.5.2 Designing for amenity is considered a particular priority. The proposed green features (i.e. the proposed attenuation pond and infiltration basin) will provide an amenity benefit to employees because of the proposed inclusion of seating areas around the landscaped areas, which will enable employees to comfortably access and enjoy these areas.

4.5.3 The proposed attenuation pond and proposed infiltration basin will each provide an opportunity to maximise biodiversity benefits. To achieve this, it is proposed that they will each be planted with local plant species. This should help to attract local wildlife and provide a continuation of habitat.

4.6 S6 – CONSTRUCTION, OPERATION AND MAINTENANCE

4.6.1 All surface water drainage systems will be designed taking account of health and safety considerations during the construction, long-term operation and maintenance of the system.

4.6.2 The existing site drainage is limited to the Combined Adopted Sewer (a DCWW combined sewer running along the eastern boundary of the site) and an existing drainage ditch running east-to-west across the site. It is proposed that, if possible, both of these elements will be retained. Prior to any detailed design being undertaken, a condition survey of the Combined Adopted Sewer will be undertaken in accordance with current guidance and it is intended that works to the existing system will be kept to a minimum. A site drainage plan will be kept on site during the construction stage showing the location of both of the above drainage features.

4.6.3 Construction works will be undertaken in accordance with all statutory approvals (including Natural Resources Wales if applicable) and all works will adhere to Pollution Prevention Guidelines.

All hazardous substances (including liquids and solids) will be stored within impermeable, bunded areas, to remove the risk of migration to groundwater or a nearby watercourse. The measures proposed will assist in avoiding or minimising the potential for contaminants and suspended solids to migrate to surface and groundwater, reduce localised flood risk, and protect water quality and the ecosystems the water resources support.

The following list shows measures that will be put in place during the construction phase in accordance with the Environment Agency's (EA) Pollution Prevention Guidelines (PPGs): -

- The handling, use and storage of hazardous materials will to be undertaken in line with the EA's Pollution Prevention Guidelines and pollution control procedures will be put in place in line with the Guidelines
- Adequately bunded and secure areas with impervious walls and floor will be provided for the temporary storage of fuel, oil and chemicals on site during construction; drip trays will be in place to collect leaks from diesel pumps / standing plant; oil interceptor(s) will be fitted to all temporary discharge points and for discharge from any temporary oil storage / refuelling areas; suitable spill kits will be available on site; restrictions will be in place on use of unnecessary machinery near to adjacent water courses.
- No runoff from development areas will be discharged into controlled waters unless specific approval has been obtained in advance from NRW.
- The early re-seeding of cleared land will be undertaken, where practicable, to minimise exposed land and the entrainment of sediment by overland flow. Construction plant / materials will be stored on hardstanding surfaces where possible; if this is not possible, the contractor will ensure any compacted topsoil is loosened as soon as possible following completion of the works;
- Where possible, the attenuation pond/infiltration basin/other drainage features within each identified drainage catchment will be constructed first and used to attenuate and store run-off from the site during construction to prevent possible contamination of the surface and groundwaters.
- If site drainage is required (including surface runoff and dewatering effluents) it will be discharged to sewers where reasonably practicable. Site drainage will meet the requirements for effluent and flood risk standards required by the sewerage undertaker.
- The relevant sections of BS6031:2009 Code of Practice for Earthworks will be followed and reference should be made to SuDS best practice during construction.
- During construction, protection measures to control the risk of pollution to surface water will be adopted, as necessary.
- The adoption of appropriate pollution prevention measures and good construction practices should ensure that any oils, hydrocarbons or hazardous materials stored on site will not leak onto the ground surface and thereby ensure that surface water bodies and associated ecosystems in the vicinity of the site are protected.

4.6.4 All below-ground drainage will be constructed in accordance with Sewers for Adoption 7th Edition, to ensure compliance with best practice.

4.6.5 The maintenance for all on-site drainage infrastructure will be the responsibility of the client. Details of the maintenance activities for the constructed drainage infrastructure will be passed to the client as part of an Operation and Maintenance Manual upon completion of the construction works. Typical maintenance activities will include the items shown in Figure 5, below.

<u>ELEMENT</u>	<u>ACCESS METHOD</u>	<u>MAINTENANCE METHOD</u>	<u>REQUIRED FREQUENCY</u>
Roof Gutters	Pedestrian access to be provided to larger roof areas for regular inspection and maintenance. Otherwise scaffolding and/or ladders to be used to as necessary.	General cleaning of gutters. Jet clean where required.	Periodic inspection of gutters to ensure rainwater outlets do not become blocked. Periodic renewal of gutter coatings to prevent corrosion.
Oil/Petrol SPEL Stormceptor	In accordance with H&S regulations and confined spaces requirements.	In accordance with manufacturer's guidance.	Bi-annual inspection and emptying.
Channel drains/kerb drainage	In accordance with H&S regulations.	Monitor to ensure no blockages develop. Jet clean where required.	Bi-annual jet cleaning of channel drains.
Non-return flap valves	In accordance with H&S regulations and confined spaces requirements.	Monitor to ensure no blockages develop in accordance with the manufacturer's recommendations.	Bi-annual inspection or in accordance with the manufacturer's recommendations, whichever occurs sooner.
Surface Water Attenuation Pond & Infiltration Basin	In accordance with H&S regulations.	General cleaning and monitoring to ensure no blockages. Remove litter and debris. Cut grass and manage vegetation. Inspect inlets and outlets.	Bi-annual inspection, cleaning and removal of silt and/or debris.

Figure 5 – Typical Maintenance Activities for Proposed Drainage System

5.0 SURFACE WATER DRAINAGE DESIGN

The overall proposed surface water drainage layout is illustrated on Drawing No. 20.62 C09 (Rev C Proposed Surface Drainage Masterplan) by James & Nicholas LLP (copy appended, ref. Appendix C).

5.1 GREENFIELD DISCHARGE RATE

5.1.1 CIRIA 2015 provides a methodology of calculating the mean annual flood for areas less than 25 km² ($Q_{BAR(rural)}$) as follows: -

$$Q_{BAR(rural)} = 0.00108 \text{ AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17}$$

- AREA = the area of the catchment in km²
- SAAR = standard average annual rainfall for the period 1941 to 1970 in mm
- SOIL = soil index (which is a value found from the Wallingford procedure to estimate the proportion of runoff from the catchment surface)

The Institute of Hydrology's 1993 Flood Studies Report (FSR) provides 'UK and Ireland Growth Rate Factors' for various different flood return periods (ranging from 1 to 500 years) for nine defined Hydrometric Areas (numbered 1 to 9) each of which covers a particular region of the country.

The FSR also notes that where the site area is below 50 ha, the formula should be applied for 50 ha and then the result should be factored based on the ratio of the actual site area to the applied site area (50 ha)

5.1.2 The site at Margam is shown to be located in Hydrometric Area 9 and the hydrological values for the Q_{BAR} calculation for the site at Margam are as shown in Figure 6, below:

SAAR	1200 mm
SOIL	0.37
Hydrometric Area	9

Figure 6 – Site Hydrological Characteristics

5.1.3 The site area is 7.9 ha, i.e. less than 50 ha. The Q_{BAR} calculation methodology therefore requires that the calculation is carried out for a 50 ha area and then factored down (by actual site area / 50 ha, i.e. by 7.9 ha / 50.0 ha).

