LANMOR Consulting

Civil Engineers & Transport Planners

31 Barkham Ride, Finchampstead

Flood Risk Assessment & Drainage Strategy

July 2025

231641/DS/AG/RS/02

Rev D

LANMOR Consulting

Civil Engineers & Transport Planners

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APPENDICES

1 INTRODUCTION

1.1 General

1.1.1 Lanmor Consulting Ltd has been appointed to complete a Flood Risk Assessment and Drainage Strategy for the proposed residential development at 31 Barkham Ride, Finchampstead, Wokingham, RG40 4EX.

1.1.2 The location of the site is shown below in Figure 1.1.

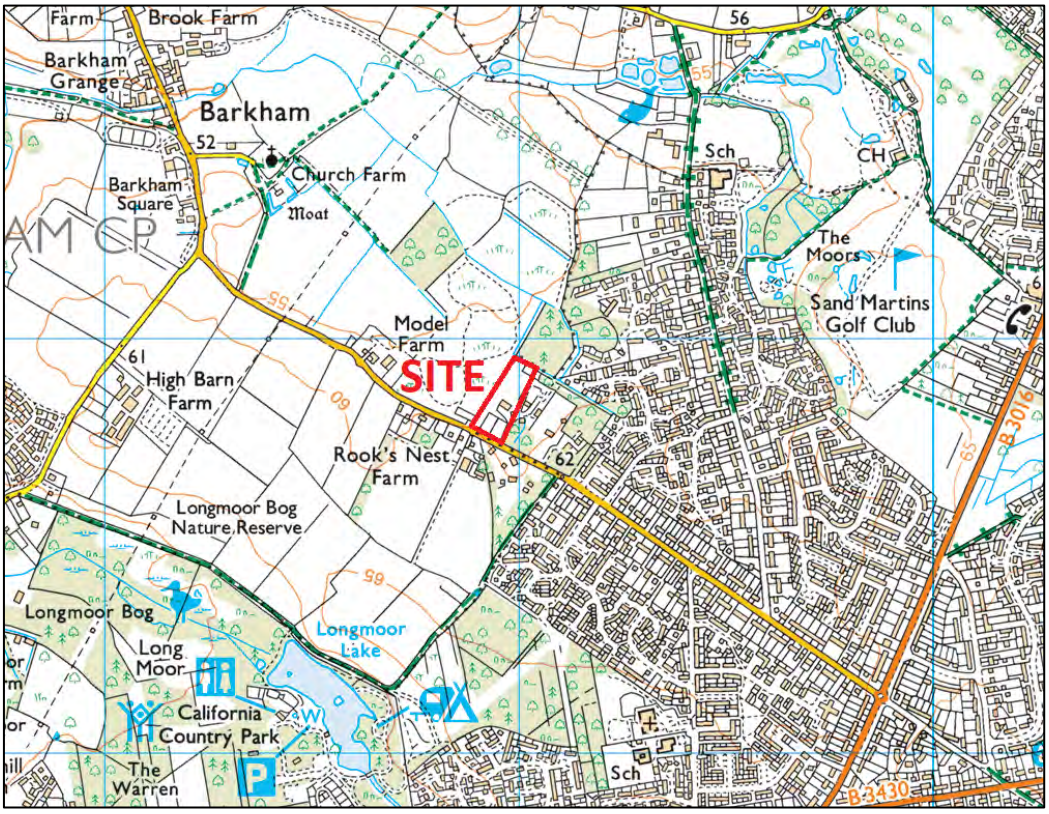

Figure 1.1 – Site Location Map

1.2 Scope

1.2.1 This report describes the existing site conditions, development proposals and implications of flooding on the site as described in the governments guidance document; National Planning Policy Framework (NPPF) and its technical guidance. This report will consider the following:

- Development proposals;
- Sources of flooding and flood defences;
- Flooding extents, depth and climate change predictions;

- Impact of flooding on the development;
- Dangers presented by flooding.

1.2.2 This report has been prepared in accordance with the requirements of the governments National Planning Policy Framework (NPPF) and its planning practice guidance and will demonstrate that the proposed development will be safe and will not increase the risk of flooding in the surrounding area.

1.2.3 This report will also consider the proposed drainage regime for the site. It will assess the site's current Greenfield runoff rate, suitable methods of discharging the runoff from the development and set the drainage strategy for the proposed development, including discharge rates and any requirements for attenuation.

2 BASELINE CONDITIONS

2.1 Existing Site

2.1.1 The site is located in an established residential area at 31 Barkham Ride, in north Finchampstead. The site is approximately 1.5 hectares and is located near to a highly developed residential area to its east and southeast, while the land to the north and west of the site is primarily classed as agricultural or greenfield land. The nearest source of fluvial flooding to the site is from the River Loddon and its tributaries, located approximately 1km to the northwest of the site.

2.2 Geology

2.2.1 The British Geological Survey (BGS) indicates that the location of the site is underlain by a mixture of Bagshot Formation – Sand, and London Clay Formation – Clay, silt, and sand. The sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period. There is no available information regarding the superficial geology of the site.

2.3 Proposed Development

2.3.1 The proposed development seeks to demolish the existing property on site to make way for 31 park homes and a community building. The park homes come in 3 different sizes but are all 2 bed, 4 person units.

2.3.2 The proposals include a road through the site and vehicular access will be provided via the adjacent Victoria Gardens estate. The community building will include offices, a hall, kitchen and bar, and toilets.

2.3.3 The proposed site plan for the development is included in Appendix A as drawing 2680-06.

3 SOURCES OF FLOODING

3.1 Fluvial/Tidal Flooding

3.1.1 Detailed flood information was not available from the Environment Agency (EA). Since the site is located within Flood Zone 1, the EA were unable to provide any flood level information for the site.

3.1.2 The NPPF and PPG define the Flood Zones as follows:

- Zone 1: 'Low Probability' This zone comprises land assessed as having a less than a 1 in 1000 annual probability of river or sea flooding (<0.1%) in any year.

- Zone 2: 'Medium Probability' – This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year.

- Zone 3a: 'High Probability' – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- Zone 3b: 'The Functional Floodplain' – This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

3.1.3 The application site is shown to be within Flood Zone 1. This is defined as land assessed as having a less than 1 in 1000 annual probability of river flooding or tidal flooding in any given year. Figure 3.1 below shows the location of the site with regards its proximity to the flood zones, as determined by the Environment Agency's flood map for planning.

Figure 3.1 – EA Fluvial Flood Map

3.1.4 The blue area shows the places at medium risk of flooding (Flood Zone 2) and the dark blue areas show the places at a high risk of flooding (Flood Zone 3). Figure 3.1 shows that the site sits securely within Flood Zone 1.

3.2 Surface Water Flooding

3.2.1 The surface water flood mapping provided by the EA is the best available source of national information on surface water flooding. It is a starting point for understanding patterns and probability of surface water flooding. The EA accept that the mapping has limitations and state that "*these maps cannot definitively show that an area of land or property is, or is not, at risk of flooding, and the maps are not suitable for use at an individual property level*."

3.2.2 Figure 3.2 below shows that the site has a "very low" probability of surface water flooding.

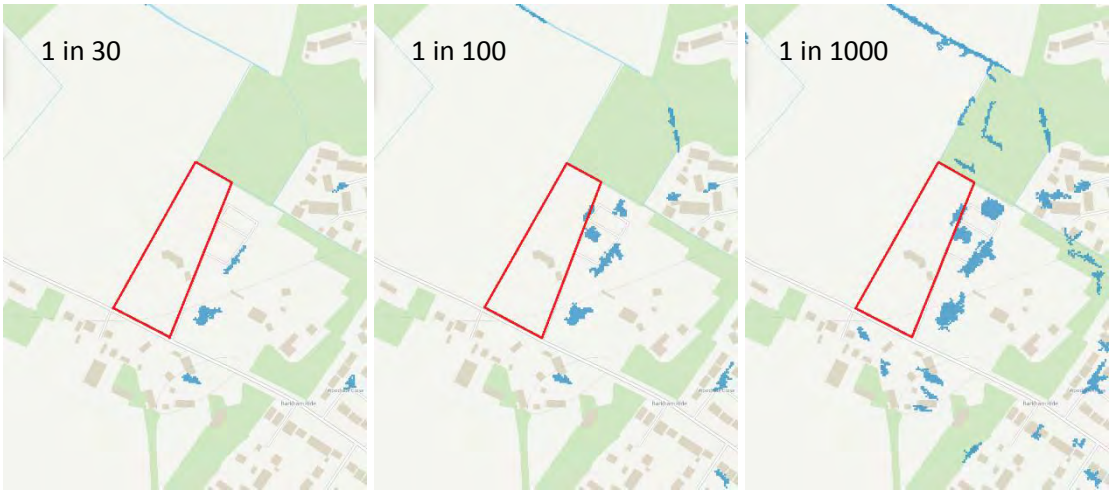

Figure 3.2 – EA Surface Water Flood Maps

3.2.3 According to the above map, the site is not susceptible to either 1 in 100 (1%) or 1 in 30 (3.3%) surface water flooding extents.

3.3 Groundwater Flooding

3.3.1 Although the Council indicates that the borough is susceptible to some degree of groundwater flooding, the map included within Wokingham Borough Council's SFRA (2011) indicates that the site is mostly at low risk of groundwater flooding. Few incidents of groundwater flooding have been reported across the borough.

3.4 Reservoir Flooding

3.4.1 The Environment Agency's flood map for reservoir flooding confirms that the site is not at risk from reservoir flooding, even in a scenario where the rivers are also in flood conditions.

4 MODELLED FLOOD EVENTS AND CLIMATE CHANGE

4.1 Modelled Flood Levels

4.1.1 The main source of flooding for the site is the River Loddon. The EA was unable to provide flood levels for the site given its distance from the flood risk area, but they were able to confirm that the site is in Flood Zone 1, as indicated on the Environment Agency (EA) flood mapping.

4.1.2 The site is therefore considered to have a risk of fluvial flooding with a probability of less than 0.1%.

4.2 Climate Change Allowances

4.2.1 New climate change allowances have been published by the EA, the allowances to be applied are based on the river basin district, the flood zone, and the site vulnerability. The site lies within the Thames River Basin District (the Loddon and Trib Catchment Area). The site is located within Flood Zone 1 and mobile home use is considered a highly vulnerable development. Based on the EA's guidance, no further allowance is required, however if the allowance for the central band was used to assess climate change allowances the flooding for a 1.0% AEP +CC event would not affect the site.

4.2.2 The application site will have a risk of flooding of less than 0.1% once climate change allowances are factored in.

4.3 Impact on Flood Waters

4.3.1 The proposed development involves the demolition of the existing buildings and construction of 31 park homes. The site is situated in a Flood Zone 1 area and has a probability of fluvial flooding of less than 0.1% (1 in 1000 years). There is no history of the site being subject to flooding from any other source.

4.3.2 The proposed development is in a low flood risk area outside of the 1 in 100 AEP +CC flood extent, therefore the proposals will not restrict the flow of flood waters during a flooding event.

4.4 Impact on Storage Volumes

4.4.1 The total footprint of the proposed buildings will be larger than the footprint of the existing building on the site, but as the site is located in a Flood Zone 1 area this will not reduce the flood storage volumes for storm events up to the 1.0% probability. This is also true when climate change allowances have been factored in.

4.5 Impact of Flood on Development

4.5.1 The flood mapping shows that the application site is in Flood Zone 1 and has a probability of flooding of less than 0.1%. Given the site is a significant distance from the nearest source of fluvial flooding and will not be subject to flooding with a probability of 1.0% AEP +CC the proposed development will therefore be safe and will not be subject to damage from flooding.

4.6 Safe Access

4.6.1 Since the site is in Flood Zone 1, dry access can be provided to and from the site at all times.

5 SEQUENTIAL TEST AND EXCEPTION TEST

5.1 Development Vulnerability Classification

5.1.1 The proposed development seeks to construct 31 park homes and a community building. Under Table 2 in the Planning Practical Guidance (PPG) of the NPPF, the proposed development would therefore be classed as a "Highly Vulnerable" proposed use.

5.2 Sequential Test

5.2.1 The aim of the Sequential Test is to ensure that a sequential approach is used to steer new developments to areas with the lowest probability of flooding, as set out in the NPPF and PPG.

5.2.2 Strategic Flood Risk Assessments (SFRA) refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account. They provide the basis for applying the sequential test.

5.2.3 The proposed use is classified as "Highly Vulnerable". The application site is also identified as being in Flood Zone 1 on the Environment Agency's flood maps for planning. The proposal therefore meets the requirements of the Sequential Test to allocate developments to low flood risk areas.

5.2.4 The PPG advises that changes of use can increase the vulnerability of a site and that site-specific flood risk assessments should therefore be undertaken where appropriate. The NPPF advises that the sequential test does not need to be undertaken for change of use applications *"except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate."*

5.2.5 By "*applied as appropriate*", the NPPF suggests that, where a site-specific flood risk assessment shows the site to be within either Flood Zone 2 or 3, a Sequential Test should subsequently be undertaken for changes of use to mobile home / park home sites, due to the high vulnerability of these developments.

5.2.6 Since the site is securely within Flood Zone 1, a Sequential Test is not required. Furthermore, it would not be possible to locate the development in a sequentially better flood risk zone as the site is already in Flood Zone 1. And so even if a Sequential Test were to be undertaken, the application site would either equal or surpass any other site brought forward as part of the test.

5.2.7 Table 2 of the PPG shows that highly vulnerable developments in Flood Zone 1 are appropriate, which means the Exception Test is not required.

Table 2: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓ *

Key:

✓ Exception test is not required

X Development should not be permitted

Table 5.1 – Flood Risk Vulnerability and Flood Zone 'Incompatibility'

5.2.8 Given the proposed dwellings will be located in Flood Zone 1, it is considered that the development meets the requirements of the Sequential Test as the proposed development has been allocated to an area at less risk of flooding.

6 ONSITE DRAINAGE

6.1 Existing Drainage

6.1.1 The application site is currently comprised of 1 residential property (which is to be demolished) and the surrounding land belonging to this dwelling.

6.1.2 Thames Water sewer records were obtained as part of the investigation into the drainage regime for the site. The records indicate that there is a 450mm diameter adopted foul sewer running to the north of the site, flowing to the north-west. The topographical survey shows manholes by the house and on the northern boundary, so it has been assumed that the current property is connected to the public sewer, however a CCTV survey will be required to confirm whether this is the case.

6.1.3 The only surface water sewers in the local area are to the north-east, one of which discharges into the existing ditch that runs along the northern boundary of the site. Other surface water sewers to the north also discharge to the local network of ditches. A copy of the Thames Water sewer records has been included in Appendix C.

6.2 Proposed Foul Drainage

6.2.1 The application site will be provided with a new foul water drainage network to serve the proposed 31 park homes. The preferred option would be to discharge into the existing public foul sewer located to the north of the site via the existing connection, subject to a Section 106 application with Thames Water. Falls across the site mean the connection point would be at a lower level than the houses so any discharge from the properties would not need to be pumped into the connecting foul sewer, and a simple gravity-fed connection could be exploited.

6.3 Proposed Surface Water Drainage

6.3.1 Sustainable Drainage Systems (SuDS) were considered as part of this assessment for the disposal of surface water runoff from the development. The proposed homes are to have pitched roofs, so the use of green or blue roofs is not a viable option for this development and has therefore been discounted.

6.3.2 Rainwater harvesting was also considered to reuse surface water runoff within the dwellings. These systems require a separate network of pipes in the property, tanks and pumps to store the rainwater and distribute it throughout the building. Rainwater harvesting is suitable for large scale developments where the uptake matches the runoff.

6.3.3 Furthermore, if there were consecutive storms the harvesting tank would be full at the start of the storm and all the runoff would discharge via the overflow, so the attenuation would need to be sized ignoring the harvesting facility. Given that rainwater harvesting cannot be relied upon to reduce the rate of runoff from the site and considering the additional costs of the infrastructure necessary to its implementation, rainwater harvesting has been discounted.

6.3.4 Next on the sustainable drainage hierarchy is the use of ground infiltration techniques, such as soakaways and infiltration basins. Percolation testing was undertaken at the site by the client's company A1 UK Drains Ltd on the 31st of January 2023 and the completed report is included in Appendix B. Four separate tests revealed that the ground is unsuitable for infiltration techniques, which is likely due to the large presence of London Clay which underlays the site (as recorded by the British Geological Survey). It is therefore expected that any soakaways designed for the site would not achieve a half drain time of less than 24 hours and therefore would not comply with Building Regulations. It is for this reason that infiltration techniques have been discounted.

6.3.5 Next on the hierarchy is discharging to a watercourse. Although there are no main watercourses directly adjacent to the site, there is a ditch which runs along the northern border of the site. Photographs of the ditch have been included in Appendix F. It is therefore proposed to discharge surface water runoff to this ditch via a box culvert / cellular storage tank, retention pond and control chamber with 2 Hydro-Brakes.

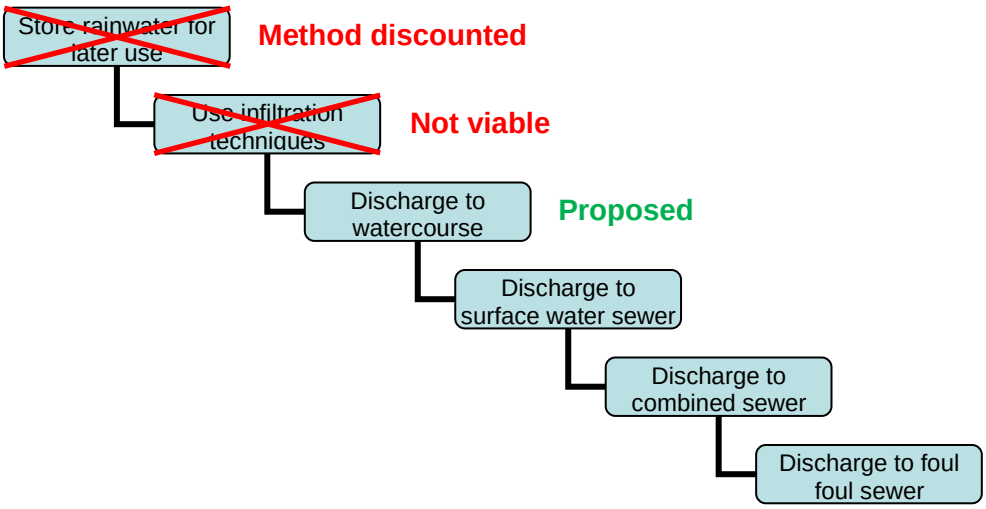

Figure 6.1 – Sustainable Drainage Hierarchy

6.3.6 Calculations have been undertaken to determine the existing Greenfield runoff rate from the site to set the proposed discharge rates. The results are tabulated below in Table 6.1 and are also included in Appendix E.

Return Period (Years)	Greenfield Rate (l/s)	Proposed Rate (l/s)	% Reduction	Max Water Level (mAOD)
1	5.5	5.4	2%	55.965
2	5.8	5.4	7%	56.013
5	8.4	5.6	33%	56.075
10	10.6	6.0	43%	56.142
20	13.1	9.1	31%	56.205
30	14.8	12.4	16%	56.242
50	17.1	16.6	3%	56.291
75	19.3	17.1	11%	56.341
100	20.8	17.2	17%	56.382
200	24.5	18.8	23%	56.497
100 +40% CC	-	20.2	-	56.579

Table 6.1 – Existing and Proposed Flow Rates

6.3.7 The proposed discharge rate from the site to the ditch will be restricted through the use of 2 Hydro-Brake devices, which will both be located in the flow control chamber. The first Hydro-Brake has a design flow of 5.5 l/s, design head of 0.35m and invert level of 55.700m while the second Hydro-Brake has a design flow of 10.0 l/s, design head of 0.30m and invert level of 56.140m.

6.3.8 The control devices have been set so that the peak proposed discharge is limited to below the Greenfield rate for all return periods, and the discharge for the 1 in 100-year event plus 40% allowance for climate change (20.2 l/s) is just under the 1 in 100-year Greenfield rate (20.8 l/s). The reduction in peak flow rate ranges from 2% for a 1 in 1-year event to 43% for a 1 in 10-year event. The existing and proposed peak flow rates have been plotted on the graph below.

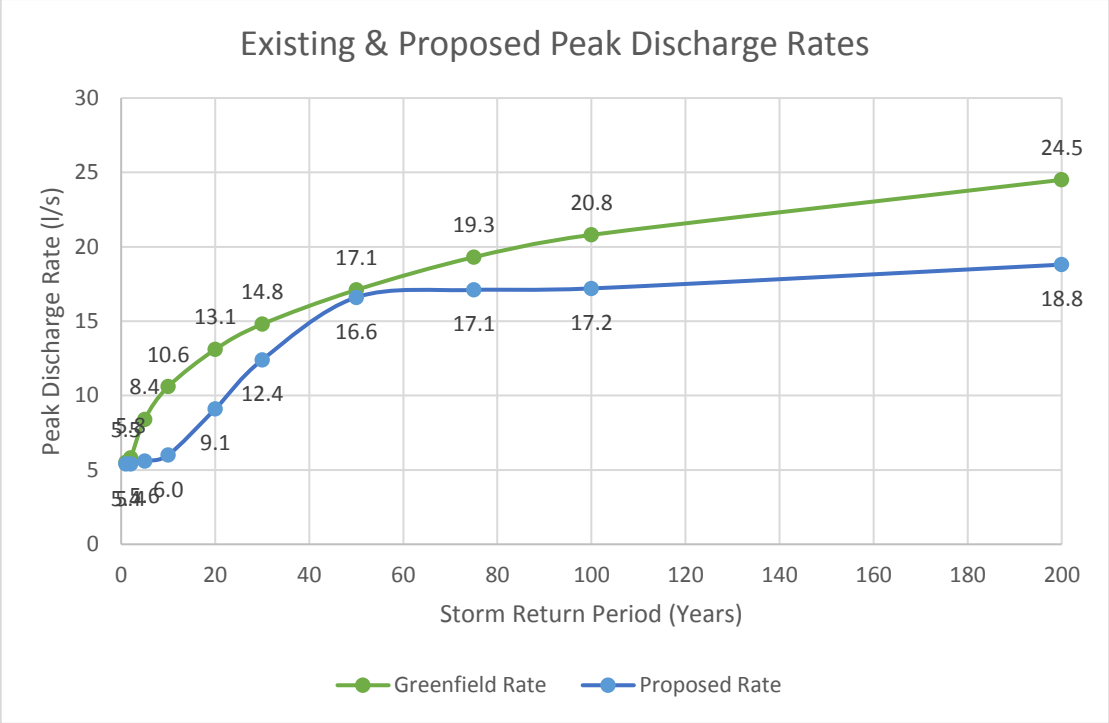

Figure 6.2 – Existing & Proposed Flow Rates

6.3.9 Attenuation storage will be provided in the form of a box culvert / cellular storage tank (to be situated under the proposed access road) and a retention pond (to be situated at the northernmost edge of the site), with the pond collecting runoff from the culvert / tank and reducing the flow rate. The water will not need to be pumped and can rely on a gravity connection from the box culvert to the ditch.

6.3.10 The culvert / tank has been sized at 2m wide x 0.4m deep x 110m long and the base of the retention pond will be sized at 170m^2. The culvert / tank and subsequently the retention pond will collect surface water runoff from the roofs and access road via gullies and pipes and store it before discharging it to the control chamber, where the flow will be further restricted through the Hydro-Brake flow controls into the nearby ditch.

6.3.11 A box culvert is the preferred solution for this development due to the high vehicle loading from refuse vehicles and the limited cover over the structure. However, there may be other products, such as a crate system, that may be more suitable in this particular scenario, and this can be further investigated during the detailed design stage.

6.3.12 Drawing 231641/DS/02 included in Appendix D sets out the proposed drainage strategy for the site, with the box culvert running beneath the access road before the water flows out towards the pond and control chamber at the north of the site. This also shows the proposed foul connection to the nearby public sewer, subject to S106 approval. This drainage assessment has therefore found that discharging surface water to a nearby watercourse/ditch is the most sustainable way to dispose of surface water runoff from the development.

7 SURFACE WATER / SUDS MAINTENANCE

7.1.1 Regularly inspecting the surface water drainage network for blockages and clearing unwanted debris / silt from the system should improve the performance of the surface water network and decrease the need for future repairs. In the event that road gullies become blocked, high pressure water jets can be used to clear the gully and ensure they are functioning correctly, this should be undertaken by certified trained professionals.