For a notional 50 ha (=0.25 km²) site area $Q_{BAR(rural)}$ is calculated as follows: -

$$Q_{BAR(rural)} = 0.00108 \times (\text{AREA})^{0.89} \times (\text{SAAR})^{1.17} \times \text{SOIL}^{2.17}$$

$$Q_{BAR(rural)} = 0.00108 \times 0.5^{0.89} \times 1200^{1.17} \times 0.37^{2.17}$$

$$Q_{BAR(rural)} = 0.00108 \times 0.54 \times 4005.36 \times 0.12$$

$$Q_{BAR(rural)} = 0.2699 \text{ m}^3 / \text{s for 50 ha site}$$

$$Q_{BAR(rural)} = 269.9 \text{ l / s for 50 ha site}$$

The above equates to $Q_{BAR(rural)}$ of 269.9 / 50 = 5.4 litres per second per hectare

This is then factored for the actual total 7.9 ha site area as follows: -

Total allowable $Q_{BAR} = 5.4 \text{ l / s / ha} \times 7.9 \text{ ha} = 42.6 \text{ l/s}$ for the site as a whole

5.1.4 The FSR Growth Rate Factors (as per Table 24.2 in CIRIA 2015 – see Figure 7, below) are then applied to the total Q_{BAR} rate to determine the allowable discharge for the 1 in 1 year, 1 in 30 year and 1 in 100 year return periods.

TABLE 24.2	UK and Ireland growth curve factors (after NERC, 1993)									
	Hydrometric area	Return period								
		1 ¹	2	5	10	25	30 ²	50	100	500
1		0.85	0.90	1.20	1.45	1.81	1.99	2.12	2.48	3.25
2		0.87	0.91	1.11	1.42	1.81	1.99	2.17	2.63	3.45
3		0.86	0.94	1.25	1.45	1.70	1.75	1.90	2.08	2.73
9		0.88	0.93	1.21	1.42	1.71	1.80	1.94	2.18	2.86
10		0.87	0.93	1.19	1.38	1.64	1.70	1.85	2.08	2.73
4		0.83	0.89	1.23	1.49	1.87	1.99	2.20	2.57	3.62
5		0.87	0.89	1.29	1.65	2.25	2.55	2.83	3.56	5.02
6/7		0.85	0.88	1.28	1.62	2.14	2.40	2.62	3.19	4.49
8		0.78	0.88	1.23	1.49	1.84	1.98	2.12	2.42	3.41
Ireland		0.83 ²	0.95	1.20	1.37	1.60	1.65	1.77	1.96	2.40

Notes

- 1 year return period growth curve factors are taken from NERC (1977)
- 30 year (and 1 year for Ireland) return period growth curve factors are interpolated estimates

Figure 7 – Table 24.2, CIRIA 2015

The relevant allowable discharge rates for the three return periods are therefore calculated as follows for the Margam site (Hydrometric Area 9): -

1 in 1 year return

Total allowable Q_{BAR} for the site (ref. 5.1.3, above) = 42.6 l / s

$FSR_{1yr} = 0.88$

$Q_{BAR(rural)1yr} = 0.88 \times 42.6 \text{ l / s} = 37.5 \text{ l/s}$

1 in 30 year return

Total allowable Q_{BAR} for the site (ref, 5.1.3, above) = 42.6 l / s

$FSR_{30yr} = 1.80$

$Q_{BAR(rural)30yr} = 1.80 \times 42.6 \text{ l / s} = 76.7 \text{ l/s}$

1 in 100 year return

Total allowable Q_{BAR} for the site (ref, 5.1.3, above) = 42.6 l / s

$FSR_{100yr} = 2.18$

$Q_{BAR(rural)100yr} = 2.18 \times 42.6 \text{ l / s} = 93.0 \text{ l/s}$

5.2 PEAK DISCHARGE RATES BY SUB-CATCHMENT AREA

Given the area (7.9 ha) and topography of the site, the peak greenfield runoff rates have been considered separately for each of the below sub-catchment areas, as detailed in Sections 5.3 to 5.7, below: -

- Area 1 – Office Block and North Car Park
- Area 2 – Office Block South Car Park
- Area 3 – Main Car Park
- Area 4 – Production Unit (West)
- Area 5 – Production Unit (East)

5.3 SUB-CATCHMENT AREA 1 (OFFICE BLOCK AND NORTH CAR PARK)

This area comprises the office block and the north car park serving the office block along with its adjacent access road.

It is proposed that this area will be served by an attenuation pond.

5.3.1 Allowable discharge rate for Area 1

Area 1 comprises circa 2,600 m² (i.e. 0.26 ha) of hardstanding. It is proposed that this will drain into an attenuation pond which will then drain into the existing drainage system via an existing culvert (Culvert B) located at the north-west corner of the site.

Because the attenuation pond is proposed to drain into the existing system the maximum allowable peak flow rate will be set at a 1 in 30 year return period.

Total allowable Q_{BAR} for the office block = area of hardstanding in hectares x total allowable $Q_{BAR(rural)}$ per hectare for the site

Total allowable Q_{BAR} for the office block = 0.26 ha x 5.4l/s/ha = 1.4l/s

1 in 1 year return

$$FSR_{1yr} = 0.88$$

$$Q_{BAR(rural)1yr} = 0.88 \times 1.41 \text{ l / s} = 1.23\text{l/s}$$

1 in 30 year return

$$FSR_{30yr} = 1.80$$

$$Q_{BAR(rural)30yr} = 1.80 \times 1.41 \text{ l / s} = 2.54\text{l/s}$$

1 in 100 year return

$$FSR_{100yr} = 2.18$$

$$Q_{BAR(rural)100yr} = 2.18 \times 1.41 \text{ l / s} = 3.05\text{l/s}$$

The discharge rate from the attenuation pond will therefore be restricted to the 1 in 30 year return of 2.5l/s

5.3.2 Attenuation Pond Design

The proposed attenuation pond will be 1.0 m deep with the outlet level set at 500 mm (thereby giving a permanent body of water of 500 mm depth). The pond base area is proposed to be approximately 261 m² and the cover area is proposed to be approximately 400 m².

The pond is proposed to be constructed to the north of the office block, as shown on Drawing No. 20.62 C09 (Rev B Proposed Surface Drainage Masterplan) by James & Nicholas LLP (copy appended, ref. Appendix C).

The outfall is proposed to be a concrete headwall draining into a hydrobrake chamber which will be set to restrict the flow back into the existing drain system to a maximum of 2.5 l / s.

Detailed calculations are appended (ref. Appendix D).

5.4 SUB-CATCHMENT AREA 2 (OFFICE BLOCK SOUTH CAR PARK)

This area comprises the south car park serving the office block along with its adjacent access road.

It is proposed that this area will be served by a cellular soakaway installed within the south car park.

The area of hardstanding of the car park and adjacent access road is 3,670 m² (=0.367 ha)

The proposed cellular soakaway will have a storage capacity of 257 m³ (= 15.0 m x 15.0 m x 1.28 m with a 95% void ratio) to take a 1 in 100 year + 40% climate change storm.

An estimated average infiltration rate of 0.280 m / hr has been used to calculate the storage capacity.

Detailed calculations are appended (ref. Appendix E).

5.5 SUB-CATCHMENT AREA 3 – MAIN CAR PARK

This area comprises the main car park along with its adjacent access roads.

It is proposed that this area will be served by a shallow infiltration basin to be constructed at the southern boundary of the main car park area.

The area of hardstanding of the car park and associated roads which totals to approximately 3,500 m² (= 0.35 ha).

The proposed infiltration basin is 450 m² sloping down at a gradient 1:4 to a maximum depth of 500 mm. The infiltration basin has been designed to store a 1 in 100 year storm + 40% climate change storm based on a calculated infiltration rate of 0.450 m / hour.

It is proposed that the infiltration basin will be grassed and planted to allow for a green space near the proposed amenity block.

Detailed calculations are appended (ref. Appendix F).

5.6 SUB-CATCHMENT AREA 4 – PRODUCTION UNIT (WEST)

This area comprises the western portion of the production unit, the service area, the substation and the adjacent access roads.

It is proposed that this area will be served by an attenuation tank.

5.6.1 Allowable discharge rate for Area 4

Area 4 comprises circa 18,000 m² (i.e. 1.8 ha) of hardstanding.

It is proposed that this will drain into a new attenuation tank which will then drain into the existing drainage system (initially into the existing drainage ditch that runs east-to-west across the site and then into the Margam Moors system via an existing culvert (Culvert A) located at the western boundary of the site).

It has been assumed that, due to the existing topography of the site, the majority of the surface water runoff that will be collected in the proposed new attenuation tank, in fact already drains to the above-mentioned drainage ditch that runs across the site and therefore the maximum allowable discharge rate from the attenuation tank into the ditch will be for a 1 in 100 year return period.

Total allowable Q_{BAR} for the Production Unit (West) = area of hardstanding in hectares x total allowable $Q_{BAR(rural)}$ per hectare for the site

Total allowable Q_{BAR} for the Production Unit (West) = 1.8 ha x 5.4l/s/ha = 9.72l/s

1 in 1 year return

$$FSR_{1yr} = 0.88$$

$$Q_{BAR(rural)1yr} = 0.88 \times 9.72 \text{ l/s} = 8.55 \text{ l/s}$$

1 in 30 year return

$$FSR_{30yr} = 1.80$$

$$Q_{BAR(rural)30yr} = 1.80 \times 9.72 \text{ l/s} = 17.50 \text{ l/s}$$

1 in 100 year return

$$FSR_{100yr} = 2.18$$

$$Q_{BAR(rural)100yr} = 2.18 \times 9.72 \text{ l/s} = 21.19 \text{ l/s}$$

The discharge rate from the attenuation tank will therefore be restricted to 21.19l/s

5.6.2 Attenuation Tank Design

The attenuation tank is proposed to be a cellular storage system with the collection of surface water to be via gullies and beany block kerb drainage.

The area of attenuation required will be 1,250 m³ (= 25.0 m x 25.0 m x 2.0 m) based on the 1 in 100 year discharge rate of 21.19 l / s.

Detailed calculations are appended (ref. Appendix G).

5.7 SUB-CATCHMENT AREA 5 – PRODUCTION UNIT (EAST)

This area comprises the eastern portion of the production unit and its adjacent yard area and the amenity block which totals circa 12,000 m² (i.e.1.2 ha) of hardstanding.

It is proposed that this area will be served by a cellular soakaway to be installed within an area of green space situated to the east of the proposed amenity block.

The proposed cellular soakaway will have a storage capacity of 690 m³ (= 25.0 m x 23.0 m x 1.2 m) to take a 1 in 100 year + 40% climate change storm based on an calculated infiltration rate of 0.450 m / hour.

Detailed calculations are appended (ref. Appendix H).

5.8 SUB-CATCHMENT AREA 6 – ACCESS ROAD

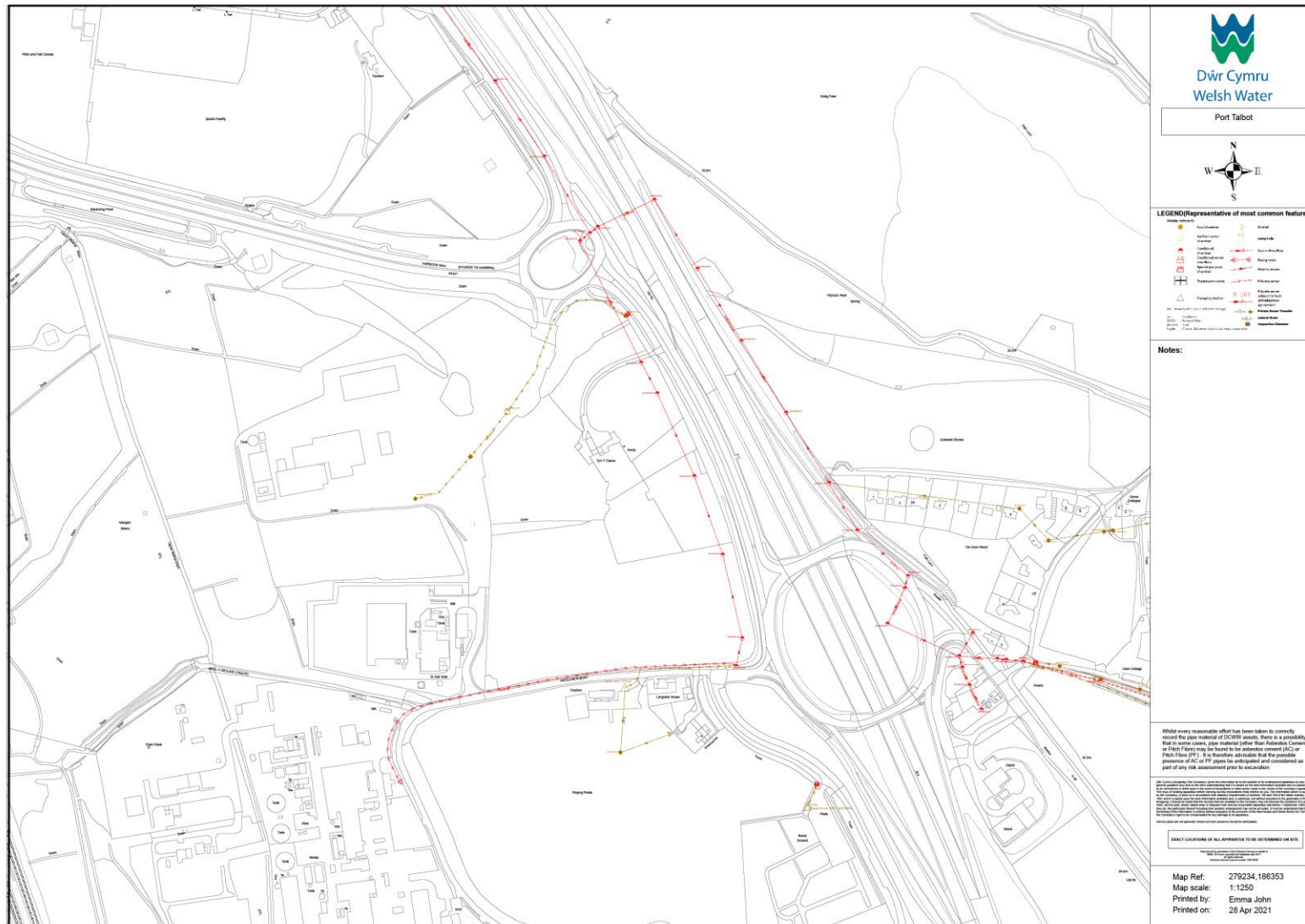
It is proposed that the access road will be constructed with a cross fall that will discharge surface water run-off into an infiltration filter strip running along its western perimeter. The area of the access road totals 961m²

The filter strip will be 2m in width and 700mm deep and designed to accommodate a 1 in 100 year + 40% climate change storm based on a calculated infiltration rate of 0.450 m / hour.

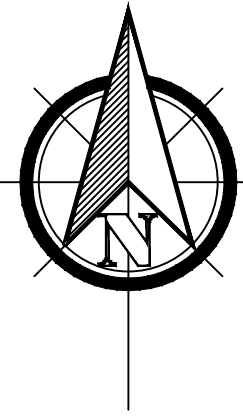
It is proposed that the filter strip will be planted with wet meadow grass to replace the existing wet meadow grass which be removed to allow the access road into the site.

Detailed calculations are appended (ref. Appendix I).