7.1.2 The level and frequency of maintenance required on site is dependent on the type of facility. The type of maintenance will fall into one of three categories "regular maintenance", "occasional maintenance" and "remedial maintenance".

7.1.3 Regular maintenance of the drainage and SuDS features will include, inspections, removal of litter / debris and sweeping of the surfaces. Occasional maintenance will include removal of sediment etc. and remedial maintenance may include structural repairs and infiltration reconditioning if required.

7.1.4 The drainage and SuDS elements after an initial inspection following construction should be inspected on a monthly basis for the first 12 months and after large storms, thereafter the following maintenance regime should be applied and adjusted if the 12-month monitoring process has identified any issues.

7.1.5 Following completion of the development a Management Company will be set up to maintain all the communal areas, including the drainage. It will be their responsibility to maintain the drainage network, including the SuDS elements.

7.1.6 The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained.

7.1.7 Pipes are intended to be the main conveyance across the development. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

7.1.8 For manholes and pipes, the following maintenance will be required.

Manhole / Pipe Maintenance Schedule		
	Required Action	**Typical Frequency**
Regular maintenance	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.
	Check and remove large vegetation growth near pipe runs.	Monthly or as required
	Remove sediment from structures.	Annually or as required
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required
	If continued poor performance jet and CCTV survey poorly performing runs.	As required
Monitoring	Inspect/check all inlets, outlets, to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of pipe manholes for sediment build-up and remove if necessary	Every 5 years or as required

Table 7.1 – Manhole, Catchpit and Pipe Maintenance Schedule

7.1.9 For ponds and wetlands, the following maintenance is recommended.

Ponds and Wetlands Maintenance Schedule		
	Required Action	**Typical Frequency**
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public area	Monthly (During growing season)
	Cute the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as require)

	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal	Half Early
	Check any mechanical devices, e.g. penstocks	Half early
	Hand cut submerged and emergent aquatic plants (at minimum of 1.0m above pond and base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5, or as required
	Remove sediment and planting from one quadrant of the main body of ponds	Every 5 years, or as required
Remedial Actions	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. every 25-50 years
Monitoring	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets outlets and overflows	As required

Table 7.2 – Pond Maintenance Schedule

7.1.10 For specialist pieces of equipment such as the Hydro-Brakes, maintenance brochures will be provided by the manufacturers. These will set out the frequency of inspections and correct methods of cleaning etc. that should be followed. It is recommended that once installed the facility should be inspected monthly for the first three months and thereafter at six monthly intervals or as advised in the maintenance brochure.

7.1.11 The above information is only intended as guidance in standard maintenance practise for surface water drainage and SuDS features. The above measures should be reviewed regularly and modified to suit the site conditions.

8 SUMMARY AND CONCLUSION

8.1.1 The site is located on the northern outskirts of Finchampstead in Wokingham, near to other residential areas. The planning application is for the demolition of the existing dwelling and the erection of 31 park homes, community building and access road.

8.1.2 The proposed development site is located in fluvial Flood Zone 1 and is at very low risk of surface water flooding, or from any other sources. The development will therefore not increase the risk of flooding in or around the site and will not be at risk of damage from flood waters for a 1 in 100-year AEP event, including allowances for climate change. Safe and dry access routes can always be provided to and from the site during a flooding event and therefore the proposals are considered NPPF compliant.

8.1.3 Foul drainage from the proposed development will be discharged to the Thames Water sewer running along the northern boundary of the site, subject to an S106 application. Surface water runoff from the new homes, roads and other hard surfaces will drain into an underground box culvert or cellular storage tank (located below the access road) and subsequently to a retention pond, and these will store the water before it is finally discharged at a restricted rate via Hydro-Brake into the nearby ditch. A SuDS assessment has been completed for the development and has found that a discharge to a watercourse/ditch is the most sustainable method of discharge.

8.1.4 For the reasons outlined in this report we see no reason to refuse planning permission on the grounds of flood risk, or there being insufficient capacity to discharge runoff from the development.

APPENDIX A

2680-06 – Proposed Site Layout

LOCATION PLAN 1:2500

Notes

All dimensions and levels on site are to be checked prior to commencement of work.

This drawing is the copyright of Paul Edwards Architecture

SCALE
0 5 10 15 20 30 40 50

SITE AREA = 1:501ha = 3·710 acres

Accommodation

6 N° Omar Heritage units
15 N° Omar Ikon units
10 N° Omar Image units
31 N° TOTAL

Residents community building with 6N° parking spaces and 2N° Sheffield cycle stands

- EXISTING RETAINED TREES WITH ROOT PROTECTION AREA.
- EXISTING HEDGE SCREENING.
- PROPOSED HEDGING.
- PROPOSED SHRUB LANDSCAPE PLANTING.
- PROPOSED GRASSED AREAS.
- POSITION ON AMAZON ECO TWO CYCLE SECURE STORAGE LOCKER OR SIMILAR.
- POSITION OF EV CHARGING POINTS.

F : SURFACE WATER POND INCREASED TO ACCORD WITH DRAINAGE CONSULTANTS DRAWINGS & REPORT. 30:6:25
E : PLOTS 1-3 MOVED TO ALLOW INCREASE OF TREE PLANTING AND LANDSCAPING TO ENTRANCE. 9:6:25
D : FURTHER UNIT OMITTED AND AREA USED FOR ADDITIONAL POCKET LANDSCAPE 20:05:25
C : UNIT NUMBERS REDUCED AREAS OF LANDSCAPE PLANTING AND EV POINTS AND CYCLE STORAGE ADDED. 8:5:25
B : REDRAWN TO SHOW EXISTING MOBILES ON VICTORIA GARDENS TO SITE PLAN AND LOCATION PLAN 25:02:25

CYCLE STORAGE LOCKER - AMAZON ECO 2 L 1900 x W 900 x H 1400

CYCLE STORE

Project
Proposed mobile homes
Victoria Gardens extension
31 Barkham Ride
FINCHAMPSTEAD
Berks

Client
Mr T. Roberts

Drawing
SITE PLAN

Scale	Date
1:500 at A1	February 2025

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Job 2680 Dwg. 06F

APPENDIX B

Infiltration Test Results

A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
Tel: 0118 973 0999 Email: info@a1ukdrains.co.uk

A1 Roberts Properties Ltd

31 Barkham Ride

Finchamsptead

RG40 4EX

31st January 2023

Percolation Testing conducted at 31 Barkham Ride on 30th January 2023

Trench 1 = 1.2m Length, 0.4m Wide, 1.5m Deep (Front Garden)

Measurements every 5 mins for the first hour

Minutes	cm
5	99
10	98
15	98
20	98
25	98
30	98
35	98
40	97
45	97
50	97
55	97
60	97

Measurements every 15 mins for next 3 hours

Minutes	cm
15	97
30	97
45	97
60	97
75	97
90	97
105	97
120	97
135	97
150	97
165	97
180	97

Trench 2 = 1.2m Length, 0.4m Wide, 1.5m Deep (Back Garden)

Measurements every 5 mins for the first hour

Minutes	cm
5	100
10	100
15	100
20	100
25	99
30	99
35	99
40	99
45	99
50	99
55	99
60	99

Measurements every 15 mins for next 3 hours

Minutes	cm
15	99
30	98
45	98
60	98
75	98
90	98
105	98
120	98
135	98
150	98
165	98
180	98

A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
Tel: 0118 973 0999 Email: info@a1ukdrains.co.uk

Trench 3 = 1.2m Length, 0.3m Wide, 1.5m Deep (Play Area)

Measurements every 5 mins for the first hour

Minutes	cm
5	100
10	100
15	99
20	99
25	99
30	98
35	98
40	98
45	97
50	97
55	97
60	96

Measurements every 15 mins for next 3 hours

Minutes	cm
15	96
30	96
45	96
60	96
75	96
90	96
105	96
120	96
135	95
150	95
165	93
180	92

Trench 4 = 1.2m Length, 0.3m Wide, 1.5m Deep (Rear of Menage)

Measurements every 5 mins for the first hour

Minutes	cm
5	100
10	98
15	98
20	97
25	95
30	95
35	94
40	93
45	90
50	88
55	86
60	85

Measurements every 15 mins for next 3 hours

Minutes	cm
15	80
30	78
45	75
60	74
75	72
90	70
105	70
120	67
135	67
150	66
165	66
180	64

Monitoring will continue every 3-4 days for the next month.

A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
Tel: 0118 973 0999 Email: info@a1ukdrains.co.uk

A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
Tel: 0118 973 0999 Email: info@a1ukdrains.co.uk

A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
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A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
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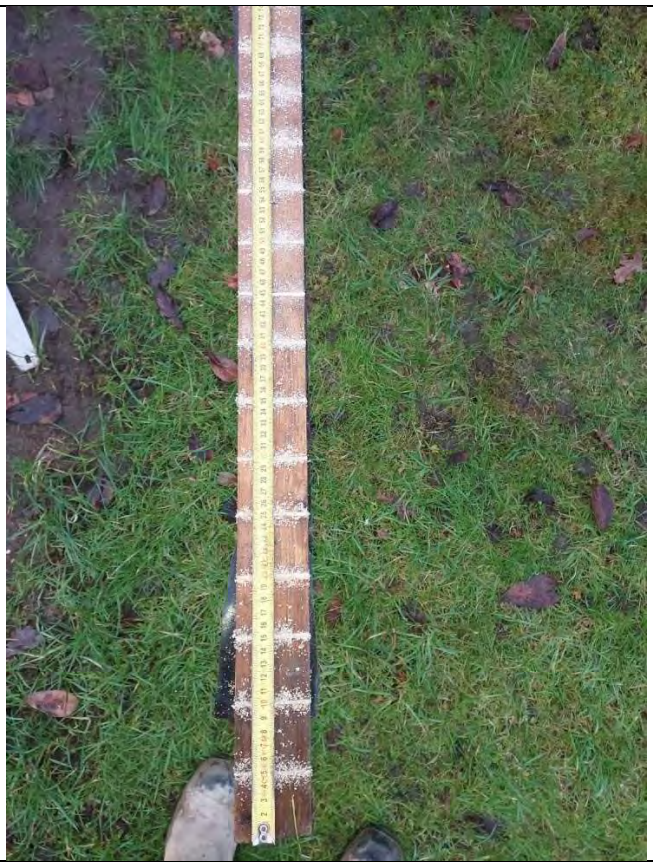
A1 UK DRAINS LTD, 31 Barkham Ride, Finchampstead, Berkshire, RG40 4EX
Tel: 0118 973 0999 Email: info@a1ukdrains.co.uk



LOCATION PLAN 1:2500

Notes

All dimensions and levels on site are to be checked prior to commencement of work.

This drawing is the copyright of Paul Edwards Architecture

SCALE 0 5 10 15 20 30 40 50

SITE AREA = 1·501ha = 3·710 acres

Accommodation

6 N° Omar Heritage units
15 N° Omar Ikon units
10 N° Omar Image units
31 N° TOTAL

Residents community building with 6N° parking spaces and 2N° Sheffield cycle stands

EXISTING RETAINED TREES WITH ROOT PROTECTION AREA.
EXISTING HEDGE SCREENING.
PROPOSED HEDGING.
PROPOSED SHRUB LANDSCAPE PLANTING.
PROPOSED GRASSED AREAS.
POSITION ON AMAZON ECO TWO CYCLE SECURE STORAGE LOCKER OR SIMILAR.
POSITION OF EV CHARGING POINTS.

F : SURFACE WATER POND INCREASED TO ACCORD WITH DRAINAGE CONSULTANTS DRAWINGS & REPORT. 30:6:25
E : PLOTS 1-3 MOVED TO ALLOW INCREASE OF TREE PLANTING AND LANDSCAPING TO ENTRANCE. 9:6:25
D : FURTHER UNIT OMITTED AND AREA USED FOR ADDITIONAL POCKET LANDSCAPE 20:05:25
C : UNIT NUMBERS REDUCED AREAS OF LANDSCAPE PLANTING AND EV POINTS AND CYCLE STORAGE ADDED. 8:5:25
B : REDRAWN TO SHOW EXISTING MOBILES ON VICTORIA GARDENS TO SITE PLAN AND LOCATION PLAN 25:02:25

CYCLE STORAGE LOCKER - AMAZON ECO 2 L1900 x W900 x H1400

CYCLE STORE

Project: Proposed mobile homes Victoria Gardens extension 31 Barkham Ride FINCHAMPSTEAD Berks

Client: Mr T. Roberts

Drawing: SITE PLAN

Scale: 1:500 at A1 | Date: February 2025

Paul Edwards Architecture
12 Sindy Lane, Barkham, Wokingham, Berks RG41 4DR

Job 2680 Dwg. 06F

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: 31 Barkham Ride, Finchampstead, Wokingham
Client: A1 Roberts Properties Ltd

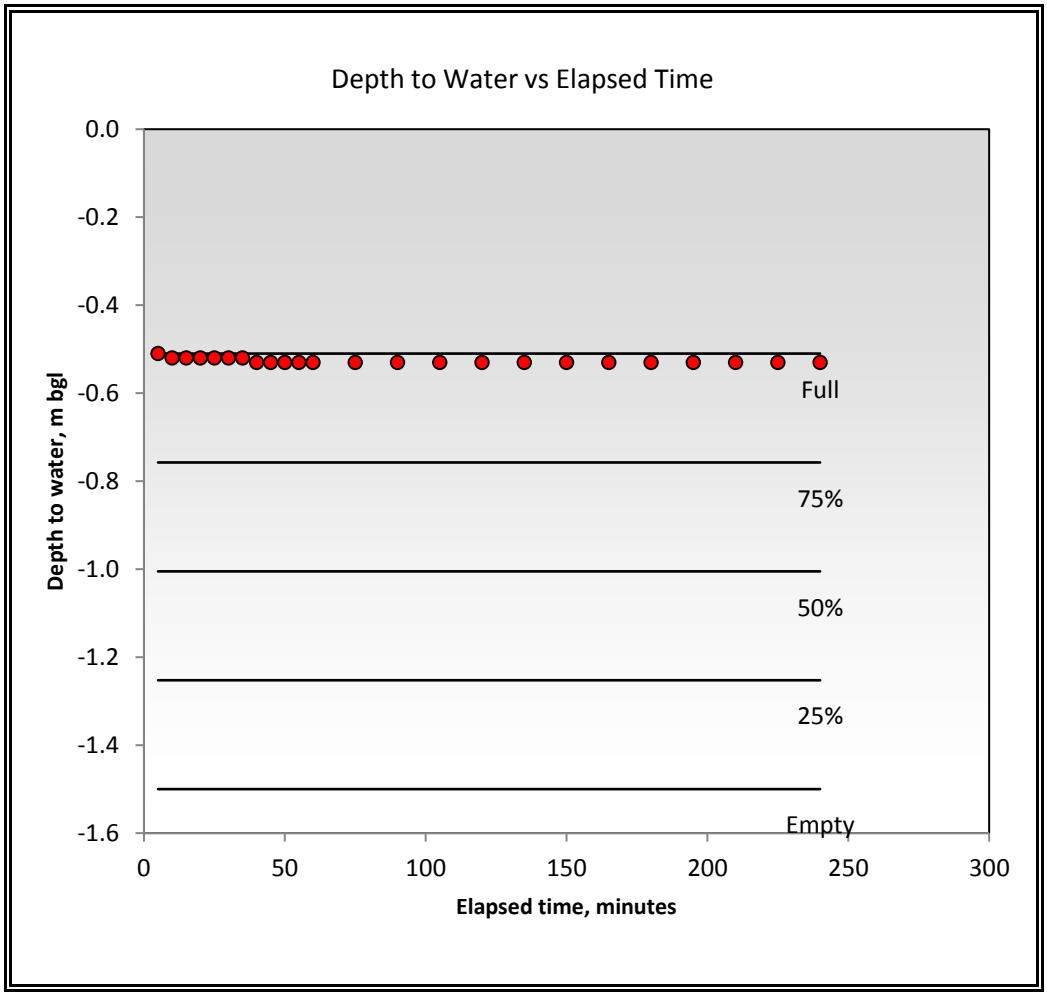
Project No: 231641
Sheet No: 1 of 4

Trial Pit:	1
Test No:	1
Depth, m	1.50
Length, m	1.20
Width, m	0.40

Description of stratum under test
-

Depth of water prior to test, m bgl
0.5

Elapsed Time min	Depth to Water m
5	0.51
10	0.52
15	0.52
20	0.52
25	0.52
30	0.52
35	0.52
40	0.53
45	0.53
50	0.53
55	0.53
60	0.53
75	0.53
90	0.53
105	0.53
120	0.53
135	0.53
150	0.53
165	0.53
180	0.53
195	0.53
210	0.53
225	0.53
240	0.53



f = (V75-V25)/A50(T75-T25)

V75-V25 = 0.24 m^3

A50 = 2.08 m^2

T75-T25 = indeterminate min

f = indeterminate m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: 31 Barkham Ride, Finchampstead, Wokingham
Client: A1 Roberts Properties Ltd

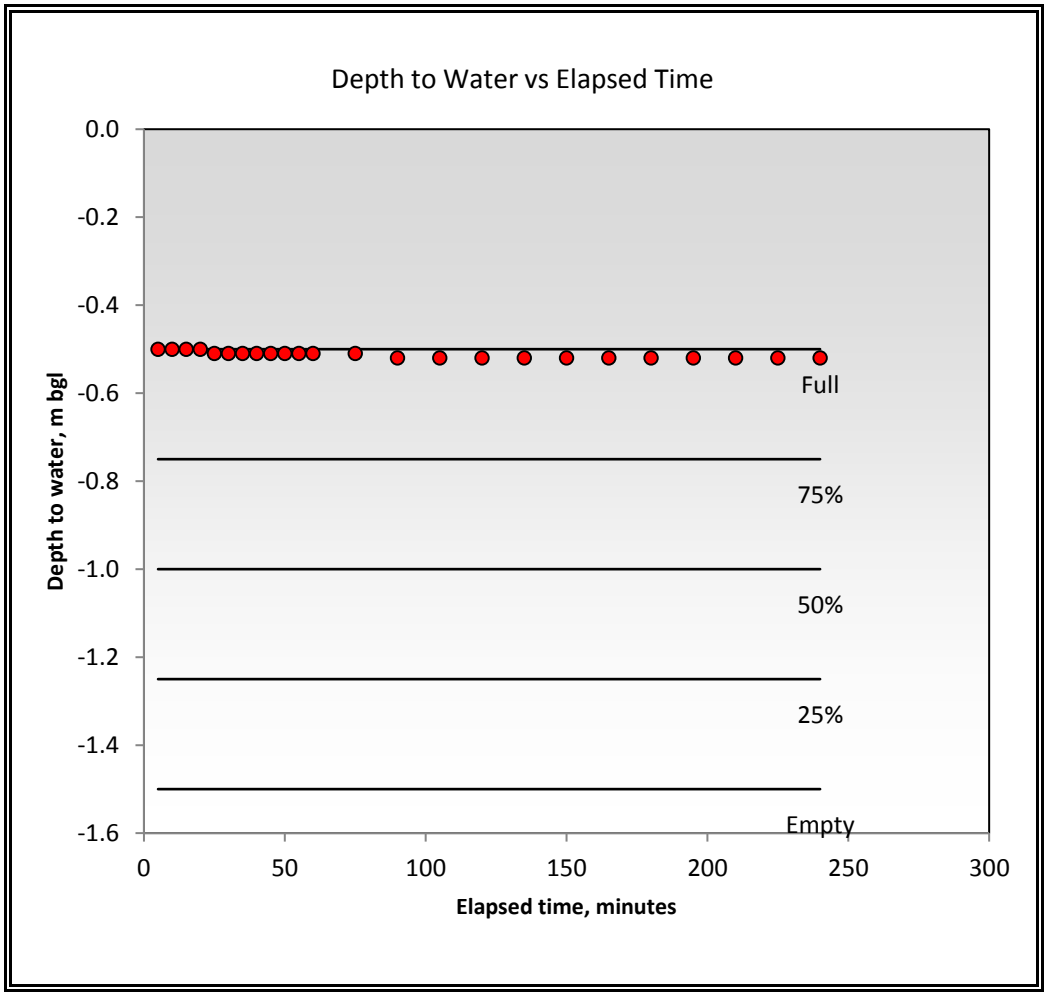
Project No: 231641
Sheet No: 2 of 4

Trial Pit:	2
Test No:	1
Depth, m	1.50
Length, m	1.20
Width, m	0.40

Description of stratum under test
-

Depth of water prior to test, m bgl
0.5

Elapsed Time min	Depth to Water m
5	0.50
10	0.50
15	0.50
20	0.50
25	0.51
30	0.51
35	0.51
40	0.51
45	0.51
50	0.51
55	0.51
60	0.51
75	0.51
90	0.52
105	0.52
120	0.52
135	0.52
150	0.52
165	0.52
180	0.52
195	0.52
210	0.52
225	0.52
240	0.52



f = (V75-V25)/A50(T75-T25)

V75-V25 = 0.24 m^3

A50 = 2.08 m^2

T75-T25 = indeterminate min

f = indeterminate m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: 31 Barkham Ride, Finchampstead, Wokingham
Client: A1 Roberts Properties Ltd

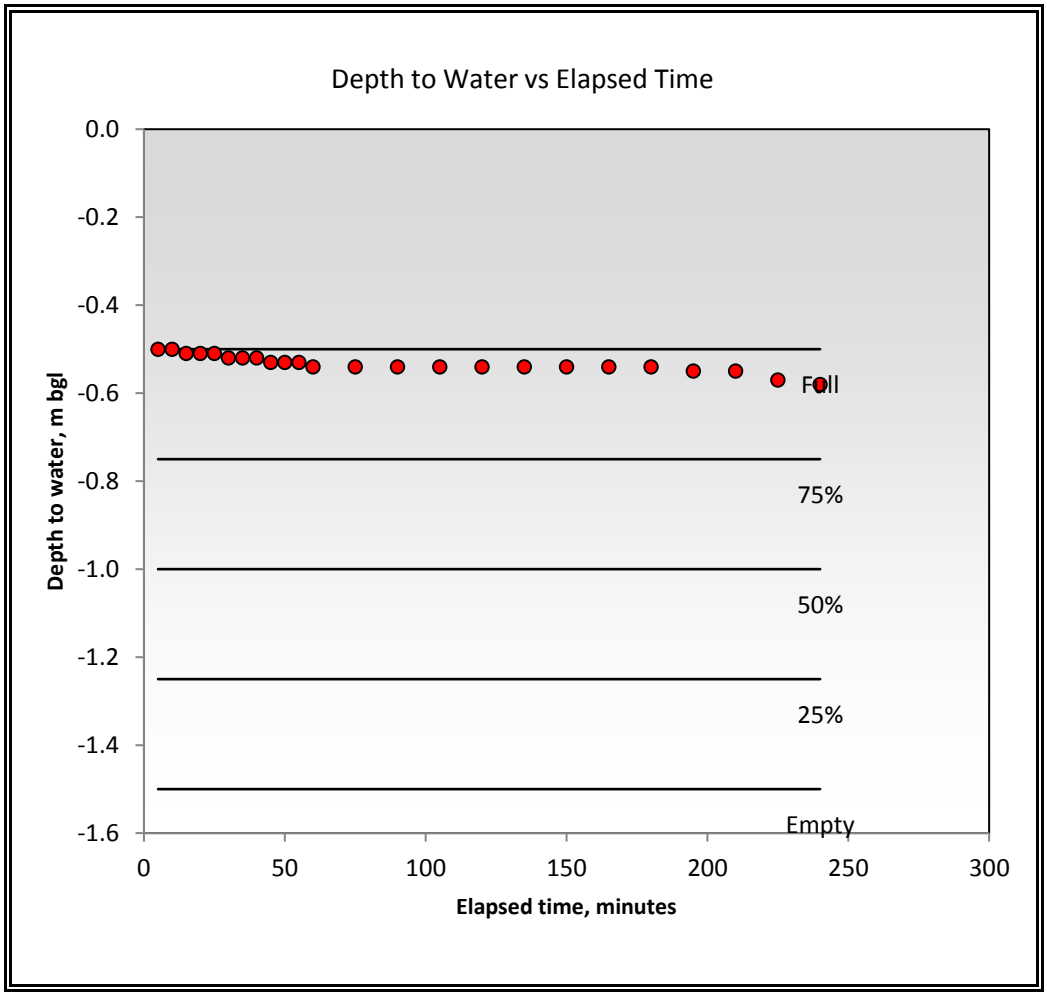
Project No: 231641
Sheet No: 3 of 4

Trial Pit:	3
Test No:	1
Depth, m	1.50
Length, m	1.20
Width, m	0.30

Description of stratum under test
-

Depth of water prior to test, m bgl
0.5

Elapsed Time min	Depth to Water m
5	0.50
10	0.50
15	0.51
20	0.51
25	0.51
30	0.52
35	0.52
40	0.52
45	0.53
50	0.53
55	0.53
60	0.54
75	0.54
90	0.54
105	0.54
120	0.54
135	0.54
150	0.54
165	0.54
180	0.54
195	0.55
210	0.55
225	0.57
240	0.58



f = (V75-V25)/A50(T75-T25)