DWR CYMRU WELSH WATER SEWER PLAN



PROPOSED FOUL DRAINAGE LAYOUT



im Green Energy
Station

Balancing Point

Pump

Tyn Y Caeau

Western Bio Energy
Power Station

WB

Chy
Tank

El Sub Stas

Inert Gas Pipe Line Option A

Pavilion

HEULCAE'R-BUNT

PERING MAIN TO CONNECT TO EXISTING
DOWN SOWES (SUBJECT TO APPROVAL)

PUMPING
STATION
F.F.L. +9.500m

SERVICES AREA
F.F.L. +10.000m

SUB STATION
F.F.L. +10.500m

MAIN BUILDING
F.F.L. +11.000m

PHASE 2
F.F.L. +11.000m

NOTES
1 Do not scale from this drawing
2 All dimensions to be checked on site
3 All built drawings are prepared, in part, based upon information
furnished by others. While this information is believed to be reliable,
James & Nicholas LLP assumes no responsibility for the accuracy of
its built drawings or for any errors or omissions that may have been
incorporated into them as a result of incorrect information provided to
us by others. Those relying on an As built drawing are advised to
obtain independent verification of its accuracy.

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Drawings:

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admin@jamesandnicholas.com • www.jamesandnicholas.com
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Job title
DEVELOPMENT SITE, PORT TALBOT, SANDVIK OSPREY LTD.

Drawing title
PROPOSED FOUL DRAINAGE MASTER PLAN

Job No:
20.62
Drawing No:
C07-1
Rev:
1

scales: 1:500 @ A3

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APPENDIX C

PROPOSED STORM DRAINAGE LAYOUT

OFFICE BLOCK ATTENUATION POND CALCULATIONS

james&nicholas		Development Site Sandvik Margam				Page 1
Date 30/09/2021 10:17		Designed by karlj				
File Office Block Attenuation...		Checked by				
Innovyze		Source Control 2019.1				
Summary of Results for 100 year Return Period (+40%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Overflow (l/s)	Max Volume (m³)	Status	
15 min Summer	8.473	0.183	0.0	49.8	O K	
30 min Summer	8.546	0.256	0.0	71.1	O K	
60 min Summer	8.633	0.343	0.0	97.2	O K	
120 min Summer	8.732	0.442	0.0	128.1	O K	
180 min Summer	8.793	0.503	0.0	147.5	O K	
240 min Summer	8.832	0.542	0.8	160.3	O K	
360 min Summer	8.869	0.579	2.0	173.0	O K	
480 min Summer	8.884	0.594	2.4	177.9	O K	
600 min Summer	8.896	0.606	2.5	181.9	O K	
720 min Summer	8.909	0.619	2.5	186.5	O K	
960 min Summer	8.932	0.642	2.5	194.3	O K	
1440 min Summer	8.962	0.672	2.5	204.9	O K	
2160 min Summer	8.985	0.695	2.5	213.1	O K	
2880 min Summer	8.994	0.704	2.5	216.2	Flood Risk	
4320 min Summer	8.993	0.703	2.5	215.9	Flood Risk	
5760 min Summer	8.977	0.687	2.5	210.4	O K	
7200 min Summer	8.956	0.666	2.5	202.9	O K	
8640 min Summer	8.934	0.644	2.5	195.2	O K	
10080 min Summer	8.914	0.624	2.5	188.3	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)		
15 min Summer	104.254	0.0	0.0	19		
30 min Summer	74.337	0.0	0.0	34		
60 min Summer	50.812	0.0	0.0	64		
120 min Summer	33.478	0.0	0.0	124		
180 min Summer	25.705	0.0	0.3	184		
240 min Summer	21.111	0.0	13.6	244		
360 min Summer	16.007	0.0	35.7	362		
480 min Summer	13.122	0.0	52.7	466		
600 min Summer	11.233	0.0	66.7	506		
720 min Summer	9.885	0.0	78.6	570		
960 min Summer	8.066	0.0	98.4	696		
1440 min Summer	6.037	0.0	128.1	980		
2160 min Summer	4.502	0.0	162.4	1388		
2880 min Summer	3.650	0.0	187.3	1792		
4320 min Summer	2.723	0.0	226.3	2592		
5760 min Summer	2.213	0.0	259.2	3296		
7200 min Summer	1.887	0.0	285.7	4032		
8640 min Summer	1.658	0.0	308.9	4672		
10080 min Summer	1.488	0.0	329.5	5344		
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james&nicholas		Development Site Sandvik Margam		Page 2	
Date 30/09/2021 10:17 File Office Block Attenuation...		Designed by karlj Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Overflow (l/s)	Max Volume (m³)	Status
15 min Winter	8.494	0.204	0.0	55.8	O K
30 min Winter	8.575	0.285	0.0	79.6	O K
60 min Winter	8.671	0.381	0.0	108.8	O K
120 min Winter	8.780	0.490	0.0	143.4	O K
180 min Winter	8.841	0.551	1.1	163.7	O K
240 min Winter	8.874	0.584	2.1	174.5	O K
360 min Winter	8.914	0.624	2.5	188.2	O K
480 min Winter	8.943	0.653	2.5	198.3	O K
600 min Winter	8.964	0.674	2.5	205.5	O K
720 min Winter	8.979	0.689	2.5	210.8	O K
960 min Winter	9.002	0.712	2.5	219.2	Flood Risk
1440 min Winter	9.030	0.740	2.5	229.3	Flood Risk
2160 min Winter	9.042	0.752	2.5	233.3	Flood Risk
2880 min Winter	9.034	0.744	2.5	230.7	Flood Risk
4320 min Winter	8.998	0.708	2.5	217.6	Flood Risk
5760 min Winter	8.951	0.661	2.5	200.9	O K
7200 min Winter	8.909	0.619	2.5	186.7	O K
8640 min Winter	8.886	0.596	2.4	178.8	O K
10080 min Winter	8.877	0.587	2.2	175.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	
15 min Winter	104.254	0.0	0.0	19	
30 min Winter	74.337	0.0	0.0	34	
60 min Winter	50.812	0.0	0.0	64	
120 min Winter	33.478	0.0	0.0	124	
180 min Winter	25.705	0.0	17.3	180	
240 min Winter	21.111	0.0	32.9	238	
360 min Winter	16.007	0.0	57.7	350	
480 min Winter	13.122	0.0	76.7	460	
600 min Winter	11.233	0.0	92.3	568	
720 min Winter	9.885	0.0	105.7	666	
960 min Winter	8.066	0.0	127.8	760	
1440 min Winter	6.037	0.0	160.9	1068	
2160 min Winter	4.502	0.0	199.5	1532	
2880 min Winter	3.650	0.0	227.5	1960	
4320 min Winter	2.723	0.0	271.3	2728	
5760 min Winter	2.213	0.0	307.9	3408	
7200 min Winter	1.887	0.0	337.6	4032	
8640 min Winter	1.658	0.0	363.7	4576	
10080 min Winter	1.488	0.0	387.0	5240	
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[illegible]

Rainfall Details			
Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.255

Time (mins)	Area
From:	To: (ha)

0	4	0.255
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		Page 4
	Development Site Sandvik Margam	
Date 30/09/2021 10:17 File Office Block Attenuation...	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 9.290