V75-V25 = 0.18 m^3

A50 = 1.86 m^2

T75-T25 = indeterminate min

f = indeterminate m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: 31 Barkham Ride, Finchampstead, Wokingham
Client: A1 Roberts Properties Ltd

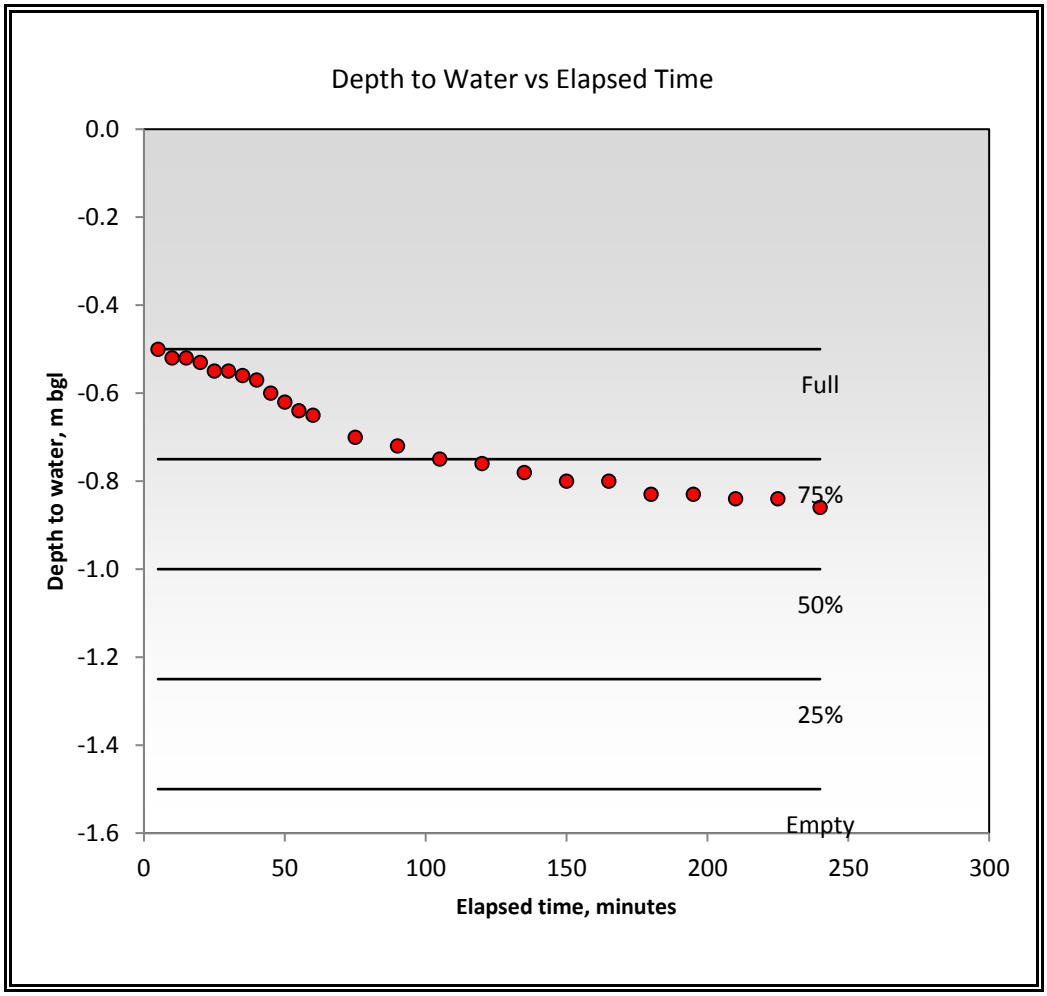
Project No: 231641
Sheet No: 4 of 4

Trial Pit:	4
Test No:	1
Depth, m	1.50
Length, m	1.20
Width, m	0.30

Description of stratum under test
-

Depth of water prior to test, m bgl
0.5

Elapsed Time min	Depth to Water m
5	0.50
10	0.52
15	0.52
20	0.53
25	0.55
30	0.55
35	0.56
40	0.57
45	0.60
50	0.62
55	0.64
60	0.65
75	0.70
90	0.72
105	0.75
120	0.76
135	0.78
150	0.80
165	0.80
180	0.83
195	0.83
210	0.84
225	0.84
240	0.86



f = (V75-V25)/A50(T75-T25)

V75-V25 = 0.18 m^3

A50 = 1.86 m^2

T75-T25 = indeterminate min

f = indeterminate m/s

APPENDIX C

Thames Water Asset Records

Asset Location Search Sewer Map - ALS/ALS Standard/2023_4793456

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 478964,165854

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8001	55.11	52.41
1002	57.14	55.5
1006	57.65	n/a
1005	57.73	55.95
1001	57.14	55.89
1604	61.94	60.43
1603	61.93	60.46
1601	61.97	60.53
1602	61.69	60.68
1605	62.27	60.27
9001	n/a	n/a
9901	n/a	n/a
0901	n/a	n/a
1901	56.89	55.28
1955	57.11	55.66
1953	57.03	55.23
1801	57.81	54.76
1959	57.41	55.8
1952	57.18	55.39
1802	n/a	n/a
1951	57.75	55.62
1803	58.48	55.53
1902	58.41	56.8
1950	58.32	57.27
1851	58.49	56.74
2964	58.36	55.79

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or divects the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement.

If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

APPENDIX D

231641/DS/02 – Proposed Drainage Strategy

31 Barkham Ride
Finchampstead

Drainage Strategy

SCALE	DRAWN BY	JOB No.	DWG No.
1:750	RS	231641	231641/DS/02 Rev A

LANMOR Consulting
Civil Engineers & Transport Planning

Thorogood House, 34 Tolworth Close, Surbiton, Surrey, KT6 7EP
Telephone: 0208 339 7899 Fax: 0208 339 7898
E-mail: info@lanmor.co.uk
www.lanmor.co.uk

APPENDIX E

MicroDrainage – Greenfield Runoff

MicroDrainage – Box Culvert & Pond Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 700 Urban 0.000
Area (ha) 1.486 Soil 0.450 Region Number Region 6

Results l/s

QBAR Rural 6.5
QBAR Urban 6.5

Q100 years 20.8

Q1 year 5.5
Q30 years 14.8
Q100 years 20.8

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Summary of Results for 1 year Return Period

Half Drain Time : 77 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	55.917	0.167	0.0	5.4	0.0	5.4	32.9	O K
30 min Summer	55.933	0.183	0.0	5.4	0.0	5.4	36.9	O K
60 min Summer	55.941	0.191	0.0	5.4	0.0	5.4	38.8	O K
120 min Summer	55.939	0.189	0.0	5.4	0.0	5.4	38.3	O K
180 min Summer	55.933	0.183	0.0	5.4	0.0	5.4	36.7	O K
240 min Summer	55.925	0.175	0.0	5.4	0.0	5.4	34.7	O K
360 min Summer	55.907	0.157	0.0	5.4	0.0	5.4	30.5	O K
480 min Summer	55.890	0.140	0.0	5.4	0.0	5.4	26.7	O K
600 min Summer	55.874	0.124	0.0	5.4	0.0	5.4	23.2	O K
720 min Summer	55.860	0.110	0.0	5.4	0.0	5.4	20.2	O K
960 min Summer	55.837	0.087	0.0	5.4	0.0	5.4	15.7	O K
1440 min Summer	55.812	0.062	0.0	4.8	0.0	4.8	11.0	O K
2160 min Summer	55.794	0.044	0.0	3.8	0.0	3.8	7.7	O K
2880 min Summer	55.783	0.033	0.0	3.2	0.0	3.2	5.8	O K
4320 min Summer	55.771	0.021	0.0	2.5	0.0	2.5	3.7	O K
5760 min Summer	55.764	0.014	0.0	2.1	0.0	2.1	2.3	O K
7200 min Summer	55.758	0.008	0.0	1.8	0.0	1.8	1.4	O K
8640 min Summer	55.754	0.004	0.0	1.6	0.0	1.6	0.8	O K
10080 min Summer	55.751	0.001	0.0	1.4	0.0	1.4	0.2	O K
15 min Winter	55.935	0.185	0.0	5.4	0.0	5.4	37.3	O K
30 min Winter	55.954	0.204	0.0	5.4	0.0	5.4	42.2	O K
60 min Winter	55.965	0.215	0.0	5.4	0.0	5.4	45.1	O K
120 min Winter	55.962	0.212	0.0	5.4	0.0	5.4	44.2	O K
180 min Winter	55.952	0.202	0.0	5.4	0.0	5.4	41.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	39.264	0.0	37.1	0.0	18
30 min Summer	23.574	0.0	44.5	0.0	32
60 min Summer	14.154	0.0	53.5	0.0	58
120 min Summer	8.498	0.0	64.2	0.0	88
180 min Summer	6.305	0.0	71.6	0.0	124
240 min Summer	5.102	0.0	77.2	0.0	158
360 min Summer	3.786	0.0	86.0	0.0	224
480 min Summer	3.063	0.0	92.7	0.0	288
600 min Summer	2.599	0.0	98.4	0.0	350
720 min Summer	2.273	0.0	103.2	0.0	410
960 min Summer	1.845	0.0	111.7	0.0	522
1440 min Summer	1.374	0.0	124.8	0.0	754
2160 min Summer	1.024	0.0	139.5	0.0	1120
2880 min Summer	0.831	0.0	151.0	0.0	1472
4320 min Summer	0.627	0.0	170.8	0.0	2204
5760 min Summer	0.513	0.0	186.4	0.0	2936
7200 min Summer	0.439	0.0	199.5	0.0	3672
8640 min Summer	0.387	0.0	210.8	0.0	4408
10080 min Summer	0.347	0.0	221.1	0.0	5136
15 min Winter	39.264	0.0	41.6	0.0	18
30 min Winter	23.574	0.0	49.9	0.0	31
60 min Winter	14.154	0.0	60.0	0.0	60
120 min Winter	8.498	0.0	71.9	0.0	96
180 min Winter	6.305	0.0	80.1	0.0	134

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	55.940	0.190	0.0	5.4	0.0	5.4	38.5	O K
360 min Winter	55.913	0.163	0.0	5.4	0.0	5.4	31.8	O K
480 min Winter	55.886	0.136	0.0	5.4	0.0	5.4	25.7	O K
600 min Winter	55.861	0.111	0.0	5.4	0.0	5.4	20.5	O K
720 min Winter	55.841	0.091	0.0	5.4	0.0	5.4	16.4	O K
960 min Winter	55.817	0.067	0.0	5.0	0.0	5.0	11.9	O K
1440 min Winter	55.795	0.045	0.0	3.9	0.0	3.9	7.9	O K
2160 min Winter	55.779	0.029	0.0	3.0	0.0	3.0	5.1	O K
2880 min Winter	55.770	0.020	0.0	2.4	0.0	2.4	3.4	O K
4320 min Winter	55.760	0.010	0.0	1.9	0.0	1.9	1.6	O K
5760 min Winter	55.753	0.003	0.0	1.5	0.0	1.5	0.5	O K
7200 min Winter	55.750	0.000	0.0	1.3	0.0	1.3	0.0	O K
8640 min Winter	55.750	0.000	0.0	1.2	0.0	1.2	0.0	O K
10080 min Winter	55.750	0.000	0.0	1.0	0.0	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	5.102	0.0	86.6	0.0	172
360 min Winter	3.786	0.0	96.3	0.0	242
480 min Winter	3.063	0.0	103.9	0.0	306
600 min Winter	2.599	0.0	110.2	0.0	366
720 min Winter	2.273	0.0	115.6	0.0	420
960 min Winter	1.845	0.0	125.1	0.0	530
1440 min Winter	1.374	0.0	139.8	0.0	766
2160 min Winter	1.024	0.0	156.3	0.0	1124
2880 min Winter	0.831	0.0	169.1	0.0	1496
4320 min Winter	0.627	0.0	191.3	0.0	2200
5760 min Winter	0.513	0.0	208.8	0.0	2936
7200 min Winter	0.439	0.0	223.5	0.0	0
8640 min Winter	0.387	0.0	236.2	0.0	0
10080 min Winter	0.347	0.0	247.6	0.0	0

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	1	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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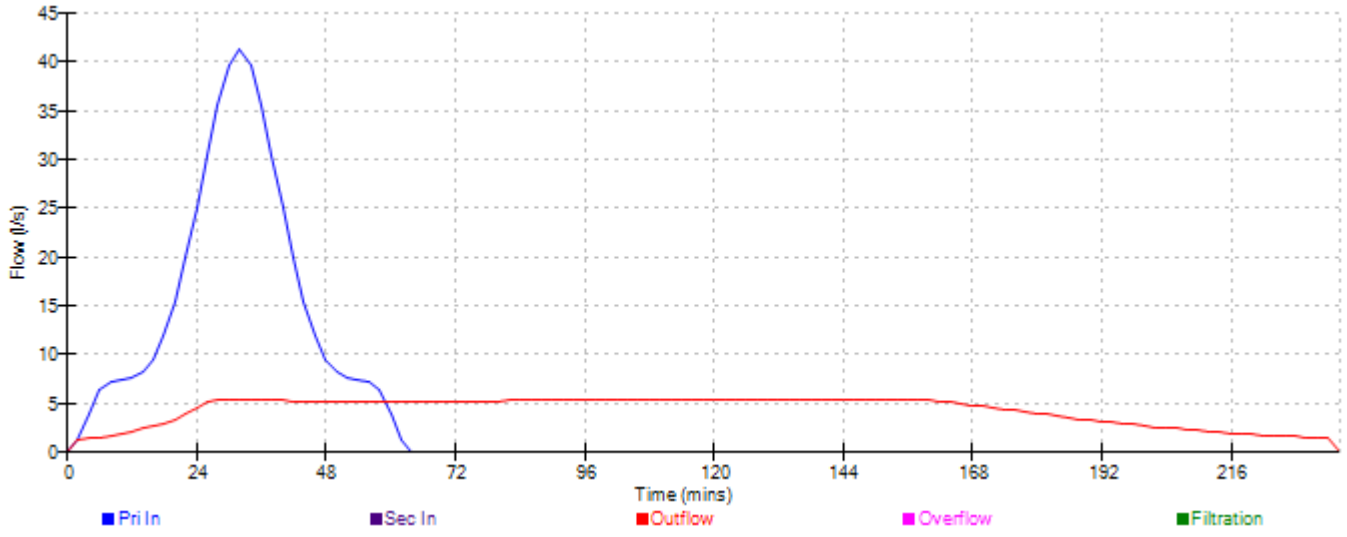
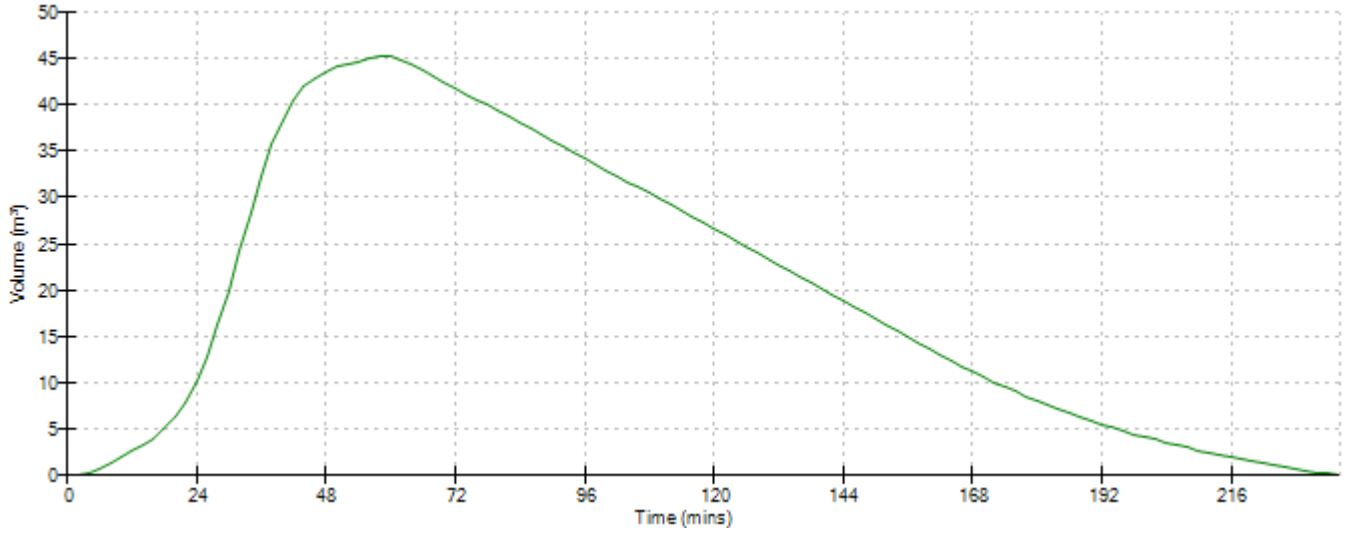
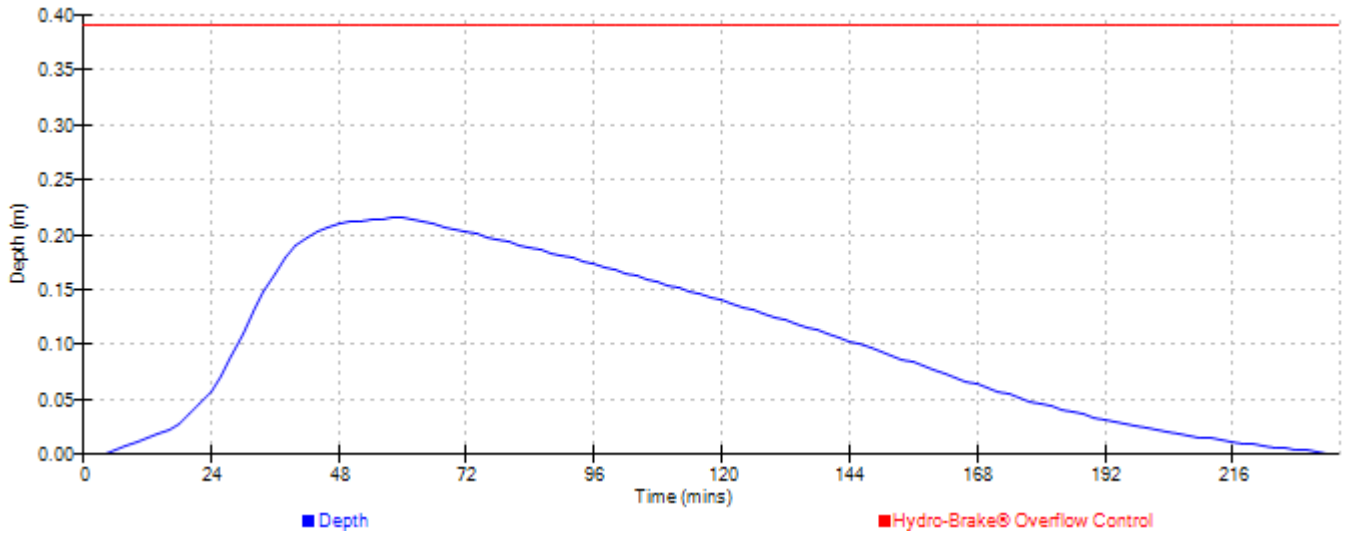
Event: 60 min Winter







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Summary of Results for 2 year Return Period

Half Drain Time : 103 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	55.957	0.207	0.0	5.4	0.0	5.4	42.9	O K
30 min Summer	55.976	0.226	0.0	5.4	0.0	5.4	48.0	O K
60 min Summer	55.987	0.237	0.0	5.4	0.0	5.4	51.2	O K
120 min Summer	55.984	0.234	0.0	5.4	0.0	5.4	50.4	O K
180 min Summer	55.977	0.227	0.0	5.4	0.0	5.4	48.4	O K
240 min Summer	55.969	0.219	0.0	5.4	0.0	5.4	46.0	O K
360 min Summer	55.950	0.200	0.0	5.4	0.0	5.4	41.2	O K
480 min Summer	55.932	0.182	0.0	5.4	0.0	5.4	36.5	O K
600 min Summer	55.914	0.164	0.0	5.4	0.0	5.4	32.1	O K
720 min Summer	55.897	0.147	0.0	5.4	0.0	5.4	28.2	O K
960 min Summer	55.868	0.118	0.0	5.4	0.0	5.4	21.9	O K
1440 min Summer	55.828	0.078	0.0	5.3	0.0	5.3	14.0	O K
2160 min Summer	55.804	0.054	0.0	4.4	0.0	4.4	9.5	O K
2880 min Summer	55.791	0.041	0.0	3.7	0.0	3.7	7.2	O K
4320 min Summer	55.777	0.027	0.0	2.8	0.0	2.8	4.7	O K
5760 min Summer	55.768	0.018	0.0	2.3	0.0	2.3	3.2	O K
7200 min Summer	55.762	0.012	0.0	2.0	0.0	2.0	2.1	O K
8640 min Summer	55.758	0.008	0.0	1.8	0.0	1.8	1.4	O K
10080 min Summer	55.755	0.005	0.0	1.6	0.0	1.6	0.8	O K
15 min Winter	55.978	0.228	0.0	5.4	0.0	5.4	48.5	O K
30 min Winter	55.999	0.249	0.0	5.4	0.0	5.4	54.7	O K
60 min Winter	56.013	0.263	0.0	5.4	0.0	5.4	58.8	O K
120 min Winter	56.012	0.262	0.0	5.4	0.0	5.4	58.3	O K
180 min Winter	56.003	0.253	0.0	5.4	0.0	5.4	55.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	49.878	0.0	47.2	0.0	18
30 min Summer	29.533	0.0	55.8	0.0	32
60 min Summer	17.486	0.0	66.1	0.0	60
120 min Summer	10.353	0.0	78.4	0.0	98
180 min Summer	7.620	0.0	86.5	0.0	130
240 min Summer	6.130	0.0	92.8	0.0	164
360 min Summer	4.512	0.0	102.5	0.0	230
480 min Summer	3.630	0.0	109.9	0.0	296
600 min Summer	3.066	0.0	116.0	0.0	360
720 min Summer	2.671	0.0	121.3	0.0	422
960 min Summer	2.155	0.0	130.5	0.0	540
1440 min Summer	1.593	0.0	144.7	0.0	764
2160 min Summer	1.177	0.0	160.4	0.0	1124
2880 min Summer	0.950	0.0	172.6	0.0	1472
4320 min Summer	0.710	0.0	193.6	0.0	2204
5760 min Summer	0.578	0.0	210.1	0.0	2936
7200 min Summer	0.493	0.0	223.8	0.0	3672
8640 min Summer	0.432	0.0	235.7	0.0	4392
10080 min Summer	0.387	0.0	246.3	0.0	5112
15 min Winter	49.878	0.0	52.8	0.0	18
30 min Winter	29.533	0.0	62.5	0.0	32
60 min Winter	17.486	0.0	74.2	0.0	60
120 min Winter	10.353	0.0	87.9	0.0	112
180 min Winter	7.620	0.0	97.0	0.0	140

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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	55.992	0.242	0.0	5.4	0.0	5.4	52.5	O K
360 min Winter	55.964	0.214	0.0	5.4	0.0	5.4	44.9	O K
480 min Winter	55.935	0.185	0.0	5.4	0.0	5.4	37.3	O K
600 min Winter	55.907	0.157	0.0	5.4	0.0	5.4	30.6	O K
720 min Winter	55.881	0.131	0.0	5.4	0.0	5.4	24.7	O K
960 min Winter	55.840	0.090	0.0	5.4	0.0	5.4	16.3	O K
1440 min Winter	55.807	0.057	0.0	4.5	0.0	4.5	10.0	O K
2160 min Winter	55.787	0.037	0.0	3.4	0.0	3.4	6.4	O K
2880 min Winter	55.776	0.026	0.0	2.8	0.0	2.8	4.5	O K
4320 min Winter	55.764	0.014	0.0	2.1	0.0	2.1	2.4	O K
5760 min Winter	55.757	0.007	0.0	1.7	0.0	1.7	1.2	O K
7200 min Winter	55.752	0.002	0.0	1.5	0.0	1.5	0.3	O K
8640 min Winter	55.750	0.000	0.0	1.3	0.0	1.3	0.0	O K
10080 min Winter	55.750	0.000	0.0	1.2	0.0	1.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	6.130	0.0	103.9	0.0	178
360 min Winter	4.512	0.0	114.7	0.0	252
480 min Winter	3.630	0.0	123.0	0.0	320
600 min Winter	3.066	0.0	130.0	0.0	382
720 min Winter	2.671	0.0	135.9	0.0	442
960 min Winter	2.155	0.0	146.2	0.0	550
1440 min Winter	1.593	0.0	162.1	0.0	766
2160 min Winter	1.177	0.0	179.7	0.0	1124
2880 min Winter	0.950	0.0	193.3	0.0	1496
4320 min Winter	0.710	0.0	216.8	0.0	2200
5760 min Winter	0.578	0.0	235.3	0.0	2944
7200 min Winter	0.493	0.0	250.8	0.0	3672
8640 min Winter	0.432	0.0	264.1	0.0	0
10080 min Winter	0.387	0.0	275.9	0.0	0

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	2	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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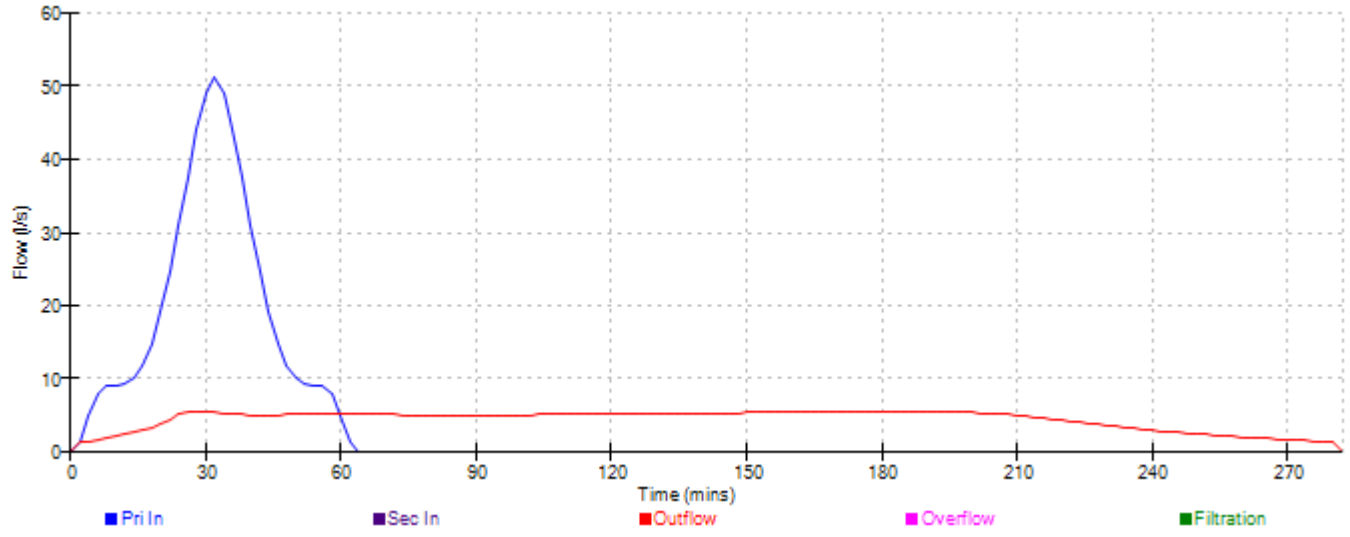
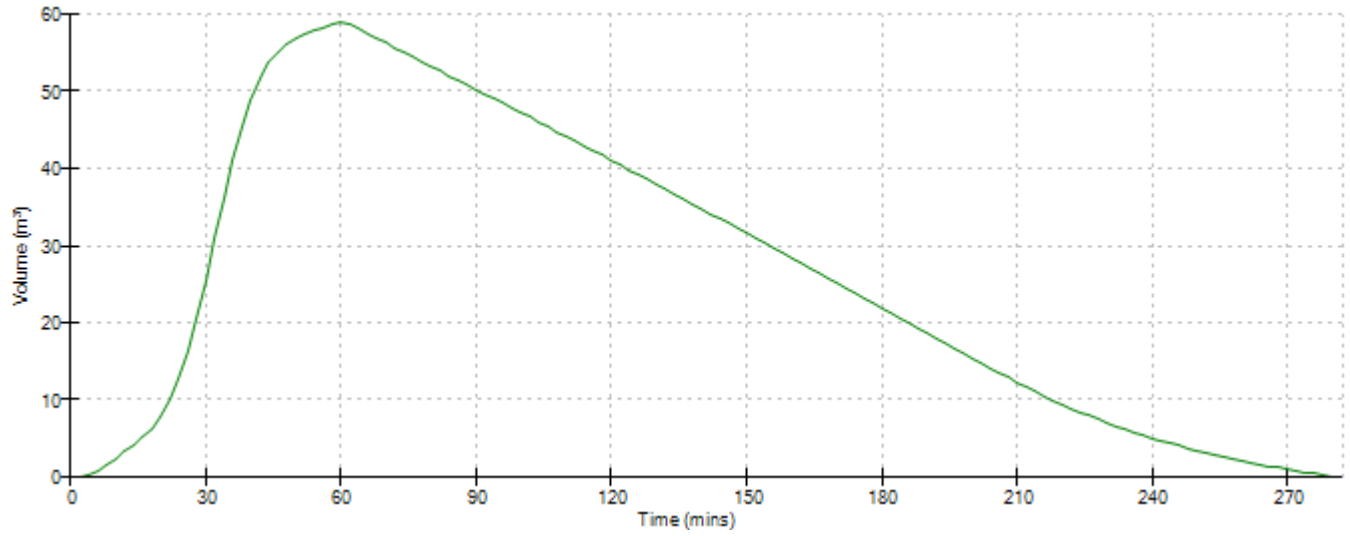
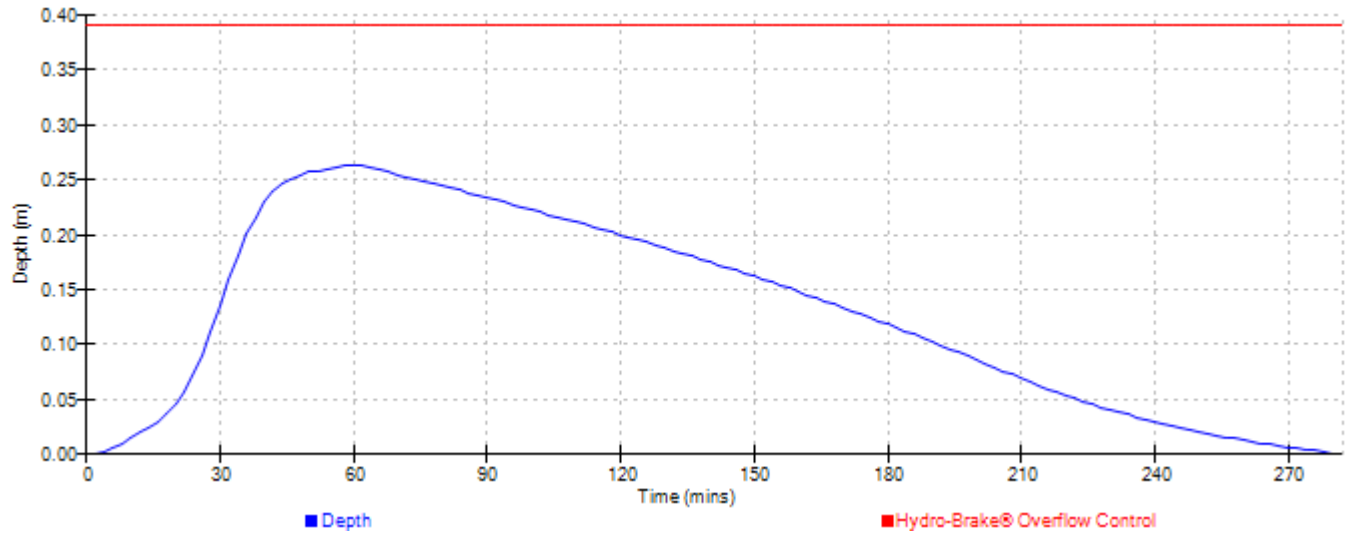
Event: 60 min Winter







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Summary of Results for 5 year Return Period

Half Drain Time : 125 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.010	0.260	0.0	5.4	0.0	5.4	57.9	O K
30 min Summer	56.031	0.281	0.0	5.4	0.0	5.4	64.3	O K
60 min Summer	56.045	0.295	0.0	5.4	0.0	5.4	68.6	O K
120 min Summer	56.042	0.292	0.0	5.4	0.0	5.4	67.7	O K
180 min Summer	56.034	0.284	0.0	5.4	0.0	5.4	65.3	O K
240 min Summer	56.026	0.276	0.0	5.4	0.0	5.4	62.7	O K
360 min Summer	56.008	0.258	0.0	5.4	0.0	5.4	57.4	O K
480 min Summer	55.990	0.240	0.0	5.4	0.0	5.4	52.1	O K
600 min Summer	55.971	0.221	0.0	5.4	0.0	5.4	46.7	O K
720 min Summer	55.952	0.202	0.0	5.4	0.0	5.4	41.7	O K
960 min Summer	55.918	0.168	0.0	5.4	0.0	5.4	33.1	O K
1440 min Summer	55.863	0.113	0.0	5.4	0.0	5.4	20.7	O K
2160 min Summer	55.819	0.069	0.0	5.1	0.0	5.1	12.3	O K
2880 min Summer	55.802	0.052	0.0	4.3	0.0	4.3	9.2	O K
4320 min Summer	55.785	0.035	0.0	3.3	0.0	3.3	6.0	O K
5760 min Summer	55.774	0.024	0.0	2.7	0.0	2.7	4.2	O K
7200 min Summer	55.768	0.018	0.0	2.3	0.0	2.3	3.0	O K
8640 min Summer	55.763	0.013	0.0	2.0	0.0	2.0	2.2	O K
10080 min Summer	55.759	0.009	0.0	1.8	0.0	1.8	1.5	O K
15 min Winter	56.034	0.284	0.0	5.4	0.0	5.4	65.3	O K
30 min Winter	56.058	0.308	0.0	5.5	0.0	5.5	72.9	O K
60 min Winter	56.075	0.325	0.0	5.6	0.0	5.6	78.4	O K
120 min Winter	56.075	0.325	0.0	5.6	0.0	5.6	78.6	O K
180 min Winter	56.065	0.315	0.0	5.5	0.0	5.5	75.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	65.897	0.0	62.3	0.0	18
30 min Summer	38.390	0.0	72.6	0.0	32
60 min Summer	22.365	0.0	84.5	0.0	62
120 min Summer	13.029	0.0	98.6	0.0	106
180 min Summer	9.498	0.0	107.9	0.0	138
240 min Summer	7.590	0.0	114.9	0.0	170
360 min Summer	5.533	0.0	125.6	0.0	240
480 min Summer	4.422	0.0	133.8	0.0	308
600 min Summer	3.716	0.0	140.6	0.0	374
720 min Summer	3.224	0.0	146.5	0.0	436
960 min Summer	2.583	0.0	156.5	0.0	560
1440 min Summer	1.891	0.0	171.8	0.0	792
2160 min Summer	1.384	0.0	188.7	0.0	1124
2880 min Summer	1.109	0.0	201.6	0.0	1472
4320 min Summer	0.822	0.0	224.1	0.0	2204
5760 min Summer	0.664	0.0	241.5	0.0	2936
7200 min Summer	0.563	0.0	256.0	0.0	3672
8640 min Summer	0.492	0.0	268.4	0.0	4392
10080 min Summer	0.439	0.0	279.4	0.0	5096
15 min Winter	65.897	0.0	69.8	0.0	18
30 min Winter	38.390	0.0	81.3	0.0	32
60 min Winter	22.365	0.0	94.8	0.0	60
120 min Winter	13.029	0.0	110.4	0.0	116
180 min Winter	9.498	0.0	120.8	0.0	144

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Summary of Results for 5 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.055	0.305	0.0	5.5	0.0	5.5	71.9	O K
360 min Winter	56.031	0.281	0.0	5.4	0.0	5.4	64.3	O K
480 min Winter	56.005	0.255	0.0	5.4	0.0	5.4	56.5	O K
600 min Winter	55.977	0.227	0.0	5.4	0.0	5.4	48.3	O K
720 min Winter	55.947	0.197	0.0	5.4	0.0	5.4	40.3	O K
960 min Winter	55.894	0.144	0.0	5.4	0.0	5.4	27.4	O K
1440 min Winter	55.825	0.075	0.0	5.3	0.0	5.3	13.3	O K
2160 min Winter	55.797	0.047	0.0	4.0	0.0	4.0	8.3	O K
2880 min Winter	55.784	0.034	0.0	3.3	0.0	3.3	5.9	O K
4320 min Winter	55.770	0.020	0.0	2.4	0.0	2.4	3.4	O K
5760 min Winter	55.762	0.012	0.0	2.0	0.0	2.0	2.0	O K
7200 min Winter	55.756	0.006	0.0	1.7	0.0	1.7	1.0	O K
8640 min Winter	55.752	0.002	0.0	1.5	0.0	1.5	0.3	O K
10080 min Winter	55.750	0.000	0.0	1.3	0.0	1.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	7.590	0.0	128.6	0.0	182
360 min Winter	5.533	0.0	140.7	0.0	260
480 min Winter	4.422	0.0	149.9	0.0	334
600 min Winter	3.716	0.0	157.6	0.0	404
720 min Winter	3.224	0.0	164.1	0.0	468
960 min Winter	2.583	0.0	175.3	0.0	586
1440 min Winter	1.891	0.0	192.4	0.0	778
2160 min Winter	1.384	0.0	211.3	0.0	1124
2880 min Winter	1.109	0.0	225.8	0.0	1496
4320 min Winter	0.822	0.0	250.9	0.0	2204
5760 min Winter	0.664	0.0	270.5	0.0	2936
7200 min Winter	0.563	0.0	286.7	0.0	3624
8640 min Winter	0.492	0.0	300.7	0.0	4360
10080 min Winter	0.439	0.0	313.0	0.0	0

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	5	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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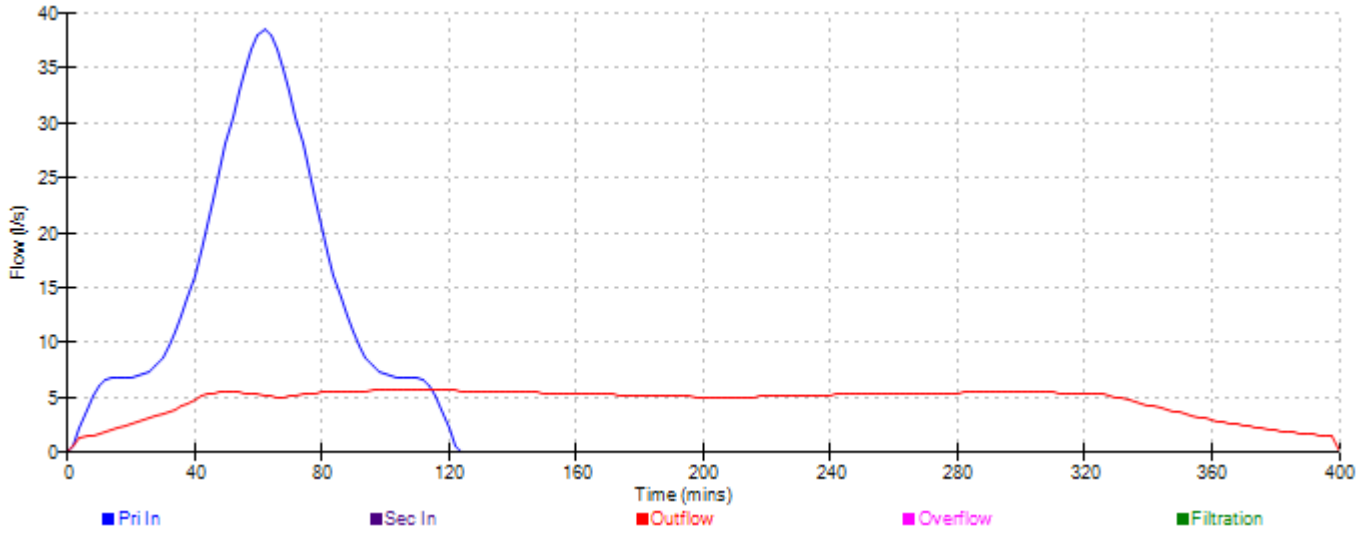
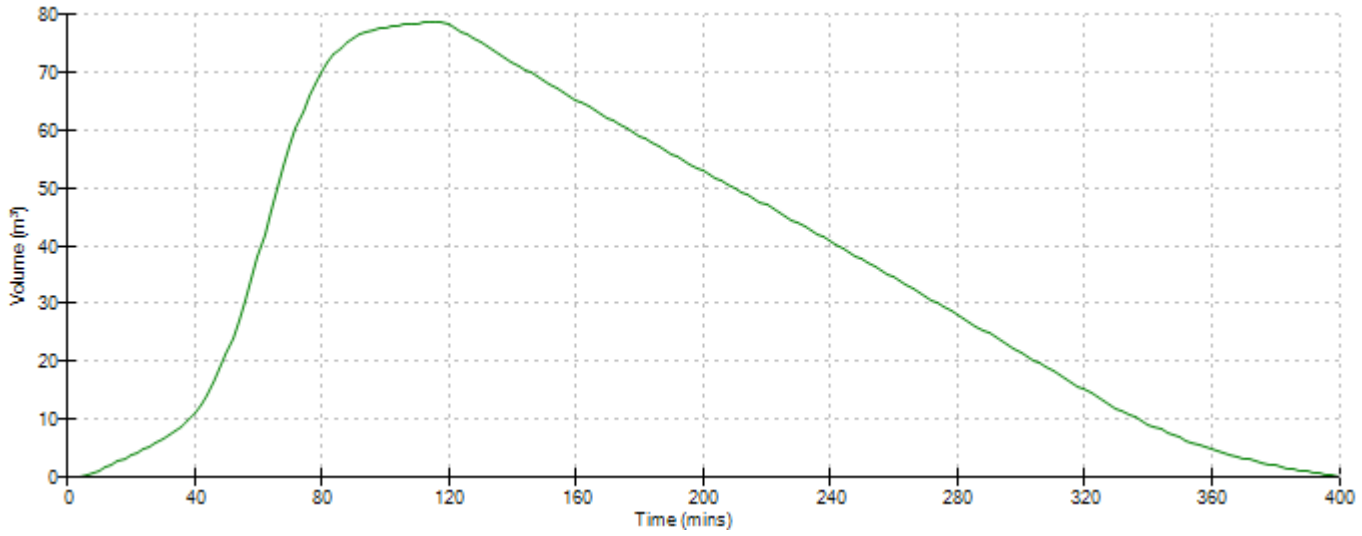
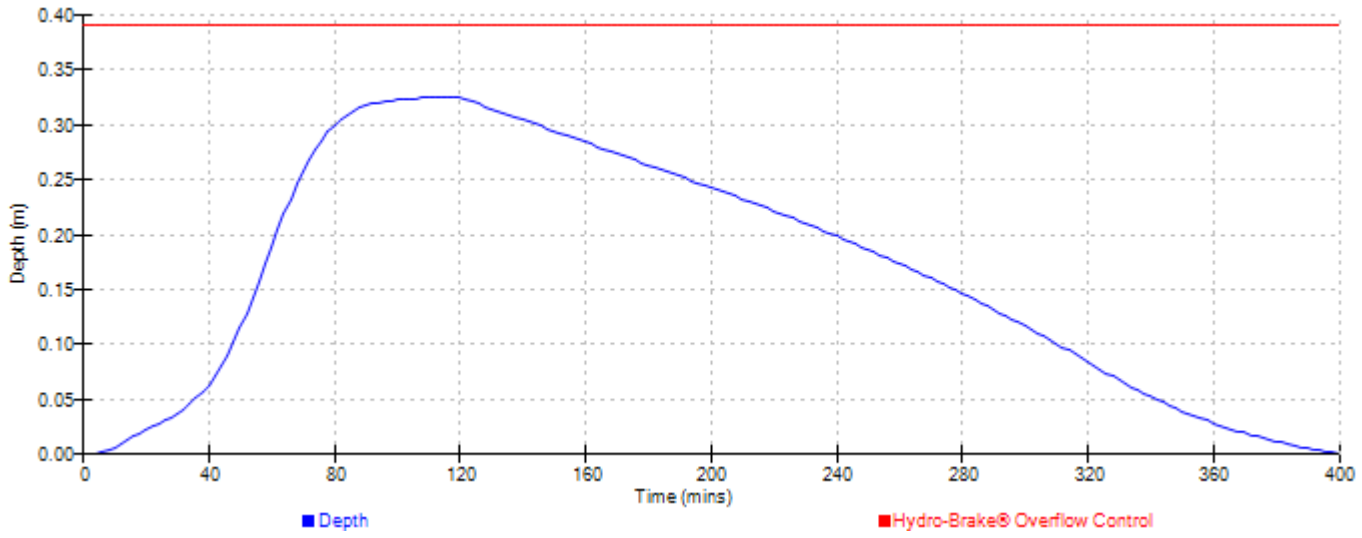
Event: 120 min Winter







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Summary of Results for 10 year Return Period

Half Drain Time : 161 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.068	0.318	0.0	5.5	0.0	5.5	76.0	O K
30 min Summer	56.091	0.341	0.0	5.7	0.0	5.7	83.8	O K
60 min Summer	56.106	0.356	0.0	5.8	0.0	5.8	89.1	O K
120 min Summer	56.103	0.353	0.0	5.8	0.0	5.8	88.3	O K
180 min Summer	56.094	0.344	0.0	5.7	0.0	5.7	84.9	O K
240 min Summer	56.084	0.334	0.0	5.7	0.0	5.7	81.6	O K
360 min Summer	56.066	0.316	0.0	5.5	0.0	5.5	75.3	O K
480 min Summer	56.047	0.297	0.0	5.4	0.0	5.4	69.4	O K
600 min Summer	56.030	0.280	0.0	5.4	0.0	5.4	63.9	O K
720 min Summer	56.013	0.263	0.0	5.4	0.0	5.4	58.6	O K
960 min Summer	55.978	0.228	0.0	5.4	0.0	5.4	48.6	O K
1440 min Summer	55.911	0.161	0.0	5.4	0.0	5.4	31.4	O K
2160 min Summer	55.843	0.093	0.0	5.4	0.0	5.4	16.8	O K
2880 min Summer	55.815	0.065	0.0	4.9	0.0	4.9	11.5	O K
4320 min Summer	55.793	0.043	0.0	3.8	0.0	3.8	7.5	O K
5760 min Summer	55.781	0.031	0.0	3.1	0.0	3.1	5.3	O K
7200 min Summer	55.773	0.023	0.0	2.6	0.0	2.6	4.0	O K
8640 min Summer	55.767	0.017	0.0	2.3	0.0	2.3	2.9	O K
10080 min Summer	55.763	0.013	0.0	2.0	0.0	2.0	2.2	O K
15 min Winter	56.096	0.346	0.0	5.7	0.0	5.7	85.6	O K
30 min Winter	56.121	0.371	0.0	5.9	0.0	5.9	94.8	O K
60 min Winter	56.140	0.390	0.0	6.0	0.0	6.0	101.6	O K
120 min Winter	56.142	0.392	0.0	6.0	0.0	6.0	102.6	O K
180 min Winter	56.131	0.381	0.0	6.0	0.0	6.0	98.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	85.383	0.0	80.7	0.0	18
30 min Summer	48.997	0.0	92.7	0.0	33
60 min Summer	28.117	0.0	106.4	0.0	62
120 min Summer	16.135	0.0	122.2	0.0	116
180 min Summer	11.659	0.0	132.3	0.0	144
240 min Summer	9.259	0.0	140.3	0.0	176
360 min Summer	6.691	0.0	151.9	0.0	244
480 min Summer	5.313	0.0	160.9	0.0	314
600 min Summer	4.443	0.0	168.2	0.0	382
720 min Summer	3.839	0.0	174.5	0.0	450
960 min Summer	3.058	0.0	185.2	0.0	580
1440 min Summer	2.219	0.0	201.6	0.0	810
2160 min Summer	1.610	0.0	219.4	0.0	1144
2880 min Summer	1.282	0.0	233.0	0.0	1476
4320 min Summer	0.942	0.0	256.7	0.0	2204
5760 min Summer	0.756	0.0	274.9	0.0	2936
7200 min Summer	0.638	0.0	290.0	0.0	3672
8640 min Summer	0.555	0.0	302.9	0.0	4400
10080 min Summer	0.494	0.0	314.2	0.0	5136
15 min Winter	85.383	0.0	90.5	0.0	18
30 min Winter	48.997	0.0	103.8	0.0	32
60 min Winter	28.117	0.0	119.1	0.0	60
120 min Winter	16.135	0.0	136.9	0.0	116
180 min Winter	11.659	0.0	148.3	0.0	166