Tank or Pond Structure

Invert Level (m) 8.290

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	261.0	1.000	400.0

Hydro-Brake® Optimum Overflow Control

Unit Reference	MD-SHE-0084-2500-0400-2500
Design Head (m)	0.400
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	8.790
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	2.5	Kick-Flo®	0.293	2.2
Flush-Flo™	0.133	2.5	Mean Flow over Head Range	-	2.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.5	1.200	4.1	3.000	6.4	7.000	9.6
0.200	2.4	1.400	4.4	3.500	6.8	7.500	9.9
0.300	2.2	1.600	4.7	4.000	7.3	8.000	10.3
0.400	2.5	1.800	5.0	4.500	7.7	8.500	10.6
0.500	2.8	2.000	5.3	5.000	8.1	9.000	10.9
0.600	3.0	2.200	5.5	5.500	8.5	9.500	11.2
0.800	3.4	2.400	5.7	6.000	8.9		
1.000	3.8	2.600	5.9	6.500	9.3		

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OFFICE CAR PARK CELLULAR SOAKAWAY CALCULATIONS

james&nicholas		Development Site Sandvik Margam		Page 1	
Date 30/09/2021 11:18 File Office Block Soakaway.SRCX		Designed by karlj Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Half Drain Time : 165 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	6.104	0.304	8.3	64.9	O K
30 min Summer	6.217	0.417	8.3	89.1	O K
60 min Summer	6.331	0.531	8.3	113.5	O K
120 min Summer	6.416	0.616	8.3	131.6	O K
180 min Summer	6.435	0.635	8.3	135.8	O K
240 min Summer	6.435	0.635	8.3	135.8	O K
360 min Summer	6.427	0.627	8.3	133.9	O K
480 min Summer	6.408	0.608	8.3	130.0	O K
600 min Summer	6.385	0.585	8.3	125.0	O K
720 min Summer	6.358	0.558	8.3	119.3	O K
960 min Summer	6.301	0.501	8.3	107.1	O K
1440 min Summer	6.186	0.386	8.3	82.5	O K
2160 min Summer	6.038	0.238	8.3	50.9	O K
2880 min Summer	5.934	0.134	8.3	28.7	O K
4320 min Summer	5.849	0.049	8.2	10.5	O K
5760 min Summer	5.840	0.040	6.7	8.6	O K
7200 min Summer	5.834	0.034	5.7	7.3	O K
8640 min Summer	5.830	0.030	5.0	6.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	104.254	0.0	18		
30 min Summer	74.337	0.0	32		
60 min Summer	50.812	0.0	62		
120 min Summer	33.478	0.0	120		
180 min Summer	25.705	0.0	152		
240 min Summer	21.111	0.0	184		
360 min Summer	16.007	0.0	252		
480 min Summer	13.122	0.0	322		
600 min Summer	11.233	0.0	392		
720 min Summer	9.885	0.0	460		
960 min Summer	8.066	0.0	596		
1440 min Summer	6.037	0.0	852		
2160 min Summer	4.502	0.0	1212		
2880 min Summer	3.650	0.0	1556		
4320 min Summer	2.723	0.0	2200		
5760 min Summer	2.213	0.0	2920		
7200 min Summer	1.887	0.0	3608		
8640 min Summer	1.658	0.0	4336		
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Date 30/09/2021 11:18		Designed by karlj			
File Office Block Soakaway.SRCX		Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	5.827	0.027	4.5	5.8	O K
15 min Winter	6.144	0.344	8.3	73.4	O K
30 min Winter	6.274	0.474	8.3	101.4	O K
60 min Winter	6.410	0.610	8.3	130.4	O K
120 min Winter	6.521	0.721	8.3	154.2	O K
180 min Winter	6.550	0.750	8.3	160.2	O K
240 min Winter	6.545	0.745	8.3	159.2	O K
360 min Winter	6.528	0.728	8.3	155.6	O K
480 min Winter	6.495	0.695	8.3	148.5	O K
600 min Winter	6.453	0.653	8.3	139.6	O K
720 min Winter	6.408	0.608	8.3	129.9	O K
960 min Winter	6.312	0.512	8.3	109.5	O K
1440 min Winter	6.129	0.329	8.3	70.3	O K
2160 min Winter	5.921	0.121	8.3	25.8	O K
2880 min Winter	5.848	0.048	7.9	10.2	O K
4320 min Winter	5.836	0.036	5.9	7.6	O K
5760 min Winter	5.829	0.029	4.8	6.2	O K
7200 min Winter	5.825	0.025	4.1	5.3	O K
8640 min Winter	5.822	0.022	3.6	4.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
10080 min Summer	1.488	0.0	5048		
15 min Winter	104.254	0.0	18		
30 min Winter	74.337	0.0	32		
60 min Winter	50.812	0.0	60		
120 min Winter	33.478	0.0	118		
180 min Winter	25.705	0.0	172		
240 min Winter	21.111	0.0	198		
360 min Winter	16.007	0.0	274		
480 min Winter	13.122	0.0	352		
600 min Winter	11.233	0.0	428		
720 min Winter	9.885	0.0	500		
960 min Winter	8.066	0.0	642		
1440 min Winter	6.037	0.0	896		
2160 min Winter	4.502	0.0	1232		
2880 min Winter	3.650	0.0	1452		
4320 min Winter	2.723	0.0	2168		
5760 min Winter	2.213	0.0	2936		
7200 min Winter	1.887	0.0	3640		
8640 min Winter	1.658	0.0	4392		
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Date 30/09/2021 11:18 File Office Block Soakaway.SRCX		Designed by karlj Checked by																							
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<u>Summary of Results for 100 year Return Period (+40%)</u> <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>10080 min Winter</td><td>5.820</td><td>0.020</td><td>3.3</td><td>4.2</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>10080 min Winter</td><td>1.488</td><td>0.0</td><td>5016</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	10080 min Winter	5.820	0.020	3.3	4.2	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	10080 min Winter	1.488	0.0	5016
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.250</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.367 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.367</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Shortest Storm (mins)	15	Ratio R	0.250	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.367
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	Development Site Sandvik Margam	
Date 30/09/2021 11:18 File Office Block Soakaway.SRCX	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 7.000

Cellular Storage Structure

Invert Level (m) 5.800 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.28000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.28000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	225.0	213.0	0.800	225.0	213.0
0.400	225.0	213.0	1.200	225.0	213.0

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MAIN CAR PARK INFILTRATION BASIN CALCULATIONS

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Half Drain Time : 41 minutes.																																																																																																																							
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Date 30/09/2021 09:25 File Car Park Infiltration Ba...		Designed by karlj Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	11.018	0.018	4.3	3.1	O K
15 min Winter	11.300	0.300	20.1	61.8	Flood Risk
30 min Winter	11.376	0.376	22.6	81.1	Flood Risk
60 min Winter	11.425	0.425	24.2	94.1	Flood Risk
120 min Winter	11.436	0.436	24.6	97.3	Flood Risk
180 min Winter	11.415	0.415	23.8	91.4	Flood Risk
240 min Winter	11.385	0.385	22.9	83.5	Flood Risk
360 min Winter	11.329	0.329	21.0	69.0	Flood Risk
480 min Winter	11.278	0.278	19.3	56.6	Flood Risk
600 min Winter	11.234	0.234	17.9	46.2	Flood Risk
720 min Winter	11.195	0.195	16.7	37.6	O K
960 min Winter	11.131	0.131	14.7	24.4	O K
1440 min Winter	11.052	0.052	12.3	9.2	O K
2160 min Winter	11.039	0.039	9.3	6.8	O K
2880 min Winter	11.032	0.032	7.6	5.5	O K
4320 min Winter	11.024	0.024	5.6	4.2	O K
5760 min Winter	11.020	0.020	4.6	3.4	O K
7200 min Winter	11.017	0.017	3.9	2.9	O K
8640 min Winter	11.015	0.015	3.4	2.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
10080 min Summer	1.481	0.0	5120		
15 min Winter	104.407	0.0	18		
30 min Winter	74.391	0.0	30		
60 min Winter	50.812	0.0	50		
120 min Winter	33.455	0.0	88		
180 min Winter	25.680	0.0	124		
240 min Winter	21.085	0.0	160		
360 min Winter	15.983	0.0	228		
480 min Winter	13.099	0.0	292		
600 min Winter	11.211	0.0	356		
720 min Winter	9.864	0.0	418		
960 min Winter	8.048	0.0	538		
1440 min Winter	6.022	0.0	748		
2160 min Winter	4.489	0.0	1100		
2880 min Winter	3.639	0.0	1464		
4320 min Winter	2.714	0.0	2204		
5760 min Winter	2.205	0.0	2848		
7200 min Winter	1.879	0.0	3576		
8640 min Winter	1.651	0.0	4400		
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Innovyze		Source Control 2019.1																							
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Rainfall Details			
Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.251	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.350						
Time (mins)		Area	Time (mins)		Area	
From:	To:	(ha)	From:	To:	(ha)	
0	4	0.250	4	8	0.100	