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Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.120	0.370	0.0	5.9	0.0	5.9	94.3	O K
360 min Winter	56.096	0.346	0.0	5.7	0.0	5.7	85.7	O K
480 min Winter	56.071	0.321	0.0	5.6	0.0	5.6	77.1	O K
600 min Winter	56.046	0.296	0.0	5.4	0.0	5.4	68.8	O K
720 min Winter	56.021	0.271	0.0	5.4	0.0	5.4	61.0	O K
960 min Winter	55.966	0.216	0.0	5.4	0.0	5.4	45.3	O K
1440 min Winter	55.866	0.116	0.0	5.4	0.0	5.4	21.4	O K
2160 min Winter	55.810	0.060	0.0	4.6	0.0	4.6	10.6	O K
2880 min Winter	55.793	0.043	0.0	3.8	0.0	3.8	7.4	O K
4320 min Winter	55.776	0.026	0.0	2.8	0.0	2.8	4.5	O K
5760 min Winter	55.767	0.017	0.0	2.3	0.0	2.3	2.8	O K
7200 min Winter	55.760	0.010	0.0	1.9	0.0	1.9	1.7	O K
8640 min Winter	55.756	0.006	0.0	1.7	0.0	1.7	0.9	O K
10080 min Winter	55.752	0.002	0.0	1.5	0.0	1.5	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	9.259	0.0	157.1	0.0	188
360 min Winter	6.691	0.0	170.2	0.0	264
480 min Winter	5.313	0.0	180.2	0.0	340
600 min Winter	4.443	0.0	188.4	0.0	414
720 min Winter	3.839	0.0	195.3	0.0	484
960 min Winter	3.058	0.0	207.5	0.0	618
1440 min Winter	2.219	0.0	225.8	0.0	826
2160 min Winter	1.610	0.0	245.7	0.0	1128
2880 min Winter	1.282	0.0	261.0	0.0	1492
4320 min Winter	0.942	0.0	287.5	0.0	2208
5760 min Winter	0.756	0.0	307.9	0.0	2936
7200 min Winter	0.638	0.0	324.8	0.0	3672
8640 min Winter	0.555	0.0	339.2	0.0	4400
10080 min Winter	0.494	0.0	352.0	0.0	5088

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	10	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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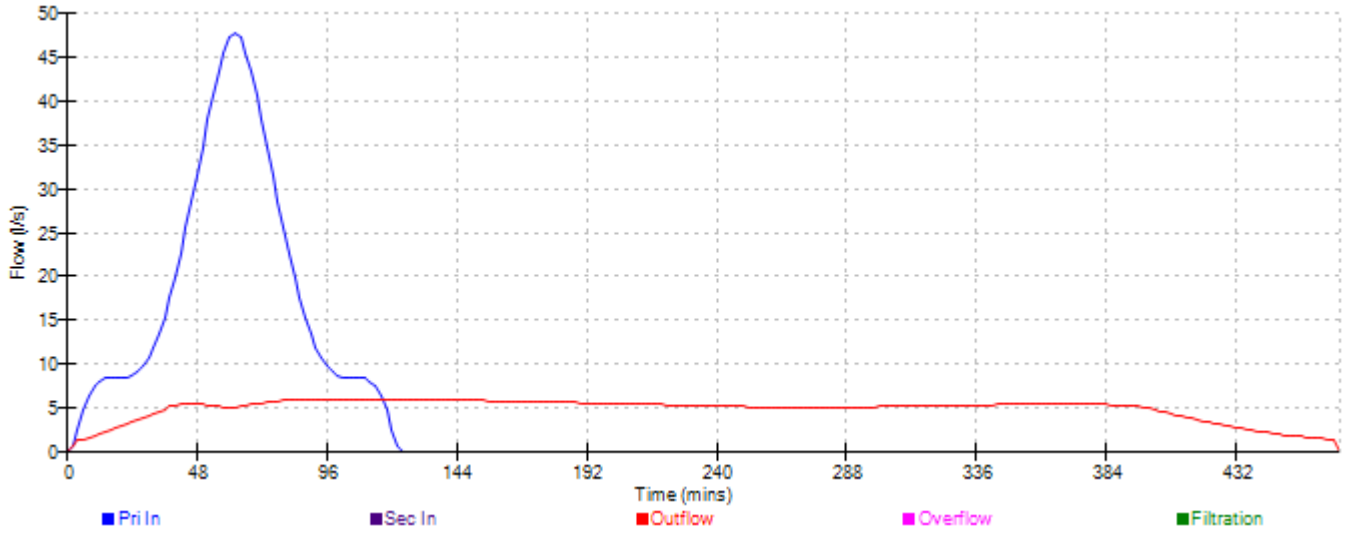
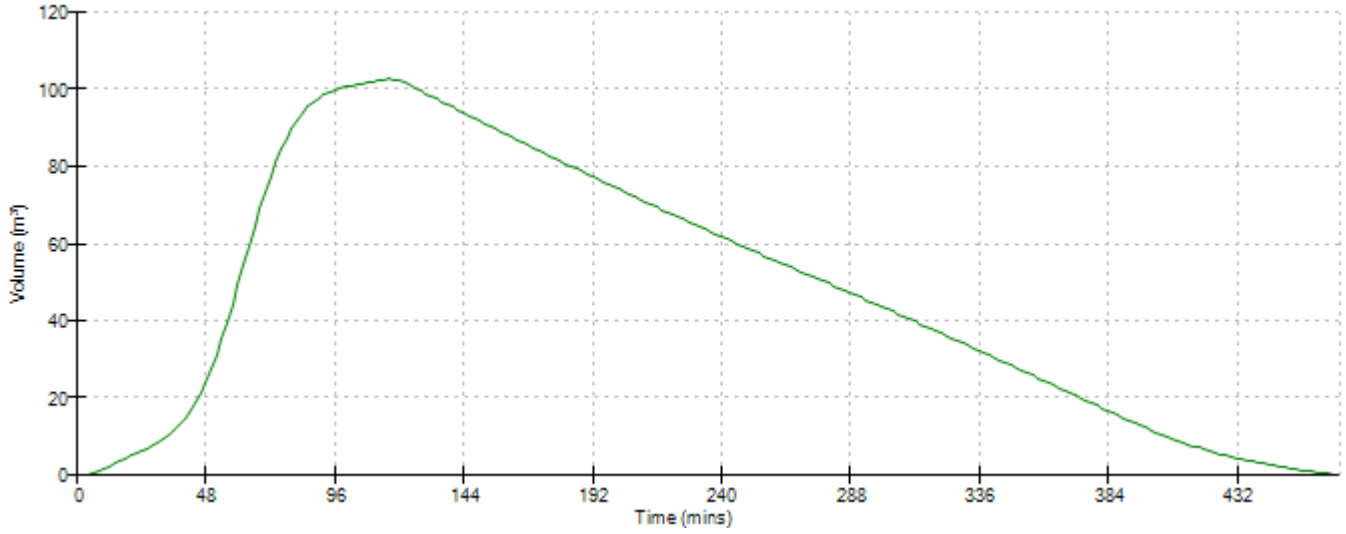
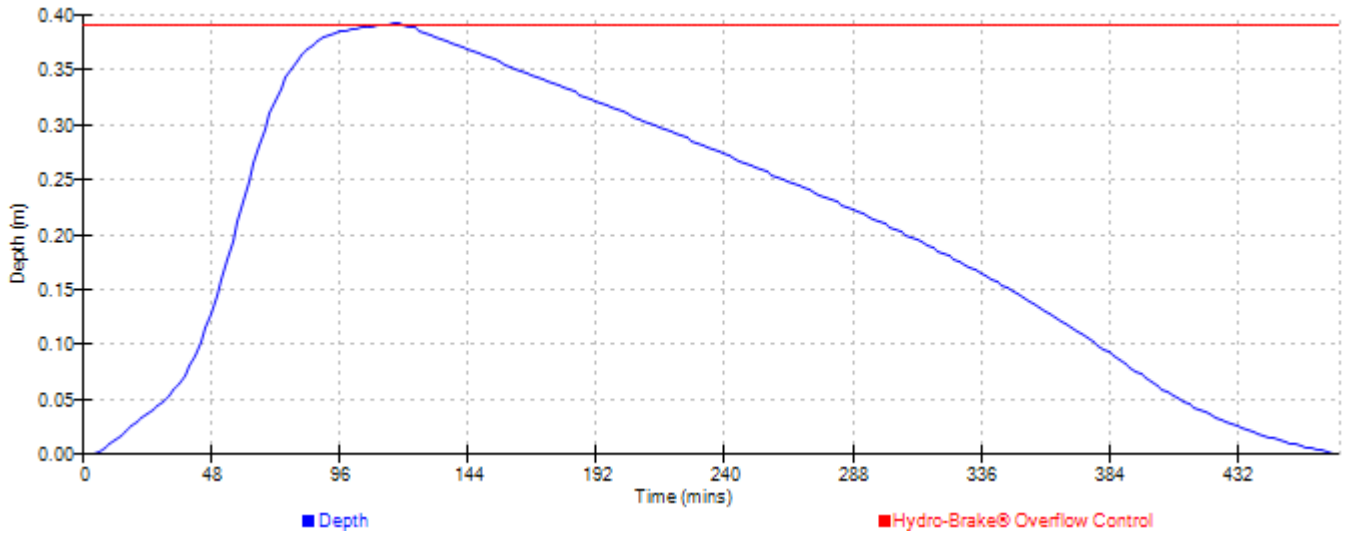
Event: 120 min Winter







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Summary of Results for 20 year Return Period

Half Drain Time : 210 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.131	0.381	0.0	6.0	0.0	6.0	98.5	O K
30 min Summer	56.155	0.405	0.0	6.1	0.2	6.3	107.6	O K
60 min Summer	56.171	0.421	0.0	6.2	0.7	6.9	113.6	O K
120 min Summer	56.168	0.418	0.0	6.2	0.6	6.8	112.7	O K
180 min Summer	56.158	0.408	0.0	6.1	0.2	6.4	108.5	O K
240 min Summer	56.147	0.397	0.0	6.1	0.0	6.1	104.5	O K
360 min Summer	56.126	0.376	0.0	5.9	0.0	5.9	96.7	O K
480 min Summer	56.107	0.357	0.0	5.8	0.0	5.8	89.6	O K
600 min Summer	56.089	0.339	0.0	5.7	0.0	5.7	83.1	O K
720 min Summer	56.071	0.321	0.0	5.6	0.0	5.6	77.1	O K
960 min Summer	56.039	0.289	0.0	5.4	0.0	5.4	66.6	O K
1440 min Summer	55.973	0.223	0.0	5.4	0.0	5.4	47.2	O K
2160 min Summer	55.884	0.134	0.0	5.4	0.0	5.4	25.3	O K
2880 min Summer	55.833	0.083	0.0	5.3	0.0	5.3	14.8	O K
4320 min Summer	55.802	0.052	0.0	4.3	0.0	4.3	9.2	O K
5760 min Summer	55.788	0.038	0.0	3.5	0.0	3.5	6.6	O K
7200 min Summer	55.779	0.029	0.0	3.0	0.0	3.0	5.0	O K
8640 min Summer	55.772	0.022	0.0	2.6	0.0	2.6	3.8	O K
10080 min Summer	55.767	0.017	0.0	2.3	0.0	2.3	2.9	O K
15 min Winter	56.163	0.413	0.0	6.2	0.4	6.6	110.8	O K
30 min Winter	56.189	0.439	0.0	6.3	1.6	7.9	121.1	O K
60 min Winter	56.205	0.455	0.0	6.4	2.7	9.1	127.7	O K
120 min Winter	56.203	0.453	0.0	6.4	2.5	8.9	126.9	O K
180 min Winter	56.193	0.443	0.0	6.4	1.8	8.2	122.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	109.468	0.0	103.5	0.0	18
30 min Summer	61.916	0.0	117.2	0.1	33
60 min Summer	35.020	0.0	132.6	0.8	62
120 min Summer	19.807	0.0	150.0	1.3	120
180 min Summer	14.192	0.0	161.2	0.7	152
240 min Summer	11.203	0.0	169.5	0.1	184
360 min Summer	8.027	0.0	182.3	0.0	250
480 min Summer	6.336	0.0	191.9	0.0	318
600 min Summer	5.274	0.0	199.7	0.0	386
720 min Summer	4.540	0.0	206.2	0.0	456
960 min Summer	3.594	0.0	217.7	0.0	588
1440 min Summer	2.586	0.0	235.0	0.0	850
2160 min Summer	1.860	0.0	253.6	0.0	1172
2880 min Summer	1.473	0.0	267.6	0.0	1500
4320 min Summer	1.072	0.0	292.4	0.0	2204
5760 min Summer	0.856	0.0	311.3	0.0	2936
7200 min Summer	0.719	0.0	326.8	0.0	3672
8640 min Summer	0.624	0.0	340.0	0.0	4408
10080 min Summer	0.553	0.0	351.7	0.0	5120
15 min Winter	109.468	0.0	116.0	0.3	18
30 min Winter	61.916	0.0	131.2	2.1	32
60 min Winter	35.020	0.0	148.5	5.4	60
120 min Winter	19.807	0.0	168.0	7.9	114
180 min Winter	14.192	0.0	180.4	7.3	146

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Summary of Results for 20 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.184	0.434	0.0	6.3	1.3	7.6	119.1	O K
360 min Winter	56.163	0.413	0.0	6.2	0.4	6.5	110.6	O K
480 min Winter	56.139	0.389	0.0	6.0	0.0	6.0	101.2	O K
600 min Winter	56.113	0.363	0.0	5.9	0.0	5.9	91.9	O K
720 min Winter	56.088	0.338	0.0	5.7	0.0	5.7	83.1	O K
960 min Winter	56.041	0.291	0.0	5.4	0.0	5.4	67.4	O K
1440 min Winter	55.935	0.185	0.0	5.4	0.0	5.4	37.4	O K
2160 min Winter	55.826	0.076	0.0	5.3	0.0	5.3	13.6	O K
2880 min Winter	55.803	0.053	0.0	4.3	0.0	4.3	9.3	O K
4320 min Winter	55.782	0.032	0.0	3.2	0.0	3.2	5.7	O K
5760 min Winter	55.772	0.022	0.0	2.5	0.0	2.5	3.7	O K
7200 min Winter	55.765	0.015	0.0	2.1	0.0	2.1	2.5	O K
8640 min Winter	55.760	0.010	0.0	1.9	0.0	1.9	1.6	O K
10080 min Winter	55.756	0.006	0.0	1.7	0.0	1.7	0.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	11.203	0.0	189.9	5.5	184
360 min Winter	8.027	0.0	204.2	1.3	268
480 min Winter	6.336	0.0	215.0	0.0	346
600 min Winter	5.274	0.0	223.7	0.0	420
720 min Winter	4.540	0.0	231.0	0.0	492
960 min Winter	3.594	0.0	243.8	0.0	634
1440 min Winter	2.586	0.0	263.2	0.0	880
2160 min Winter	1.860	0.0	284.0	0.0	1148
2880 min Winter	1.473	0.0	299.8	0.0	1496
4320 min Winter	1.072	0.0	327.5	0.0	2208
5760 min Winter	0.856	0.0	348.7	0.0	2936
7200 min Winter	0.719	0.0	366.0	0.0	3672
8640 min Winter	0.624	0.0	380.9	0.0	4336
10080 min Winter	0.553	0.0	393.9	0.0	5096

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	20	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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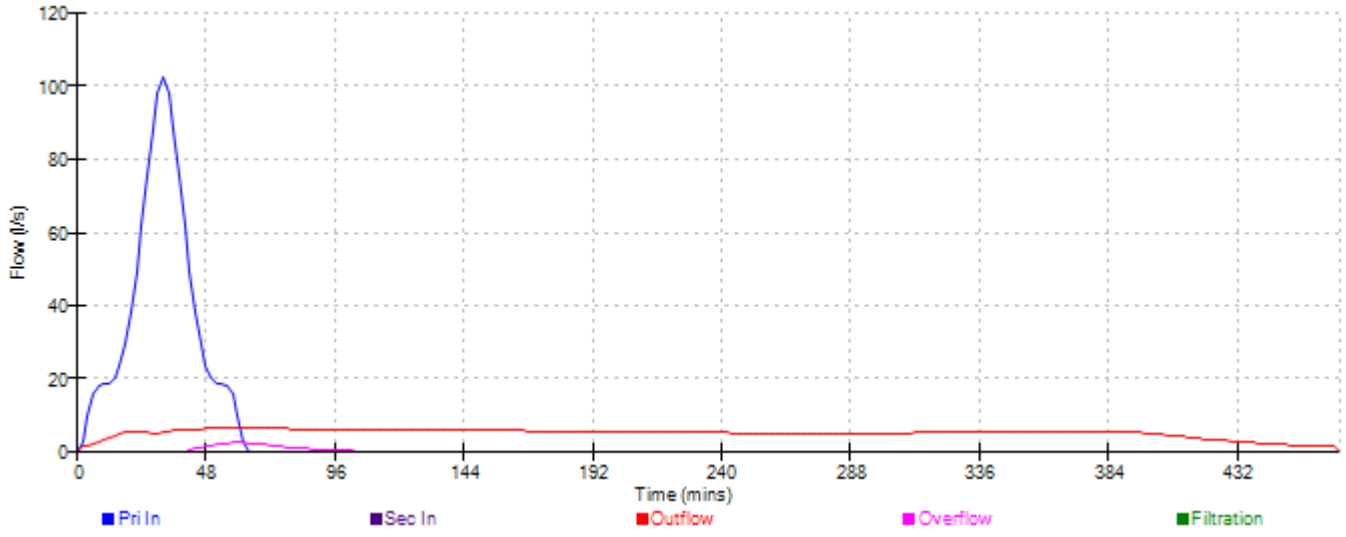
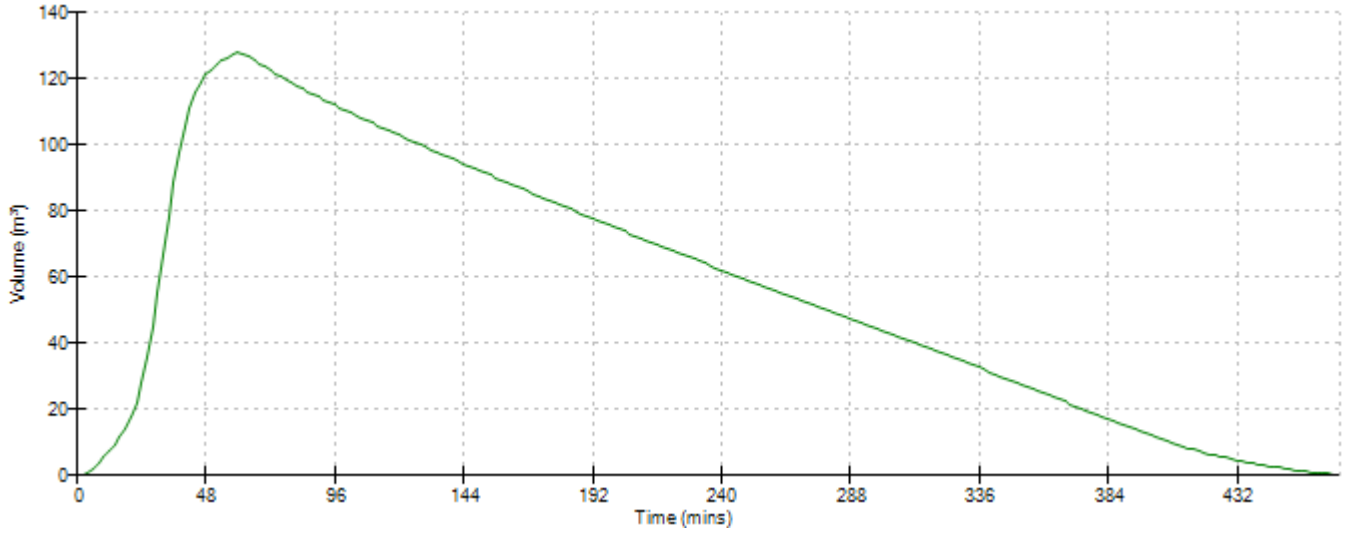
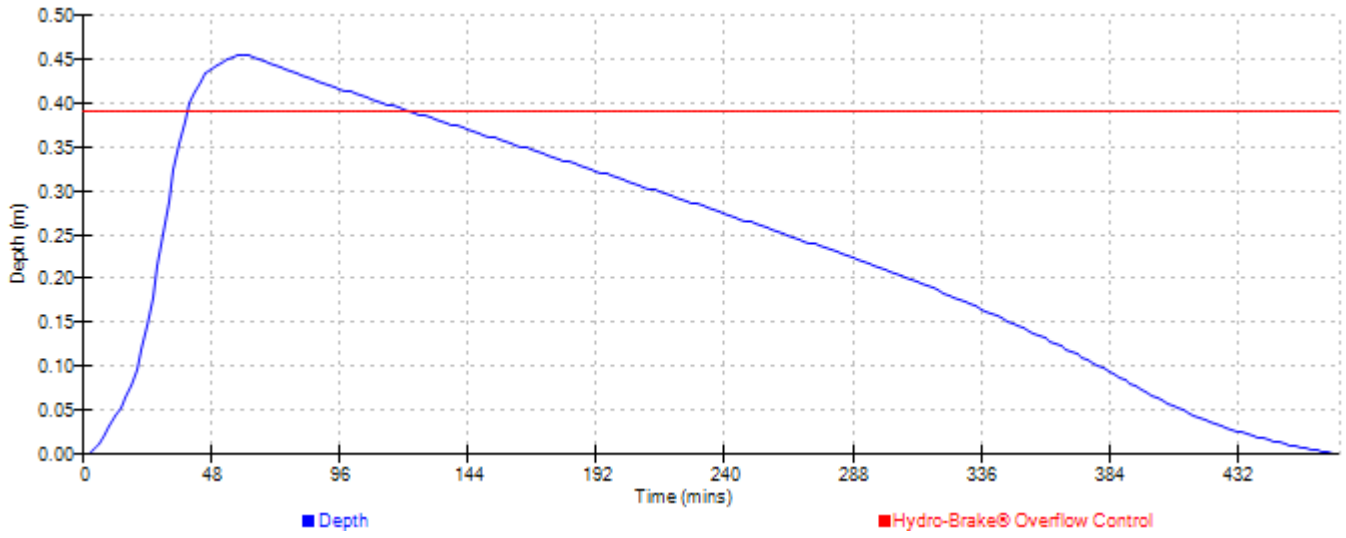
Event: 60 min Winter







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Summary of Results for 30 year Return Period