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Date 30/09/2021 09:25	File Car Park Infiltration Ba...	Designed by karlj									
Innovyze		Checked by									
		Source Control 2019.1									
Model Details Storage is Online Cover Level (m) 11.500 Infiltration Basin Structure Invert Level (m) 11.000 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.45000 Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.45000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>171.0</td><td>0.500</td><td>298.0</td></tr></tbody></table>				Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	171.0	0.500	298.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)								
0.000	171.0	0.500	298.0								
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PRODUCTION UNIT (WEST) ATTENUATION TANK CALCULATIONS

james&nicholas		Development Site Sandvik Margam		Page 1	
Date 30/09/2021 11:33 File Attenuation Tank.SRCX		Designed by karlj Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	6.559	0.559	21.9	335.1	O K
30 min Summer	6.786	0.786	21.9	471.4	O K
60 min Summer	7.046	1.046	21.9	627.3	O K
120 min Summer	7.320	1.320	21.9	792.2	O K
180 min Summer	7.452	1.452	21.9	871.2	O K
240 min Summer	7.518	1.518	21.9	910.7	O K
360 min Summer	7.579	1.579	21.9	947.6	O K
480 min Summer	7.597	1.597	21.9	958.1	O K
600 min Summer	7.600	1.600	21.9	960.1	O K
720 min Summer	7.594	1.594	21.9	956.5	O K
960 min Summer	7.568	1.568	21.9	940.6	O K
1440 min Summer	7.485	1.485	21.9	890.7	O K
2160 min Summer	7.328	1.328	21.9	796.9	O K
2880 min Summer	7.125	1.125	21.9	675.2	O K
4320 min Summer	6.797	0.797	21.9	478.2	O K
5760 min Summer	6.569	0.569	21.9	341.5	O K
7200 min Summer	6.420	0.420	21.5	251.9	O K
8640 min Summer	6.324	0.324	20.7	194.4	O K
10080 min Summer	6.261	0.261	19.7	156.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	104.560	0.0	347.0	22	
30 min Summer	74.445	0.0	496.0	36	
60 min Summer	50.812	0.0	682.9	66	
120 min Summer	33.433	0.0	899.4	124	
180 min Summer	25.656	0.0	1035.5	184	
240 min Summer	21.060	0.0	1133.5	242	
360 min Summer	15.958	0.0	1288.6	358	
480 min Summer	13.076	0.0	1407.9	414	
600 min Summer	11.190	0.0	1506.0	478	
720 min Summer	9.844	0.0	1589.8	542	
960 min Summer	8.030	0.0	1728.9	678	
1440 min Summer	6.007	0.0	1938.9	958	
2160 min Summer	4.477	0.0	2173.8	1384	
2880 min Summer	3.628	0.0	2348.3	1760	
4320 min Summer	2.705	0.0	2624.2	2468	
5760 min Summer	2.197	0.0	2846.5	3168	
7200 min Summer	1.872	0.0	3031.3	3824	
8640 min Summer	1.644	0.0	3194.0	4504	
10080 min Summer	1.475	0.0	3340.3	5240	
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james&nicholas		Development Site Sandvik Margam		Page 2	
Date 30/09/2021 11:33 File Attenuation Tank.SRCX		Designed by karlj Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	6.628	0.628	21.9	377.0	O K
30 min Winter	6.885	0.885	21.9	531.3	O K
60 min Winter	7.184	1.184	21.9	710.1	O K
120 min Winter	7.497	1.497	21.9	898.0	O K
180 min Winter	7.651	1.651	21.9	990.7	O K
240 min Winter	7.733	1.733	21.9	1040.0	Flood Risk
360 min Winter	7.821	1.821	21.9	1092.3	Flood Risk
480 min Winter	7.845	1.845	21.9	1107.1	Flood Risk
600 min Winter	7.839	1.839	21.9	1103.4	Flood Risk
720 min Winter	7.831	1.831	21.9	1098.7	Flood Risk
960 min Winter	7.790	1.790	21.9	1073.8	Flood Risk
1440 min Winter	7.656	1.656	21.9	993.4	O K
2160 min Winter	7.406	1.406	21.9	843.6	O K
2880 min Winter	7.074	1.074	21.9	644.6	O K
4320 min Winter	6.599	0.599	21.9	359.4	O K
5760 min Winter	6.351	0.351	21.0	210.6	O K
7200 min Winter	6.234	0.234	19.2	140.4	O K
8640 min Winter	6.195	0.195	17.3	117.2	O K
10080 min Winter	6.177	0.177	15.6	105.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Winter	104.560	0.0	389.2	22	
30 min Winter	74.445	0.0	556.0	36	
60 min Winter	50.812	0.0	765.1	64	
120 min Winter	33.433	0.0	1007.5	122	
180 min Winter	25.656	0.0	1160.0	180	
240 min Winter	21.060	0.0	1269.8	236	
360 min Winter	15.958	0.0	1443.4	348	
480 min Winter	13.076	0.0	1577.1	454	
600 min Winter	11.190	0.0	1686.9	504	
720 min Winter	9.844	0.0	1780.8	570	
960 min Winter	8.030	0.0	1936.5	726	
1440 min Winter	6.007	0.0	2171.5	1040	
2160 min Winter	4.477	0.0	2434.8	1496	
2880 min Winter	3.628	0.0	2630.4	1880	
4320 min Winter	2.705	0.0	2939.8	2552	
5760 min Winter	2.197	0.0	3188.3	3176	
7200 min Winter	1.872	0.0	3395.3	3816	
8640 min Winter	1.644	0.0	3577.7	4408	
10080 min Winter	1.475	0.0	3742.0	5144	
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Rainfall Details			
Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.252	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.800					
Time	(mins)	Area	Time	(mins)	Area
From:	To:	(ha)	From:	To:	(ha)
0	4	0.900	4	8	0.900

		Development Site Sandvik Margam		Page 4 																																																																																																																									
Date 30/09/2021 11:33 File Attenuation Tank.SRCX		Designed by karlj Checked by																																																																																																																											
Innovyze		Source Control 2019.1																																																																																																																											
<u>Model Details</u> Storage is Online Cover Level (m) 8.000 <u>Tank or Pond Structure</u> Invert Level (m) 6.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>600.0</td><td>2.000</td><td>600.0</td></tr></table> <u>Hydro-Brake® Optimum Outflow Control</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0192-2190-2000-2190</td></tr><tr><td>Design Head (m)</td><td>2.000</td></tr><tr><td>Design Flow (l/s)</td><td>21.9</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>192</td></tr><tr><td>Invert Level (m)</td><td>6.000</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>225</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1800</td></tr></table> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>2.000</td><td>21.9</td><td>Kick-Flo®</td><td>1.238</td><td>17.4</td></tr><tr><td>Flush-Flo™</td><td>0.579</td><td>21.9</td><td>Mean Flow over Head Range</td><td>-</td><td>19.1</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.7</td><td>1.200</td><td>18.2</td><td>3.000</td><td>26.6</td><td>7.000</td><td>40.0</td></tr><tr><td>0.200</td><td>17.8</td><td>1.400</td><td>18.5</td><td>3.500</td><td>28.6</td><td>7.500</td><td>41.3</td></tr><tr><td>0.300</td><td>20.4</td><td>1.600</td><td>19.7</td><td>4.000</td><td>30.5</td><td>8.000</td><td>42.6</td></tr><tr><td>0.400</td><td>21.4</td><td>1.800</td><td>20.8</td><td>4.500</td><td>32.3</td><td>8.500</td><td>43.9</td></tr><tr><td>0.500</td><td>21.8</td><td>2.000</td><td>21.9</td><td>5.000</td><td>34.0</td><td>9.000</td><td>45.2</td></tr><tr><td>0.600</td><td>21.9</td><td>2.200</td><td>22.9</td><td>5.500</td><td>35.6</td><td>9.500</td><td>46.4</td></tr><tr><td>0.800</td><td>21.5</td><td>2.400</td><td>23.9</td><td>6.000</td><td>37.1</td><td></td><td></td></tr><tr><td>1.000</td><td>20.5</td><td>2.600</td><td>24.8</td><td>6.500</td><td>38.6</td><td></td><td></td></tr></table>						Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	600.0	2.000	600.0	Unit Reference	MD-SHE-0192-2190-2000-2190	Design Head (m)	2.000	Design Flow (l/s)	21.9	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	192	Invert Level (m)	6.000	Minimum Outlet Pipe Diameter (mm)	225	Suggested Manhole Diameter (mm)	1800	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	2.000	21.9	Kick-Flo®	1.238	17.4	Flush-Flo™	0.579	21.9	Mean Flow over Head Range	-	19.1	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.7	1.200	18.2	3.000	26.6	7.000	40.0	0.200	17.8	1.400	18.5	3.500	28.6	7.500	41.3	0.300	20.4	1.600	19.7	4.000	30.5	8.000	42.6	0.400	21.4	1.800	20.8	4.500	32.3	8.500	43.9	0.500	21.8	2.000	21.9	5.000	34.0	9.000	45.2	0.600	21.9	2.200	22.9	5.500	35.6	9.500	46.4	0.800	21.5	2.400	23.9	6.000	37.1			1.000	20.5	2.600	24.8	6.500	38.6		
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PRODUCTION UNIT (EAST) CELLULAR SOAKAWAY CALCULATIONS

james&nicholas		Development Site Sandvik Margam				
Date 29/09/2021 21:01 File Industrial Unit Soakaway		Designed by KJ Checked by KJT				
Innovyze		Source Control 2019.1				
Summary of Results for 100 year Return Period (+40%)						
Half Drain Time : 106 minutes.						
Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer		10.571	0.371	36.3	204.3	O K
30 min Summer		10.701	0.501	36.3	276.0	O K
60 min Summer		10.819	0.619	36.3	341.1	O K
120 min Summer		10.888	0.688	36.3	379.2	O K
180 min Summer		10.898	0.698	36.3	384.7	O K
240 min Summer		10.889	0.689	36.3	379.5	O K
360 min Summer		10.859	0.659	36.3	362.9	O K
480 min Summer		10.817	0.617	36.3	340.2	O K
600 min Summer		10.772	0.572	36.3	314.9	O K
720 min Summer		10.724	0.524	36.3	288.5	O K
960 min Summer		10.629	0.429	36.3	236.5	O K
1440 min Summer		10.466	0.266	36.3	146.3	O K
2160 min Summer		10.307	0.107	36.3	59.1	O K
2880 min Summer		10.249	0.049	35.7	27.1	O K
4320 min Summer		10.237	0.037	26.6	20.2	O K
5760 min Summer		10.230	0.030	21.9	16.6	O K
7200 min Summer		10.226	0.026	18.7	14.1	O K
8640 min Summer		10.223	0.023	16.5	12.4	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer		104.254	0.0	17		
30 min Summer		74.337	0.0	32		
60 min Summer		50.812	0.0	60		
120 min Summer		33.478	0.0	100		
180 min Summer		25.705	0.0	134		
240 min Summer		21.111	0.0	168		
360 min Summer		16.007	0.0	238		
480 min Summer		13.122	0.0	306		
600 min Summer		11.233	0.0	374		
720 min Summer		9.885	0.0	440		
960 min Summer		8.066	0.0	568		
1440 min Summer		6.037	0.0	808		
2160 min Summer		4.502	0.0	1144		
2880 min Summer		3.650	0.0	1468		
4320 min Summer		2.723	0.0	2200		
5760 min Summer		2.213	0.0	2880		
7200 min Summer		1.887	0.0	3584		
8640 min Summer		1.658	0.0	4352		
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james&nicholas		Development Site Sandvik Margam		Page 1		
Date 29/09/2021 21:01 File Industrial Unit Soakaway...		Designed by KJ Checked by KJT				
Innovyze		Source Control 2019.1				
Summary of Results for 100 year Return Period (+40%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	
10080 min Summer	10.220	0.020	14.7	11.1	O K	
15 min Winter	10.621	0.421	36.3	232.1	O K	
30 min Winter	10.774	0.574	36.3	316.2	O K	
60 min Winter	10.920	0.720	36.3	396.9	O K	
120 min Winter	11.012	0.812	36.3	447.6	O K	
180 min Winter	11.018	0.818	36.3	450.7	O K	
240 min Winter	11.000	0.800	36.3	440.8	O K	
360 min Winter	10.944	0.744	36.3	409.9	O K	
480 min Winter	10.871	0.671	36.3	369.9	O K	
600 min Winter	10.793	0.593	36.3	326.7	O K	
720 min Winter	10.714	0.514	36.3	283.2	O K	
960 min Winter	10.564	0.364	36.3	200.6	O K	
1440 min Winter	10.332	0.132	36.3	72.8	O K	
2160 min Winter	10.244	0.044	32.1	24.2	O K	
2880 min Winter	10.236	0.036	25.9	19.6	O K	
4320 min Winter	10.227	0.027	19.4	14.6	O K	
5760 min Winter	10.222	0.022	15.8	11.9	O K	
7200 min Winter	10.219	0.019	13.6	10.2	O K	
8640 min Winter	10.216	0.016	11.8	8.9	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)			
10080 min Summer	1.488	0.0	5104			
15 min Winter	104.254	0.0	17			
30 min Winter	74.337	0.0	31			
60 min Winter	50.812	0.0	60			
120 min Winter	33.478	0.0	114			
180 min Winter	25.705	0.0	144			
240 min Winter	21.111	0.0	182			
360 min Winter	16.007	0.0	260			
480 min Winter	13.122	0.0	334			
600 min Winter	11.233	0.0	404			
720 min Winter	9.885	0.0	472			
960 min Winter	8.066	0.0	598			
1440 min Winter	6.037	0.0	822			
2160 min Winter	4.502	0.0	1092			
2880 min Winter	3.650	0.0	1456			
4320 min Winter	2.723	0.0	2188			
5760 min Winter	2.213	0.0	2864			
7200 min Winter	1.887	0.0	3680			
8640 min Winter	1.658	0.0	4312			
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james&nicholas		Development Site Sandvik Margam		Page 2	
Date 29/09/2021 21:01 File Industrial Unit Soakaway...		Designed by KJ Checked by KJT			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	10.215	0.015	10.7	8.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
10080 min Winter	1.488	0.0	5040		
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		Page 3																																	
	Development Site Sandvik Margam																																		
Date 29/09/2021 21:01 File Industrial Unit Soakaway...	Designed by KJ Checked by KJT																																		
Innovyze Source Control 2019.1																																			
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.250</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.200 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>1.200</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Shortest Storm (mins)	15	Ratio R	0.250	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	1.200
Rainfall Model	FSR	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.750																																
Region	England and Wales	Cv (Winter)	0.840																																
M5-60 (mm)	18.000	Shortest Storm (mins)	15																																
Ratio R	0.250	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+40																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	1.200																																	
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	Development Site Sandvik Margam	
Date 29/09/2021 21:01 File Industrial Unit Soakaway...	Designed by KJ Checked by KJT	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 11.400