Half Drain Time : 224 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.172	0.422	0.0	6.2	0.7	6.9	114.1	O K
30 min Summer	56.195	0.445	0.0	6.4	1.9	8.3	123.4	O K
60 min Summer	56.207	0.457	0.0	6.4	2.8	9.2	128.5	O K
120 min Summer	56.201	0.451	0.0	6.4	2.3	8.8	125.9	O K
180 min Summer	56.191	0.441	0.0	6.3	1.7	8.1	122.0	O K
240 min Summer	56.182	0.432	0.0	6.3	1.2	7.5	118.2	O K
360 min Summer	56.163	0.413	0.0	6.2	0.4	6.6	110.7	O K
480 min Summer	56.144	0.394	0.0	6.1	0.0	6.1	103.2	O K
600 min Summer	56.125	0.375	0.0	5.9	0.0	5.9	96.1	O K
720 min Summer	56.107	0.357	0.0	5.8	0.0	5.8	89.5	O K
960 min Summer	56.074	0.324	0.0	5.6	0.0	5.6	78.0	O K
1440 min Summer	56.012	0.262	0.0	5.4	0.0	5.4	58.5	O K
2160 min Summer	55.916	0.166	0.0	5.4	0.0	5.4	32.7	O K
2880 min Summer	55.852	0.102	0.0	5.4	0.0	5.4	18.5	O K
4320 min Summer	55.809	0.059	0.0	4.6	0.0	4.6	10.4	O K
5760 min Summer	55.792	0.042	0.0	3.8	0.0	3.8	7.4	O K
7200 min Summer	55.782	0.032	0.0	3.2	0.0	3.2	5.6	O K
8640 min Summer	55.775	0.025	0.0	2.8	0.0	2.8	4.3	O K
10080 min Summer	55.770	0.020	0.0	2.4	0.0	2.4	3.4	O K
15 min Winter	56.205	0.455	0.0	6.4	2.7	9.1	127.9	O K
30 min Winter	56.229	0.479	0.0	6.6	4.6	11.2	138.1	O K
60 min Winter	56.242	0.492	0.0	6.6	5.7	12.4	143.5	O K
120 min Winter	56.235	0.485	0.0	6.6	5.1	11.7	140.4	O K
180 min Winter	56.226	0.476	0.0	6.6	4.4	10.9	136.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	126.290	0.0	119.5	0.6	18
30 min Summer	70.838	0.0	134.1	2.8	33
60 min Summer	39.734	0.0	150.4	6.1	62
120 min Summer	22.287	0.0	168.7	8.2	110
180 min Summer	15.892	0.0	180.4	7.3	142
240 min Summer	12.501	0.0	189.2	5.3	178
360 min Summer	8.914	0.0	202.4	1.3	250
480 min Summer	7.012	0.0	212.4	0.0	322
600 min Summer	5.821	0.0	220.4	0.0	392
720 min Summer	5.000	0.0	227.1	0.0	458
960 min Summer	3.945	0.0	238.9	0.0	594
1440 min Summer	2.824	0.0	256.6	0.0	854
2160 min Summer	2.022	0.0	275.6	0.0	1192
2880 min Summer	1.595	0.0	289.9	0.0	1528
4320 min Summer	1.156	0.0	315.1	0.0	2204
5760 min Summer	0.920	0.0	334.4	0.0	2936
7200 min Summer	0.770	0.0	350.1	0.0	3672
8640 min Summer	0.667	0.0	363.5	0.0	4400
10080 min Summer	0.590	0.0	375.2	0.0	5136
15 min Winter	126.290	0.0	133.8	3.8	18
30 min Winter	70.838	0.0	150.2	9.1	32
60 min Winter	39.734	0.0	168.4	15.1	60
120 min Winter	22.287	0.0	188.9	19.5	104
180 min Winter	15.892	0.0	202.1	19.4	140

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.216	0.466	0.0	6.5	3.5	10.0	132.5	O K
360 min Winter	56.196	0.446	0.0	6.4	2.0	8.4	124.1	O K
480 min Winter	56.176	0.426	0.0	6.3	0.9	7.1	115.8	O K
600 min Winter	56.154	0.404	0.0	6.1	0.1	6.3	107.2	O K
720 min Winter	56.130	0.380	0.0	6.0	0.0	6.0	97.8	O K
960 min Winter	56.083	0.333	0.0	5.7	0.0	5.7	81.0	O K
1440 min Winter	55.989	0.239	0.0	5.4	0.0	5.4	51.7	O K
2160 min Winter	55.849	0.099	0.0	5.4	0.0	5.4	18.0	O K
2880 min Winter	55.810	0.060	0.0	4.7	0.0	4.7	10.6	O K
4320 min Winter	55.787	0.037	0.0	3.4	0.0	3.4	6.4	O K
5760 min Winter	55.775	0.025	0.0	2.7	0.0	2.7	4.3	O K
7200 min Winter	55.767	0.017	0.0	2.3	0.0	2.3	3.0	O K
8640 min Winter	55.762	0.012	0.0	2.0	0.0	2.0	2.0	O K
10080 min Winter	55.758	0.008	0.0	1.8	0.0	1.8	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	12.501	0.0	212.1	17.3	180
360 min Winter	8.914	0.0	226.8	10.5	260
480 min Winter	7.012	0.0	237.8	4.0	342
600 min Winter	5.821	0.0	246.9	0.4	422
720 min Winter	5.000	0.0	254.5	0.0	498
960 min Winter	3.945	0.0	267.7	0.0	638
1440 min Winter	2.824	0.0	287.5	0.0	912
2160 min Winter	2.022	0.0	308.7	0.0	1192
2880 min Winter	1.595	0.0	324.7	0.0	1496
4320 min Winter	1.156	0.0	353.0	0.0	2204
5760 min Winter	0.920	0.0	374.5	0.0	2944
7200 min Winter	0.770	0.0	392.1	0.0	3672
8640 min Winter	0.667	0.0	407.1	0.0	4408
10080 min Winter	0.590	0.0	420.2	0.0	5048

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	30	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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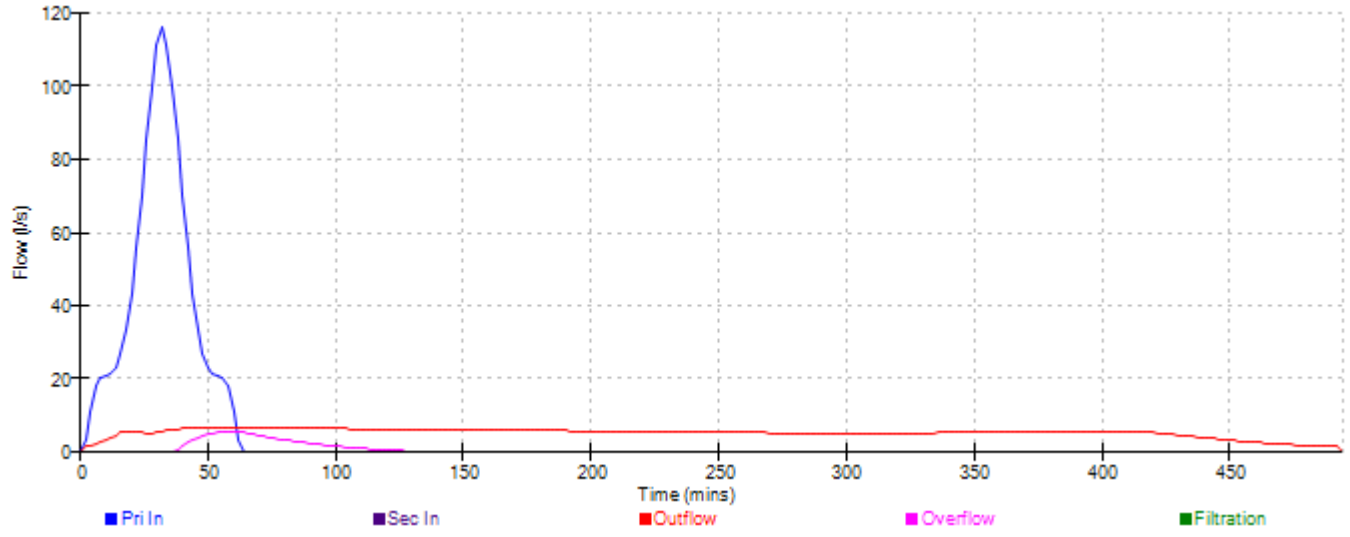
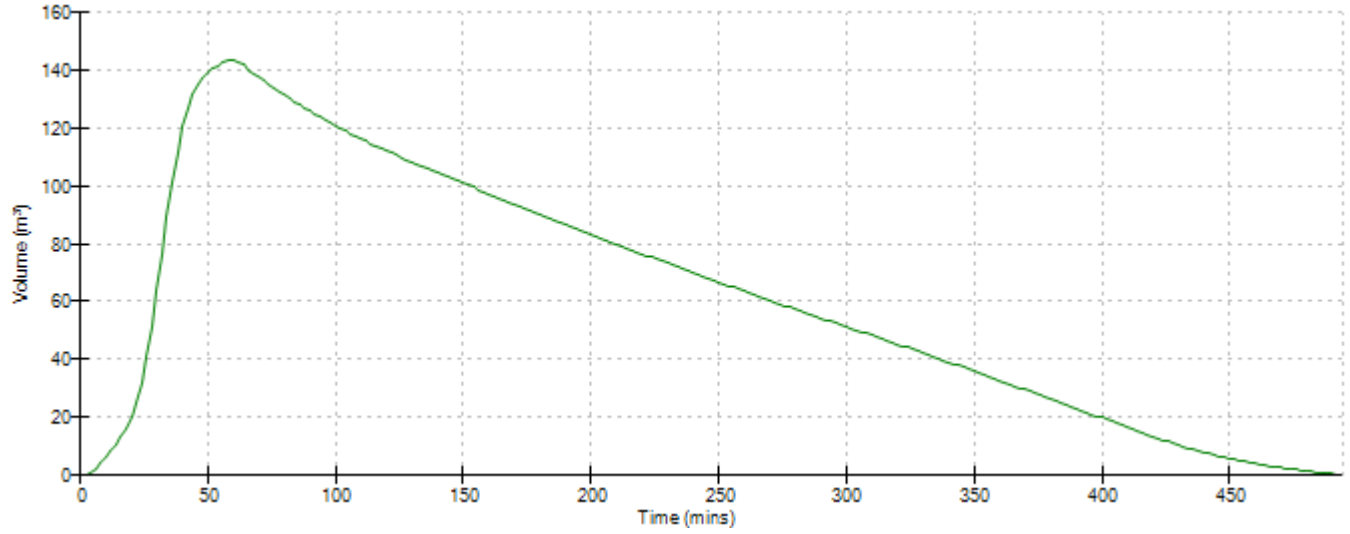
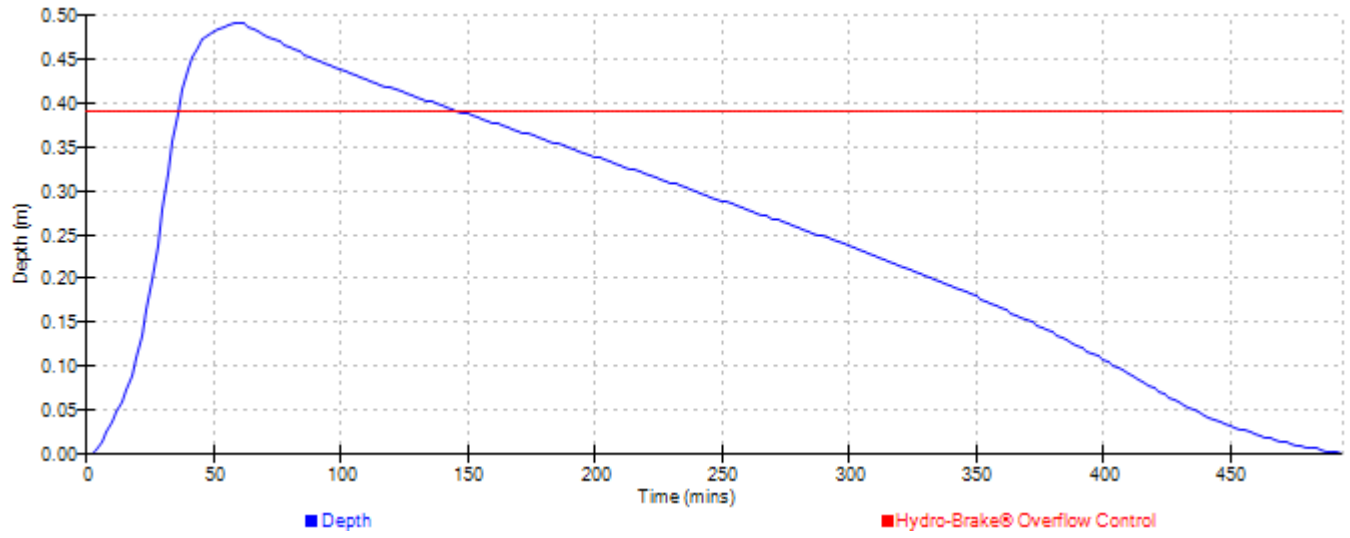
Event: 60 min Winter







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Summary of Results for 50 year Return Period

Half Drain Time : 242 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.225	0.475	0.0	6.5	4.2	10.8	136.2	O K
30 min Summer	56.245	0.495	0.0	6.7	6.0	12.6	144.9	O K
60 min Summer	56.252	0.502	0.0	6.7	6.6	13.3	148.1	O K
120 min Summer	56.241	0.491	0.0	6.6	5.7	12.3	143.4	O K
180 min Summer	56.231	0.481	0.0	6.6	4.8	11.4	139.0	O K
240 min Summer	56.222	0.472	0.0	6.5	4.0	10.5	134.8	O K
360 min Summer	56.203	0.453	0.0	6.4	2.5	8.9	127.0	O K
480 min Summer	56.187	0.437	0.0	6.3	1.4	7.8	120.1	O K
600 min Summer	56.170	0.420	0.0	6.2	0.6	6.9	113.5	O K
720 min Summer	56.154	0.404	0.0	6.1	0.1	6.3	107.0	O K
960 min Summer	56.120	0.370	0.0	5.9	0.0	5.9	94.3	O K
1440 min Summer	56.058	0.308	0.0	5.5	0.0	5.5	72.7	O K
2160 min Summer	55.966	0.216	0.0	5.4	0.0	5.4	45.4	O K
2880 min Summer	55.885	0.135	0.0	5.4	0.0	5.4	25.5	O K
4320 min Summer	55.818	0.068	0.0	5.0	0.0	5.0	12.1	O K
5760 min Summer	55.798	0.048	0.0	4.1	0.0	4.1	8.5	O K
7200 min Summer	55.787	0.037	0.0	3.4	0.0	3.4	6.4	O K
8640 min Summer	55.779	0.029	0.0	3.0	0.0	3.0	5.0	O K
10080 min Summer	55.773	0.023	0.0	2.6	0.0	2.6	4.0	O K
15 min Winter	56.261	0.511	0.0	6.8	7.4	14.2	152.2	O K
30 min Winter	56.283	0.533	0.0	6.9	9.1	16.0	162.0	O K
60 min Winter	56.291	0.541	0.0	6.9	9.7	16.6	165.6	O K
120 min Winter	56.279	0.529	0.0	6.9	8.8	15.7	160.3	O K
180 min Winter	56.268	0.518	0.0	6.8	8.0	14.8	155.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	150.999	0.0	142.9	7.3	18
30 min Summer	83.821	0.0	158.7	13.3	32
60 min Summer	46.530	0.0	176.2	19.6	60
120 min Summer	25.829	0.0	195.6	23.7	98
180 min Summer	18.305	0.0	207.9	23.2	132
240 min Summer	14.338	0.0	217.1	20.7	168
360 min Summer	10.162	0.0	230.8	13.5	242
480 min Summer	7.959	0.0	241.1	7.1	316
600 min Summer	6.585	0.0	249.4	2.7	390
720 min Summer	5.641	0.0	256.3	0.4	462
960 min Summer	4.431	0.0	268.3	0.0	598
1440 min Summer	3.153	0.0	286.5	0.0	866
2160 min Summer	2.244	0.0	305.8	0.0	1236
2880 min Summer	1.762	0.0	320.3	0.0	1556
4320 min Summer	1.269	0.0	346.1	0.0	2204
5760 min Summer	1.006	0.0	365.6	0.0	2936
7200 min Summer	0.840	0.0	381.6	0.0	3672
8640 min Summer	0.725	0.0	395.1	0.0	4392
10080 min Summer	0.640	0.0	406.9	0.0	5136
15 min Winter	150.999	0.0	160.1	15.8	18
30 min Winter	83.821	0.0	177.7	24.4	32
60 min Winter	46.530	0.0	197.3	32.9	60
120 min Winter	25.829	0.0	219.0	39.3	96
180 min Winter	18.305	0.0	232.8	40.1	134

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Summary of Results for 50 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.256	0.506	0.0	6.7	6.9	13.7	149.7	O K
360 min Winter	56.233	0.483	0.0	6.6	5.0	11.6	139.8	O K
480 min Winter	56.214	0.464	0.0	6.5	3.3	9.8	131.4	O K
600 min Winter	56.196	0.446	0.0	6.4	2.0	8.4	123.8	O K
720 min Winter	56.178	0.428	0.0	6.3	1.0	7.2	116.4	O K
960 min Winter	56.136	0.386	0.0	6.0	0.0	6.0	100.3	O K
1440 min Winter	56.047	0.297	0.0	5.4	0.0	5.4	69.3	O K
2160 min Winter	55.897	0.147	0.0	5.4	0.0	5.4	28.2	O K
2880 min Winter	55.821	0.071	0.0	5.1	0.0	5.1	12.6	O K
4320 min Winter	55.792	0.042	0.0	3.8	0.0	3.8	7.4	O K
5760 min Winter	55.779	0.029	0.0	3.0	0.0	3.0	5.1	O K
7200 min Winter	55.771	0.021	0.0	2.5	0.0	2.5	3.6	O K
8640 min Winter	55.765	0.015	0.0	2.2	0.0	2.2	2.6	O K
10080 min Winter	55.761	0.011	0.0	1.9	0.0	1.9	1.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	14.338	0.0	243.2	38.2	174
360 min Winter	10.162	0.0	258.5	30.4	252
480 min Winter	7.959	0.0	270.0	20.9	330
600 min Winter	6.585	0.0	279.3	12.0	410
720 min Winter	5.641	0.0	287.0	5.2	490
960 min Winter	4.431	0.0	300.7	0.0	646
1440 min Winter	3.153	0.0	321.0	0.0	922
2160 min Winter	2.244	0.0	342.6	0.0	1252
2880 min Winter	1.762	0.0	358.8	0.0	1500
4320 min Winter	1.269	0.0	387.6	0.0	2208
5760 min Winter	1.006	0.0	409.5	0.0	2936
7200 min Winter	0.840	0.0	427.3	0.0	3672
8640 min Winter	0.725	0.0	442.5	0.0	4376
10080 min Winter	0.640	0.0	455.7	0.0	5128

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	50	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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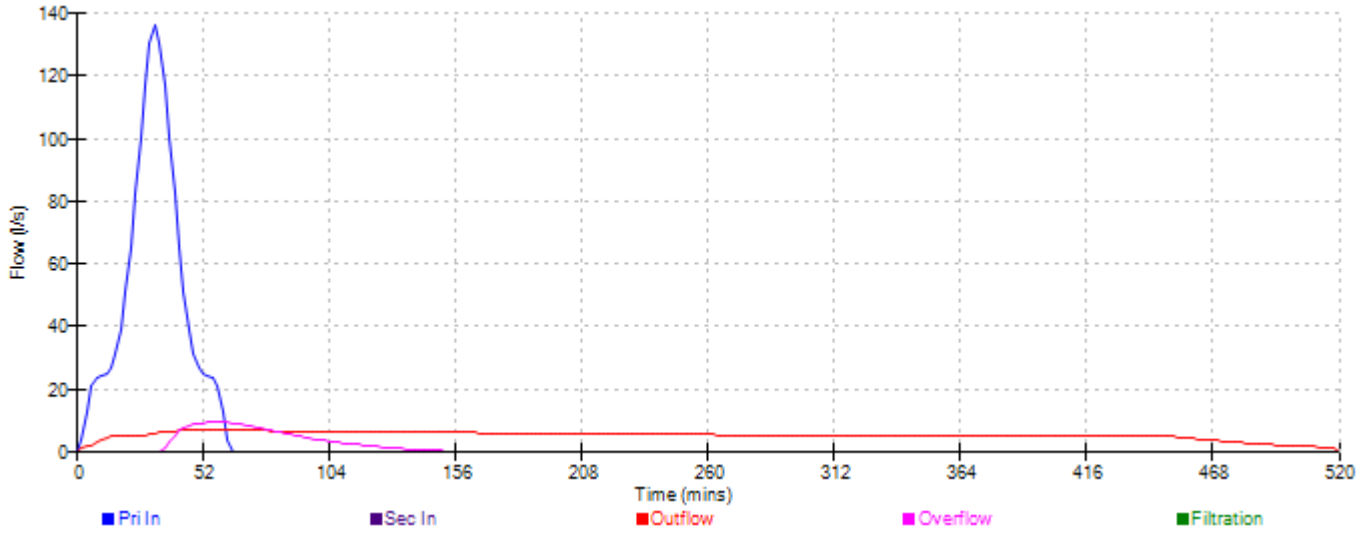
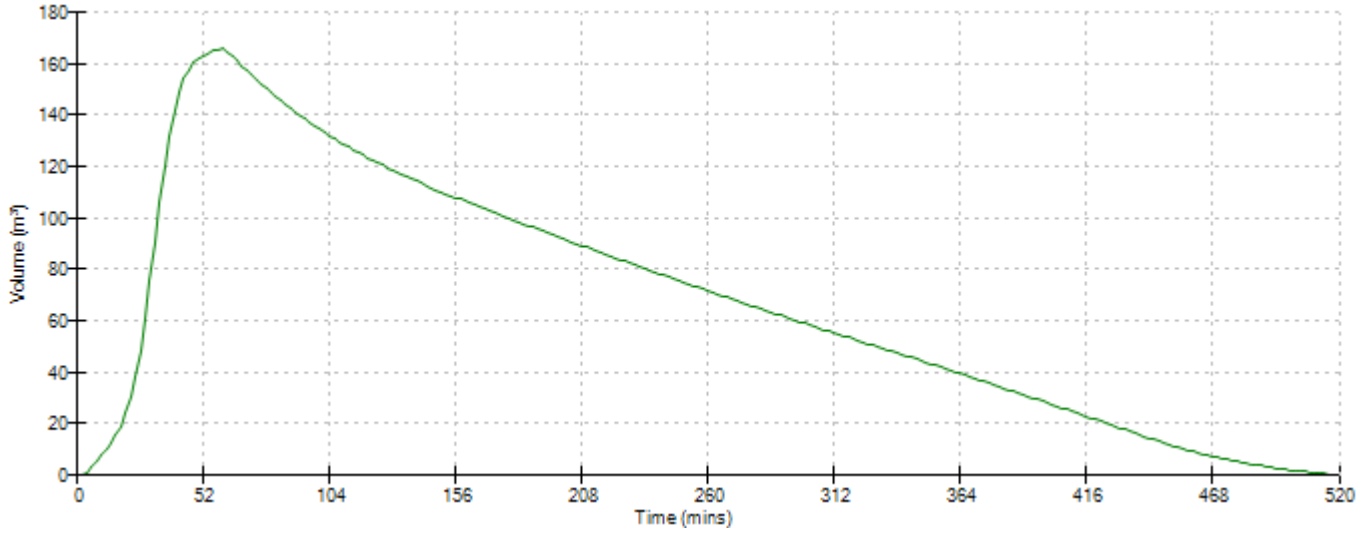
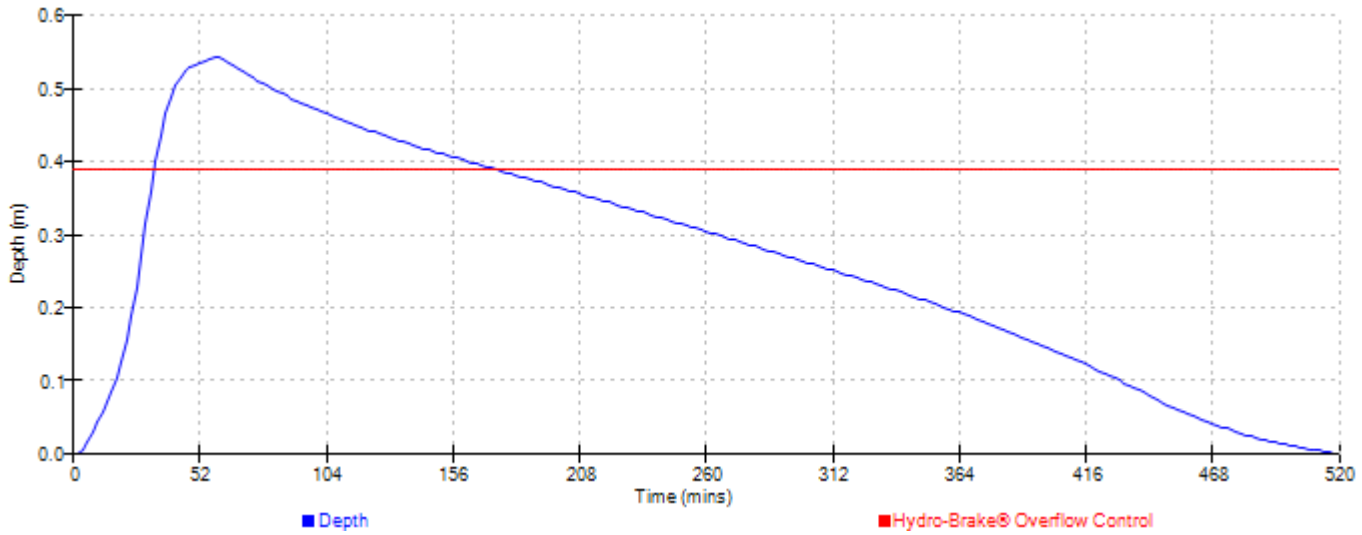
Event: 60 min Winter