Cellular Storage Structure

Invert Level (m) 10.200 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.45000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.45000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	580.0	580.0	0.800	580.0	580.0
0.400	580.0	580.0	1.200	580.0	580.0

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ACCESS ROAD FILTER STRIP CALCULATIONS

james&nicholas				Page 1	
Date 25/01/2022 10:18		Designed by karlj			
File Access Road Infiltration...		Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Half Drain Time : 45 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	7.793	0.493	4.7	15.9	Flood Risk
30 min Summer	7.856	0.556	5.5	20.5	Flood Risk
60 min Summer	7.901	0.601	6.1	24.3	Flood Risk
120 min Summer	7.925	0.625	6.4	26.4	Flood Risk
180 min Summer	7.921	0.621	6.4	26.1	Flood Risk
240 min Summer	7.909	0.609	6.2	25.0	Flood Risk
360 min Summer	7.883	0.583	5.9	22.7	Flood Risk
480 min Summer	7.858	0.558	5.5	20.7	Flood Risk
600 min Summer	7.834	0.534	5.2	18.8	Flood Risk
720 min Summer	7.812	0.512	5.0	17.2	Flood Risk
960 min Summer	7.774	0.474	4.5	14.6	Flood Risk
1440 min Summer	7.714	0.414	3.8	10.9	Flood Risk
2160 min Summer	7.651	0.351	3.1	7.7	O K
2880 min Summer	7.605	0.305	2.6	5.8	O K
4320 min Summer	7.547	0.247	2.1	3.7	O K
5760 min Summer	7.509	0.209	1.7	2.6	O K
7200 min Summer	7.483	0.183	1.5	2.0	O K
8640 min Summer	7.463	0.163	1.3	1.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	104.407	0.0	17		
30 min Summer	74.391	0.0	29		
60 min Summer	50.812	0.0	46		
120 min Summer	33.455	0.0	80		
180 min Summer	25.680	0.0	114		
240 min Summer	21.085	0.0	148		
360 min Summer	15.983	0.0	214		
480 min Summer	13.099	0.0	278		
600 min Summer	11.211	0.0	338		
720 min Summer	9.864	0.0	400		
960 min Summer	8.048	0.0	522		
1440 min Summer	6.022	0.0	764		
2160 min Summer	4.489	0.0	1124		
2880 min Summer	3.639	0.0	1472		
4320 min Summer	2.714	0.0	2204		
5760 min Summer	2.205	0.0	2936		
7200 min Summer	1.879	0.0	3672		
8640 min Summer	1.651	0.0	4400		
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Date 25/01/2022 10:18		Designed by karlj			
File Access Road Infiltration...		Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	7.448	0.148	1.2	1.3	O K
15 min Winter	7.822	0.522	5.1	17.9	Flood Risk
30 min Winter	7.890	0.590	6.0	23.4	Flood Risk
60 min Winter	7.936	0.636	6.6	27.5	Flood Risk
120 min Winter	7.954	0.654	6.8	29.1	Flood Risk
180 min Winter	7.942	0.642	6.6	28.0	Flood Risk
240 min Winter	7.922	0.622	6.4	26.1	Flood Risk
360 min Winter	7.881	0.581	5.8	22.6	Flood Risk
480 min Winter	7.844	0.544	5.4	19.6	Flood Risk
600 min Winter	7.811	0.511	4.9	17.1	Flood Risk
720 min Winter	7.781	0.481	4.6	15.0	Flood Risk
960 min Winter	7.731	0.431	4.0	11.9	Flood Risk
1440 min Winter	7.658	0.358	3.2	8.1	O K
2160 min Winter	7.588	0.288	2.5	5.1	O K
2880 min Winter	7.544	0.244	2.0	3.6	O K
4320 min Winter	7.490	0.190	1.5	2.1	O K
5760 min Winter	7.458	0.158	1.2	1.5	O K
7200 min Winter	7.436	0.136	1.1	1.1	O K
8640 min Winter	7.421	0.121	0.9	0.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
10080 min Summer	1.481	0.0	5112		
15 min Winter	104.407	0.0	17		
30 min Winter	74.391	0.0	30		
60 min Winter	50.812	0.0	48		
120 min Winter	33.455	0.0	86		
180 min Winter	25.680	0.0	122		
240 min Winter	21.085	0.0	158		
360 min Winter	15.983	0.0	226		
480 min Winter	13.099	0.0	290		
600 min Winter	11.211	0.0	354		
720 min Winter	9.864	0.0	414		
960 min Winter	8.048	0.0	538		
1440 min Winter	6.022	0.0	778		
2160 min Winter	4.489	0.0	1128		
2880 min Winter	3.639	0.0	1488		
4320 min Winter	2.714	0.0	2204		
5760 min Winter	2.205	0.0	2936		
7200 min Winter	1.879	0.0	3672		
8640 min Winter	1.651	0.0	4408		
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Date 25/01/2022 10:18		Designed by karlj																							
File Access Road Infiltration...		Checked by																							
Innovyze		Source Control 2019.1																							
Summary of Results for 100 year Return Period (+40%) <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>10080 min Winter</td><td>7.410</td><td>0.110</td><td>0.8</td><td>0.7</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>10080 min Winter</td><td>1.481</td><td>0.0</td><td>5136</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	10080 min Winter	7.410	0.110	0.8	0.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	10080 min Winter	1.481	0.0	5136
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status																				
10080 min Winter	7.410	0.110	0.8	0.7	O K																				
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10080 min Winter	1.481	0.0	5136																						
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Date 25/01/2022 10:18

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File Access Road Infiltration...

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Innovyze

Source Control 2019.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.251	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.096

Time (mins) Area
From: To: (ha)

0 4 0.096

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james&nicholas																										
Date 25/01/2022 10:18	Designed by karlj																									
File Access Road Infiltration...	Checked by																									
Innovyze	Source Control 2019.1																									
<u>Model Details</u> Storage is Online Cover Level (m) 8.000 <u>Swale Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.45000</td> <td>Length (m)</td> <td>95.0</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.45000</td> <td>Side Slope (1:X)</td> <td>1.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Slope (1:X)</td> <td>56.0</td> </tr> <tr> <td>Porosity</td> <td>1.00</td> <td>Cap Volume Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Invert Level (m)</td> <td>7.300</td> <td>Cap Infiltration Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Base Width (m)</td> <td>2.0</td> <td></td> <td></td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.45000	Length (m)	95.0	Infiltration Coefficient Side (m/hr)	0.45000	Side Slope (1:X)	1.0	Safety Factor	2.0	Slope (1:X)	56.0	Porosity	1.00	Cap Volume Depth (m)	0.000	Invert Level (m)	7.300	Cap Infiltration Depth (m)	0.000	Base Width (m)	2.0		
Infiltration Coefficient Base (m/hr)	0.45000	Length (m)	95.0																							
Infiltration Coefficient Side (m/hr)	0.45000	Side Slope (1:X)	1.0																							
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