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Summary of Results for 75 year Return Period

Half Drain Time : 263 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.270	0.520	0.0	6.8	8.1	14.9	156.1	O K
30 min Summer	56.288	0.538	0.0	6.9	9.5	16.4	164.3	O K
60 min Summer	56.291	0.541	0.0	6.9	9.7	16.6	165.7	O K
120 min Summer	56.277	0.527	0.0	6.8	8.7	15.5	159.1	O K
180 min Summer	56.265	0.515	0.0	6.8	7.7	14.5	153.8	O K
240 min Summer	56.253	0.503	0.0	6.7	6.7	13.4	148.7	O K
360 min Summer	56.233	0.483	0.0	6.6	5.0	11.6	139.7	O K
480 min Summer	56.216	0.466	0.0	6.5	3.5	10.0	132.3	O K
600 min Summer	56.200	0.450	0.0	6.4	2.3	8.7	125.8	O K
720 min Summer	56.186	0.436	0.0	6.3	1.4	7.7	119.8	O K
960 min Summer	56.158	0.408	0.0	6.1	0.2	6.4	108.5	O K
1440 min Summer	56.095	0.345	0.0	5.7	0.0	5.7	85.4	O K
2160 min Summer	56.010	0.260	0.0	5.4	0.0	5.4	57.9	O K
2880 min Summer	55.919	0.169	0.0	5.4	0.0	5.4	33.4	O K
4320 min Summer	55.826	0.076	0.0	5.3	0.0	5.3	13.7	O K
5760 min Summer	55.804	0.054	0.0	4.4	0.0	4.4	9.5	O K
7200 min Summer	55.791	0.041	0.0	3.7	0.0	3.7	7.2	O K
8640 min Summer	55.783	0.033	0.0	3.2	0.0	3.2	5.7	O K
10080 min Summer	55.776	0.026	0.0	2.8	0.0	2.8	4.5	O K
15 min Winter	56.312	0.562	0.0	7.0	9.8	16.9	174.8	O K
30 min Winter	56.334	0.584	0.0	7.2	9.9	17.1	185.0	O K
60 min Winter	56.341	0.591	0.0	7.2	9.9	17.1	188.4	O K
120 min Winter	56.323	0.573	0.0	7.1	9.9	17.0	179.9	O K
180 min Winter	56.306	0.556	0.0	7.0	9.8	16.8	172.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	173.887	0.0	164.5	18.4	18
30 min Summer	95.736	0.0	181.2	26.6	32
60 min Summer	52.709	0.0	199.5	34.5	60
120 min Summer	29.020	0.0	219.8	39.9	94
180 min Summer	20.468	0.0	232.6	40.0	128
240 min Summer	15.977	0.0	241.9	37.6	164
360 min Summer	11.269	0.0	256.0	29.4	236
480 min Summer	8.797	0.0	266.5	20.5	308
600 min Summer	7.259	0.0	274.8	13.2	380
720 min Summer	6.204	0.0	281.8	7.5	456
960 min Summer	4.857	0.0	294.2	0.8	600
1440 min Summer	3.440	0.0	312.6	0.0	866
2160 min Summer	2.436	0.0	332.1	0.0	1252
2880 min Summer	1.907	0.0	346.6	0.0	1584
4320 min Summer	1.367	0.0	372.7	0.0	2208
5760 min Summer	1.079	0.0	392.4	0.0	2936
7200 min Summer	0.899	0.0	408.4	0.0	3672
8640 min Summer	0.774	0.0	422.0	0.0	4400
10080 min Summer	0.682	0.0	433.7	0.0	5088
15 min Winter	173.887	0.0	184.4	30.1	18
30 min Winter	95.736	0.0	203.0	39.7	32
60 min Winter	52.709	0.0	223.5	48.9	60
120 min Winter	29.020	0.0	246.0	56.7	98
180 min Winter	20.468	0.0	260.3	59.4	134

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Summary of Results for 75 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.289	0.539	0.0	6.9	9.5	16.4	164.7	O K
360 min Winter	56.262	0.512	0.0	6.8	7.5	14.3	152.6	O K
480 min Winter	56.241	0.491	0.0	6.6	5.6	12.3	143.0	O K
600 min Winter	56.222	0.472	0.0	6.5	4.0	10.5	135.1	O K
720 min Winter	56.206	0.456	0.0	6.4	2.7	9.1	128.1	O K
960 min Winter	56.174	0.424	0.0	6.2	0.8	7.0	115.2	O K
1440 min Winter	56.091	0.341	0.0	5.7	0.0	5.7	84.1	O K
2160 min Winter	55.950	0.200	0.0	5.4	0.0	5.4	41.2	O K
2880 min Winter	55.836	0.086	0.0	5.4	0.0	5.4	15.4	O K
4320 min Winter	55.798	0.048	0.0	4.1	0.0	4.1	8.4	O K
5760 min Winter	55.783	0.033	0.0	3.2	0.0	3.2	5.8	O K
7200 min Winter	55.774	0.024	0.0	2.7	0.0	2.7	4.1	O K
8640 min Winter	55.768	0.018	0.0	2.3	0.0	2.3	3.0	O K
10080 min Winter	55.763	0.013	0.0	2.0	0.0	2.0	2.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	15.977	0.0	271.0	58.5	172
360 min Winter	11.269	0.0	286.7	50.7	246
480 min Winter	8.797	0.0	298.4	40.0	322
600 min Winter	7.259	0.0	307.8	29.0	398
720 min Winter	6.204	0.0	315.8	19.3	478
960 min Winter	4.857	0.0	329.5	5.0	636
1440 min Winter	3.440	0.0	350.0	0.0	924
2160 min Winter	2.436	0.0	371.9	0.0	1300
2880 min Winter	1.907	0.0	388.2	0.0	1552
4320 min Winter	1.367	0.0	417.4	0.0	2204
5760 min Winter	1.079	0.0	439.5	0.0	2936
7200 min Winter	0.899	0.0	457.4	0.0	3672
8640 min Winter	0.774	0.0	472.6	0.0	4344
10080 min Winter	0.682	0.0	485.8	0.0	5016

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	75	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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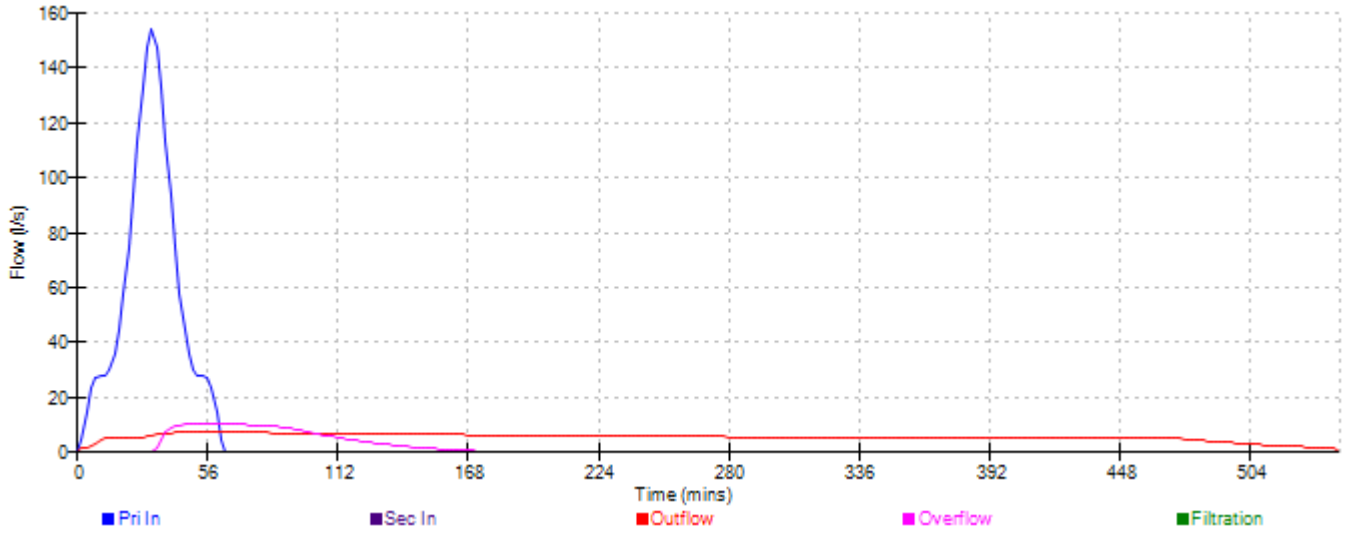
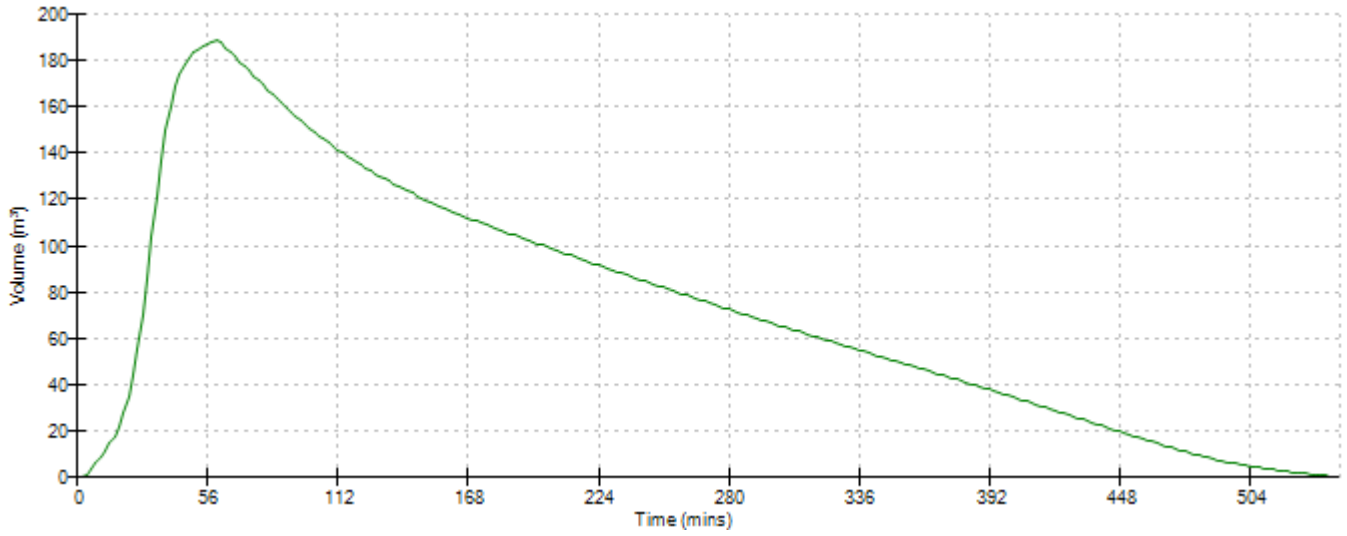
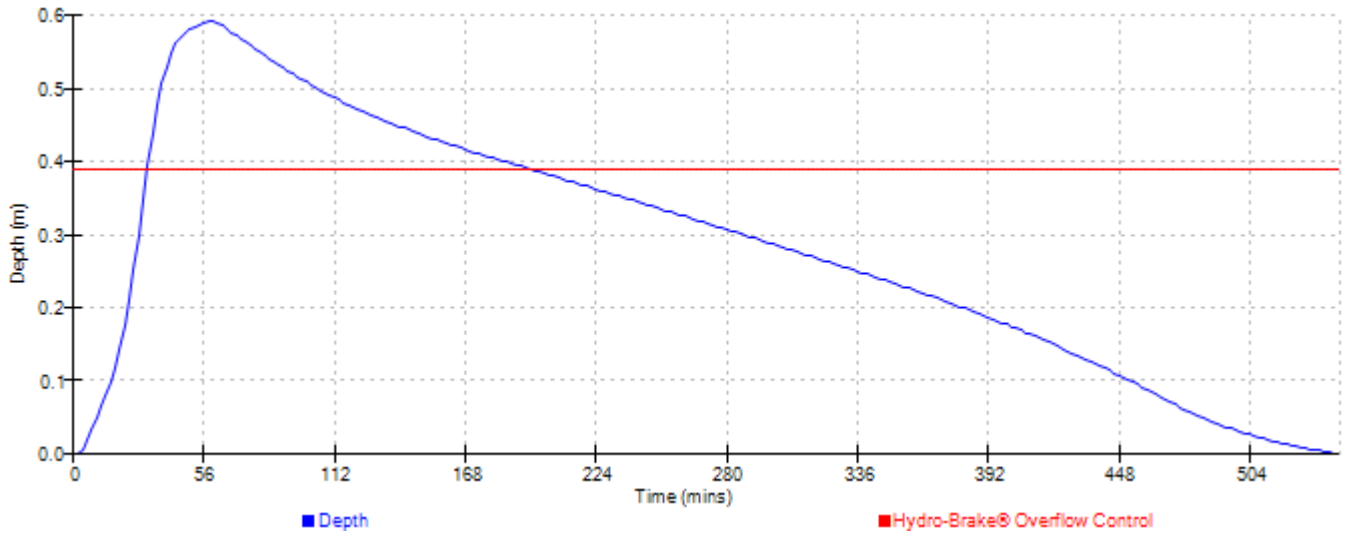
Event: 60 min Winter







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Summary of Results for 100 year Return Period

Half Drain Time : 285 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.306	0.556	0.0	7.0	9.8	16.8	172.2	O K
30 min Summer	56.324	0.574	0.0	7.1	9.9	17.0	180.5	O K
60 min Summer	56.326	0.576	0.0	7.1	9.9	17.0	181.5	O K
120 min Summer	56.306	0.556	0.0	7.0	9.8	16.8	172.5	O K
180 min Summer	56.291	0.541	0.0	6.9	9.6	16.5	165.5	O K
240 min Summer	56.277	0.527	0.0	6.8	8.7	15.5	159.5	O K
360 min Summer	56.255	0.505	0.0	6.7	6.9	13.6	149.2	O K
480 min Summer	56.236	0.486	0.0	6.6	5.2	11.8	140.9	O K
600 min Summer	56.220	0.470	0.0	6.5	3.8	10.3	134.0	O K
720 min Summer	56.206	0.456	0.0	6.4	2.7	9.1	128.0	O K
960 min Summer	56.180	0.430	0.0	6.3	1.1	7.4	117.5	O K
1440 min Summer	56.122	0.372	0.0	5.9	0.0	5.9	95.2	O K
2160 min Summer	56.037	0.287	0.0	5.4	0.0	5.4	66.2	O K
2880 min Summer	55.949	0.199	0.0	5.4	0.0	5.4	40.8	O K
4320 min Summer	55.837	0.087	0.0	5.4	0.0	5.4	15.6	O K
5760 min Summer	55.808	0.058	0.0	4.6	0.0	4.6	10.3	O K
7200 min Summer	55.794	0.044	0.0	3.9	0.0	3.9	7.7	O K
8640 min Summer	55.785	0.035	0.0	3.3	0.0	3.3	6.1	O K
10080 min Summer	55.778	0.028	0.0	2.9	0.0	2.9	4.9	O K
15 min Winter	56.352	0.602	0.0	7.2	9.9	17.2	193.5	O K
30 min Winter	56.375	0.625	0.0	7.4	9.9	17.2	204.0	O K
60 min Winter	56.382	0.632	0.0	7.4	9.9	17.2	207.4	O K
120 min Winter	56.359	0.609	0.0	7.3	9.9	17.2	196.9	O K
180 min Winter	56.339	0.589	0.0	7.2	9.9	17.1	187.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	192.154	0.0	181.9	28.7	18
30 min Summer	105.180	0.0	199.1	37.4	32
60 min Summer	57.573	0.0	217.9	45.8	60
120 min Summer	31.514	0.0	238.7	52.5	94
180 min Summer	22.152	0.0	251.6	53.7	126
240 min Summer	17.250	0.0	261.3	51.5	160
360 min Summer	12.125	0.0	275.4	43.0	232
480 min Summer	9.442	0.0	286.0	32.9	304
600 min Summer	7.777	0.0	294.5	24.1	376
720 min Summer	6.637	0.0	301.5	16.8	448
960 min Summer	5.183	0.0	314.0	6.1	594
1440 min Summer	3.658	0.0	332.4	0.0	868
2160 min Summer	2.582	0.0	352.0	0.0	1256
2880 min Summer	2.016	0.0	366.5	0.0	1612
4320 min Summer	1.440	0.0	392.7	0.0	2244
5760 min Summer	1.135	0.0	412.4	0.0	2936
7200 min Summer	0.943	0.0	428.5	0.0	3672
8640 min Summer	0.811	0.0	442.1	0.0	4400
10080 min Summer	0.713	0.0	453.8	0.0	5136
15 min Winter	192.154	0.0	203.7	41.5	18
30 min Winter	105.180	0.0	223.0	51.3	32
60 min Winter	57.573	0.0	244.1	60.9	60
120 min Winter	31.514	0.0	267.2	69.3	100
180 min Winter	22.152	0.0	281.9	72.7	136

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Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.318	0.568	0.0	7.1	9.9	16.9	177.9	O K
360 min Winter	56.284	0.534	0.0	6.9	9.2	16.0	162.4	O K
480 min Winter	56.260	0.510	0.0	6.7	7.3	14.0	151.4	O K
600 min Winter	56.240	0.490	0.0	6.6	5.6	12.2	142.8	O K
720 min Winter	56.224	0.474	0.0	6.5	4.1	10.7	135.6	O K
960 min Winter	56.195	0.445	0.0	6.4	1.9	8.3	123.4	O K
1440 min Winter	56.123	0.373	0.0	5.9	0.0	5.9	95.5	O K
2160 min Winter	55.997	0.247	0.0	5.4	0.0	5.4	53.9	O K
2880 min Winter	55.858	0.108	0.0	5.4	0.0	5.4	19.8	O K
4320 min Winter	55.802	0.052	0.0	4.3	0.0	4.3	9.1	O K
5760 min Winter	55.786	0.036	0.0	3.4	0.0	3.4	6.2	O K
7200 min Winter	55.776	0.026	0.0	2.8	0.0	2.8	4.5	O K
8640 min Winter	55.770	0.020	0.0	2.4	0.0	2.4	3.4	O K
10080 min Winter	55.764	0.014	0.0	2.1	0.0	2.1	2.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	17.250	0.0	292.6	73.4	172
360 min Winter	12.125	0.0	308.4	67.0	244
480 min Winter	9.442	0.0	320.3	55.8	318
600 min Winter	7.777	0.0	329.8	43.8	392
720 min Winter	6.637	0.0	337.8	32.7	468
960 min Winter	5.183	0.0	351.7	14.8	626
1440 min Winter	3.658	0.0	372.4	0.0	936
2160 min Winter	2.582	0.0	394.2	0.0	1340
2880 min Winter	2.016	0.0	410.4	0.0	1588
4320 min Winter	1.440	0.0	439.9	0.0	2204
5760 min Winter	1.135	0.0	462.0	0.0	2936
7200 min Winter	0.943	0.0	479.9	0.0	3672
8640 min Winter	0.811	0.0	495.1	0.0	4392
10080 min Winter	0.713	0.0	508.3	0.0	5144

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	100	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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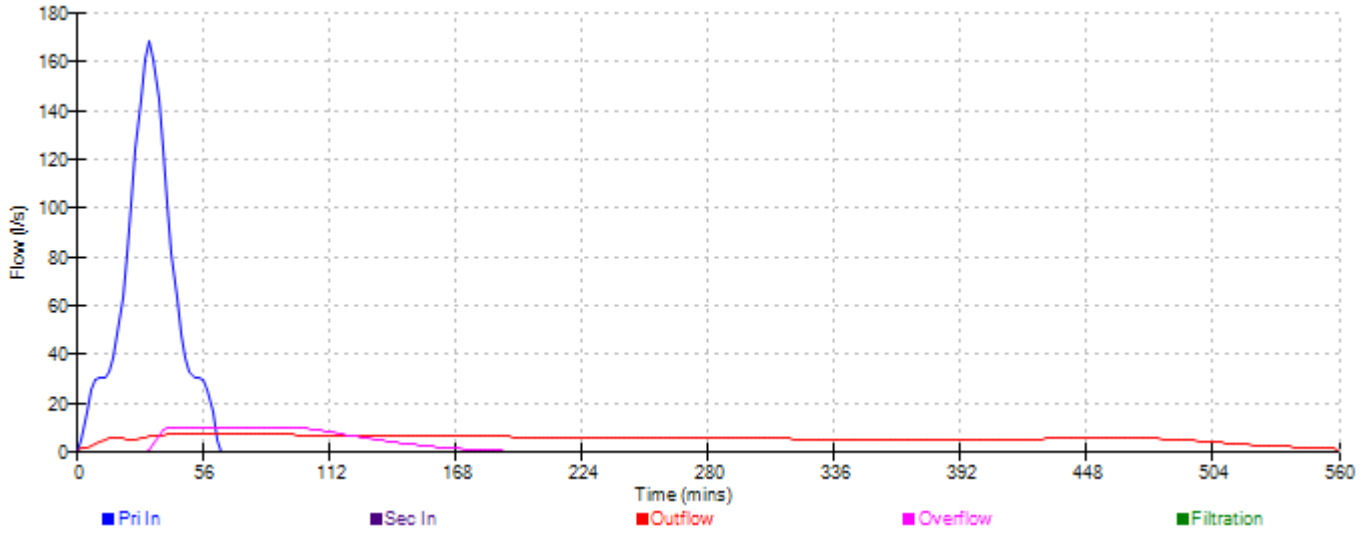
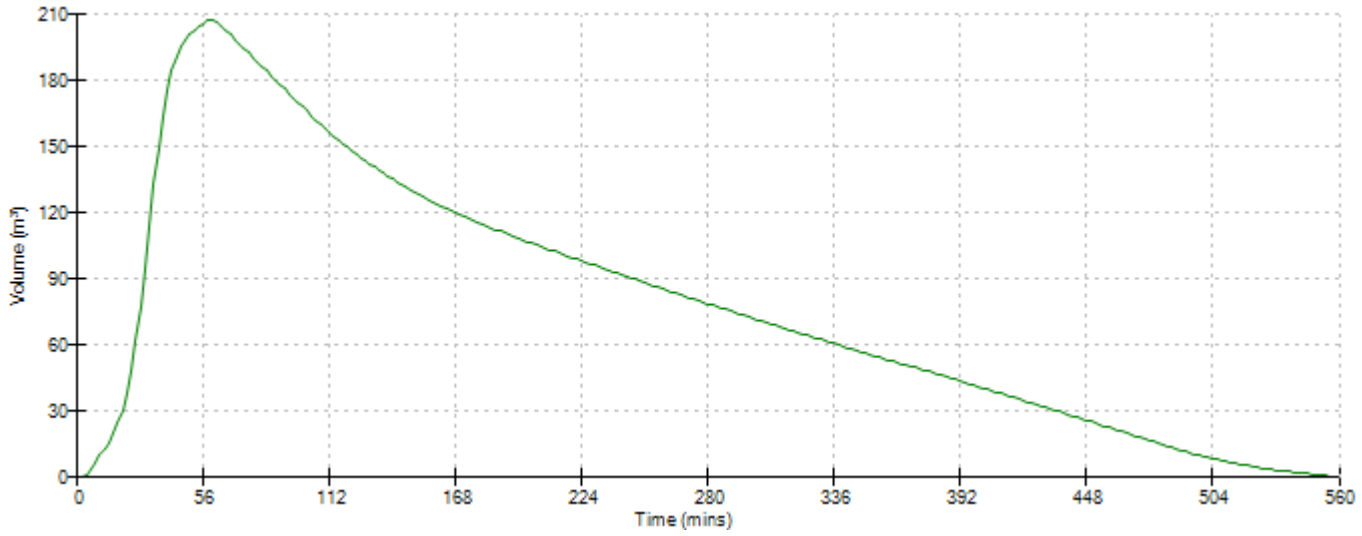
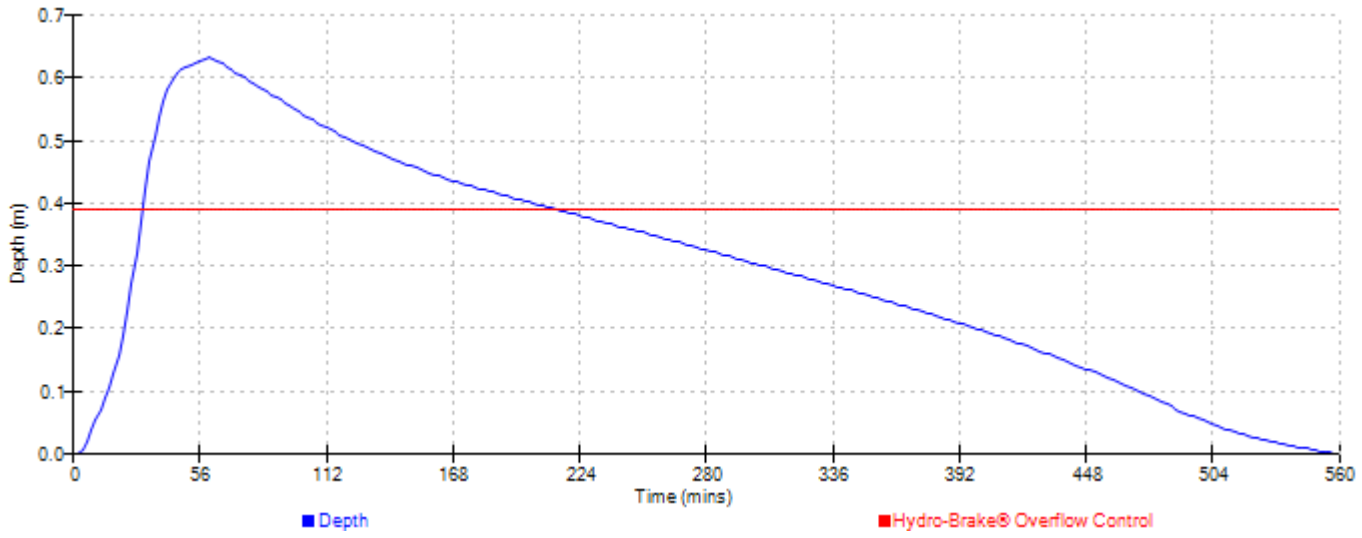
Event: 60 min Winter







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Summary of Results for 200 year Return Period

Half Drain Time : 334 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.408	0.658	0.0	7.5	9.9	17.2	220.1	Flood Risk
30 min Summer	56.427	0.677	0.0	7.6	9.9	17.4	229.0	Flood Risk
60 min Summer	56.429	0.679	0.0	7.6	9.9	17.4	229.8	Flood Risk
120 min Summer	56.399	0.649	0.0	7.5	9.9	17.2	215.9	O K
180 min Summer	56.375	0.625	0.0	7.4	9.9	17.2	204.2	O K
240 min Summer	56.353	0.603	0.0	7.3	9.9	17.2	194.1	O K
360 min Summer	56.315	0.565	0.0	7.1	9.9	16.9	176.6	O K
480 min Summer	56.287	0.537	0.0	6.9	9.4	16.3	163.6	O K
600 min Summer	56.266	0.516	0.0	6.8	7.8	14.6	154.4	O K
720 min Summer	56.250	0.500	0.0	6.7	6.4	13.1	147.1	O K
960 min Summer	56.224	0.474	0.0	6.5	4.2	10.7	136.0	O K
1440 min Summer	56.182	0.432	0.0	6.3	1.2	7.5	118.3	O K
2160 min Summer	56.104	0.354	0.0	5.8	0.0	5.8	88.5	O K
2880 min Summer	56.027	0.277	0.0	5.4	0.0	5.4	62.9	O K
4320 min Summer	55.880	0.130	0.0	5.4	0.0	5.4	24.4	O K
5760 min Summer	55.821	0.071	0.0	5.1	0.0	5.1	12.6	O K
7200 min Summer	55.803	0.053	0.0	4.3	0.0	4.3	9.3	O K
8640 min Summer	55.792	0.042	0.0	3.7	0.0	3.7	7.3	O K
10080 min Summer	55.784	0.034	0.0	3.3	0.0	3.3	5.9	O K
15 min Winter	56.467	0.717	0.0	7.8	10.4	18.2	247.5	Flood Risk
30 min Winter	56.491	0.741	0.0	7.9	10.7	18.7	258.5	Flood Risk
60 min Winter	56.497	0.747	0.0	8.0	10.8	18.8	261.1	Flood Risk
120 min Winter	56.468	0.718	0.0	7.8	10.4	18.2	247.7	Flood Risk
180 min Winter	56.437	0.687	0.0	7.7	9.9	17.6	233.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	244.311	0.0	231.3	57.3	18
30 min Summer	131.872	0.0	249.6	66.4	32
60 min Summer	71.181	0.0	269.5	75.2	62
120 min Summer	38.421	0.0	290.9	82.7	102
180 min Summer	26.787	0.0	304.3	85.8	130
240 min Summer	20.739	0.0	314.1	86.9	164
360 min Summer	14.459	0.0	328.4	81.6	230
480 min Summer	11.194	0.0	339.0	70.6	296
600 min Summer	9.179	0.0	347.5	58.7	366
720 min Summer	7.805	0.0	354.6	48.4	434
960 min Summer	6.060	0.0	367.1	32.0	576
1440 min Summer	4.242	0.0	385.5	8.2	864
2160 min Summer	2.969	0.0	404.8	0.0	1272
2880 min Summer	2.306	0.0	419.1	0.0	1644
4320 min Summer	1.634	0.0	445.4	0.0	2292
5760 min Summer	1.279	0.0	465.1	0.0	2936
7200 min Summer	1.059	0.0	481.1	0.0	3672
8640 min Summer	0.907	0.0	494.4	0.0	4400
10080 min Summer	0.795	0.0	506.0	0.0	5120
15 min Winter	244.311	0.0	259.0	73.0	18
30 min Winter	131.872	0.0	279.6	83.6	32
60 min Winter	71.181	0.0	301.9	94.0	60
120 min Winter	38.421	0.0	325.8	102.9	114
180 min Winter	26.787	0.0	340.7	106.4	140

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Summary of Results for 200 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.409	0.659	0.0	7.5	9.9	17.2	220.4	Flood Risk
360 min Winter	56.357	0.607	0.0	7.3	9.9	17.2	195.8	O K
480 min Winter	56.315	0.565	0.0	7.0	9.9	16.9	176.1	O K
600 min Winter	56.285	0.535	0.0	6.9	9.2	16.1	162.7	O K
720 min Winter	56.264	0.514	0.0	6.8	7.7	14.5	153.5	O K
960 min Winter	56.234	0.484	0.0	6.6	5.0	11.6	140.2	O K
1440 min Winter	56.187	0.437	0.0	6.3	1.4	7.8	120.1	O K
2160 min Winter	56.081	0.331	0.0	5.6	0.0	5.6	80.6	O K
2880 min Winter	55.946	0.196	0.0	5.4	0.0	5.4	40.0	O K
4320 min Winter	55.814	0.064	0.0	4.8	0.0	4.8	11.3	O K
5760 min Winter	55.793	0.043	0.0	3.8	0.0	3.8	7.5	O K
7200 min Winter	55.782	0.032	0.0	3.2	0.0	3.2	5.6	O K
8640 min Winter	55.774	0.024	0.0	2.7	0.0	2.7	4.2	O K
10080 min Winter	55.769	0.019	0.0	2.4	0.0	2.4	3.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	20.739	0.0	351.7	108.2	178
360 min Winter	14.459	0.0	367.9	108.4	250
480 min Winter	11.194	0.0	379.8	100.2	316
600 min Winter	9.179	0.0	389.2	87.4	382
720 min Winter	7.805	0.0	397.2	73.6	454
960 min Winter	6.060	0.0	411.3	50.0	598
1440 min Winter	4.242	0.0	431.7	13.0	908
2160 min Winter	2.969	0.0	453.4	0.0	1344
2880 min Winter	2.306	0.0	469.4	0.0	1700
4320 min Winter	1.634	0.0	498.9	0.0	2208
5760 min Winter	1.279	0.0	520.9	0.0	2936
7200 min Winter	1.059	0.0	538.8	0.0	3648
8640 min Winter	0.907	0.0	553.7	0.0	4408
10080 min Winter	0.795	0.0	566.7	0.0	5048

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	200	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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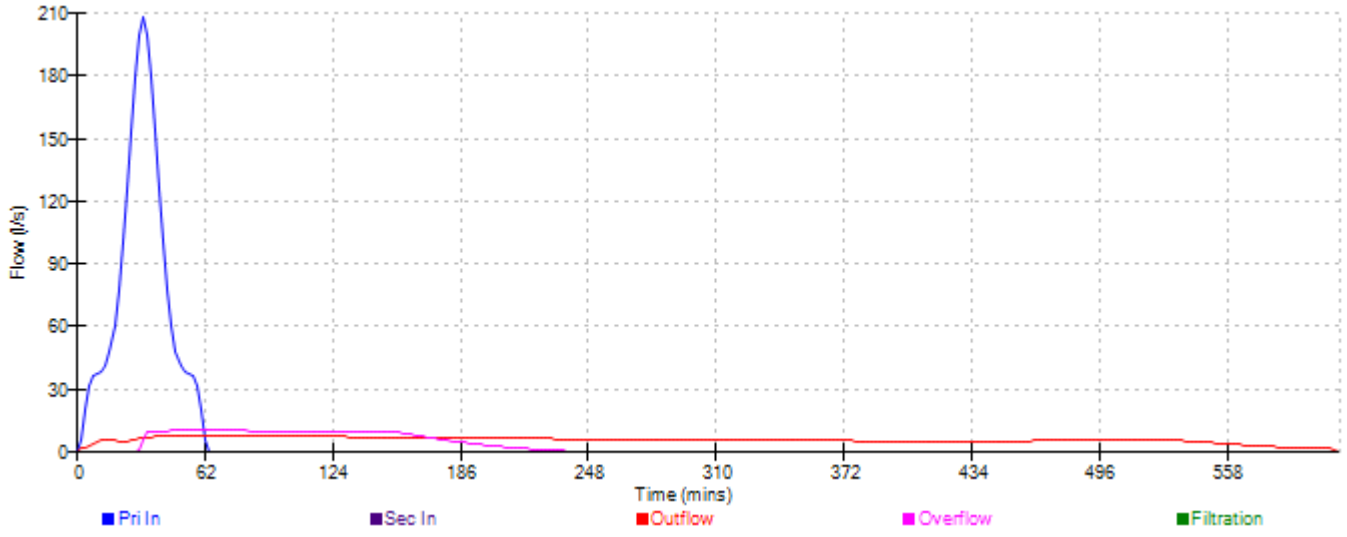
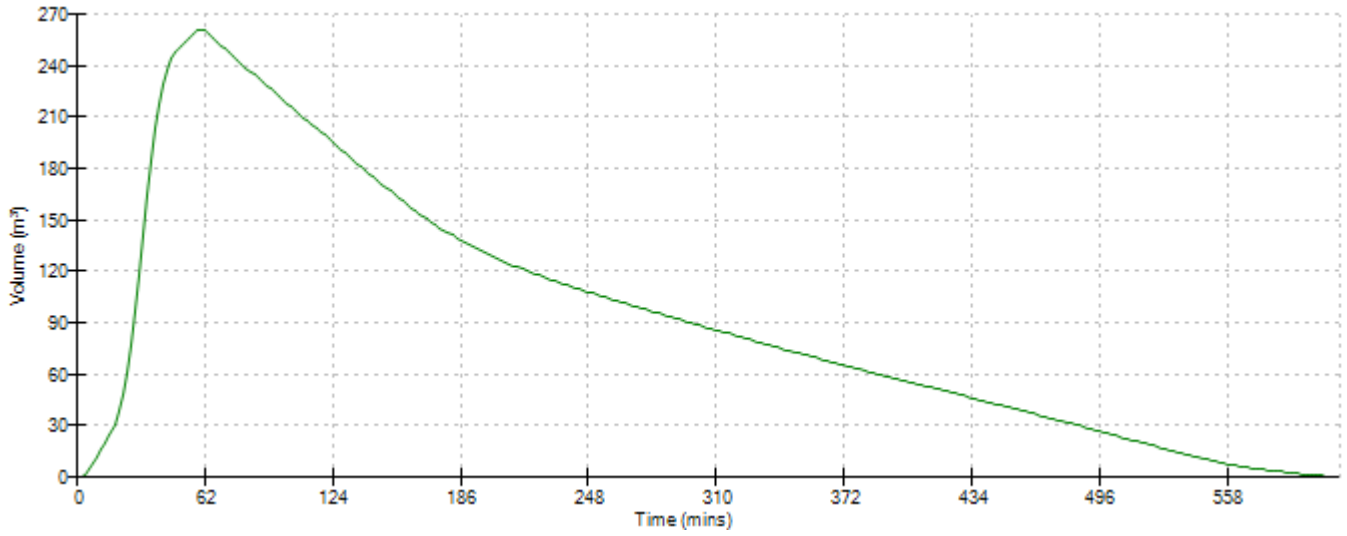
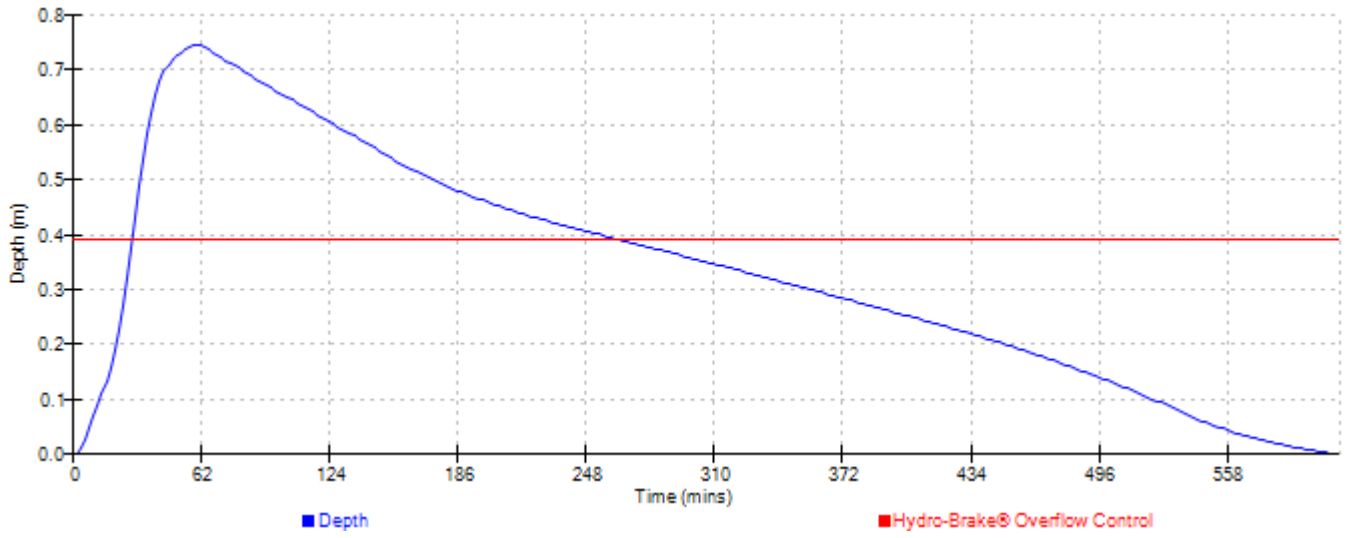
Event: 60 min Winter







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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 366 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow Σ (l/s)	Max Volume (m³)	Status
15 min Summer	56.458	0.708	0.0	7.8	10.2	18.0	243.0	Flood Risk
30 min Summer	56.488	0.738	0.0	7.9	10.7	18.6	257.0	Flood Risk
60 min Summer	56.501	0.751	0.0	8.0	10.9	18.8	262.9	Flood Risk
120 min Summer	56.479	0.729	0.0	7.9	10.5	18.4	252.9	Flood Risk
180 min Summer	56.457	0.707	0.0	7.8	10.2	18.0	242.7	Flood Risk
240 min Summer	56.436	0.686	0.0	7.7	9.9	17.6	233.2	Flood Risk
360 min Summer	56.396	0.646	0.0	7.5	9.9	17.2	214.2	O K
480 min Summer	56.359	0.609	0.0	7.3	9.9	17.2	196.9	O K
600 min Summer	56.329	0.579	0.0	7.1	9.9	17.0	182.7	O K
720 min Summer	56.304	0.554	0.0	7.0	9.8	16.8	171.3	O K
960 min Summer	56.272	0.522	0.0	6.8	8.3	15.1	157.1	O K
1440 min Summer	56.232	0.482	0.0	6.6	4.9	11.5	139.5	O K
2160 min Summer	56.188	0.438	0.0	6.3	1.5	7.9	120.7	O K
2880 min Summer	56.133	0.383	0.0	6.0	0.0	6.0	99.0	O K
4320 min Summer	56.012	0.262	0.0	5.4	0.0	5.4	58.5	O K
5760 min Summer	55.884	0.134	0.0	5.4	0.0	5.4	25.3	O K
7200 min Summer	55.826	0.076	0.0	5.3	0.0	5.3	13.6	O K
8640 min Summer	55.810	0.060	0.0	4.6	0.0	4.6	10.5	O K
10080 min Summer	55.799	0.049	0.0	4.1	0.0	4.1	8.6	O K
15 min Winter	56.523	0.773	0.0	8.1	11.2	19.2	273.0	Flood Risk
30 min Winter	56.560	0.810	0.0	8.3	11.7	19.9	289.7	Flood Risk
60 min Winter	56.579	0.829	0.0	8.3	11.9	20.2	297.9	Flood Risk
120 min Winter	56.558	0.808	0.0	8.2	11.6	19.9	288.9	Flood Risk
180 min Winter	56.528	0.778	0.0	8.1	11.2	19.3	275.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	269.015	0.0	254.7	70.5	18
30 min Summer	147.252	0.0	278.8	83.1	33
60 min Summer	80.602	0.0	305.2	95.9	62
120 min Summer	44.119	0.0	334.0	107.5	106
180 min Summer	31.012	0.0	352.4	112.7	136
240 min Summer	24.150	0.0	365.8	115.4	168
360 min Summer	16.975	0.0	385.7	118.2	236
480 min Summer	13.219	0.0	400.3	113.7	302
600 min Summer	10.888	0.0	412.3	104.4	366
720 min Summer	9.292	0.0	422.2	94.3	430
960 min Summer	7.256	0.0	439.6	76.6	558
1440 min Summer	5.121	0.0	465.4	47.5	824
2160 min Summer	3.615	0.0	492.8	14.1	1252
2880 min Summer	2.823	0.0	513.1	0.0	1672
4320 min Summer	2.017	0.0	549.9	0.0	2420
5760 min Summer	1.589	0.0	577.5	0.0	3048
7200 min Summer	1.320	0.0	599.9	0.0	3672
8640 min Summer	1.135	0.0	618.9	0.0	4400
10080 min Summer	0.999	0.0	635.4	0.0	5136
15 min Winter	269.015	0.0	285.2	88.2	18
30 min Winter	147.252	0.0	312.2	102.8	32
60 min Winter	80.602	0.0	341.9	117.8	60
120 min Winter	44.119	0.0	374.1	131.9	114
180 min Winter	31.012	0.0	394.6	138.8	142

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
240 min Winter	56.502	0.752	0.0	8.0	10.9	18.9	263.5	Flood Risk
360 min Winter	56.450	0.700	0.0	7.7	10.1	17.8	239.4	Flood Risk
480 min Winter	56.399	0.649	0.0	7.5	9.9	17.2	216.0	O K
600 min Winter	56.356	0.606	0.0	7.3	9.9	17.2	195.3	O K
720 min Winter	56.321	0.571	0.0	7.1	9.9	17.0	179.0	O K
960 min Winter	56.277	0.527	0.0	6.8	8.7	15.5	159.5	O K
1440 min Winter	56.232	0.482	0.0	6.6	4.9	11.5	139.3	O K
2160 min Winter	56.182	0.432	0.0	6.3	1.2	7.5	118.1	O K
2880 min Winter	56.097	0.347	0.0	5.8	0.0	5.8	86.1	O K
4320 min Winter	55.875	0.125	0.0	5.4	0.0	5.4	23.4	O K
5760 min Winter	55.811	0.061	0.0	4.7	0.0	4.7	10.8	O K
7200 min Winter	55.795	0.045	0.0	3.9	0.0	3.9	8.0	O K
8640 min Winter	55.786	0.036	0.0	3.4	0.0	3.4	6.3	O K
10080 min Winter	55.779	0.029	0.0	3.0	0.0	3.0	5.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
240 min Winter	24.150	0.0	409.7	142.5	180
360 min Winter	16.975	0.0	431.9	145.3	256
480 min Winter	13.219	0.0	448.5	145.9	326
600 min Winter	10.888	0.0	461.8	139.8	392
720 min Winter	9.292	0.0	472.9	129.2	454
960 min Winter	7.256	0.0	492.4	105.6	578
1440 min Winter	5.121	0.0	521.4	63.2	852
2160 min Winter	3.615	0.0	551.9	13.1	1316
2880 min Winter	2.823	0.0	574.7	0.0	1760
4320 min Winter	2.017	0.0	615.8	0.0	2380
5760 min Winter	1.589	0.0	646.8	0.0	2936
7200 min Winter	1.320	0.0	671.9	0.0	3672
8640 min Winter	1.135	0.0	693.2	0.0	4408
10080 min Winter	0.999	0.0	711.7	0.0	5056

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Rainfall Details

Rainfall Model	FEH	F (1km)	2.650
Return Period (years)	100	Summer Storms	Yes
Site Location	GB 478800 166400 SU 78800 66400	Winter Storms	Yes
C (1km)	-0.029	Cv (Summer)	0.750
D1 (1km)	0.264	Cv (Winter)	0.840
D2 (1km)	0.274	Shortest Storm (mins)	15
D3 (1km)	0.304	Longest Storm (mins)	10080
E (1km)	0.305	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.505

Time (mins) From:	To:	Area (ha)
0	4	0.505

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Model Details

Storage is Online Cover Level (m) 56.700

Complex Structure

Tank or Pond

Invert Level (m) 55.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	170.7	0.300	235.3	0.600	304.9	0.900	379.7
0.100	191.7	0.400	257.9	0.700	329.3	1.000	405.8
0.200	213.2	0.500	281.2	0.800	354.3		

Box Culvert

Height (m) 0.400 Slope (1:X) 200.000 Downstream Invert (m) 55.835
Width (m) 2.000 Length (m) 110.000

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0118-5500-0350-5500
Design Head (m)	0.350
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	118
Invert Level (m)	55.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.350	5.4	Kick-Flo®	0.284	4.9
Flush-Flo™	0.170	5.4	Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	8.0	2.000	12.3	4.000	17.1	7.000	22.6
0.200	5.4	1.000	8.9	2.200	12.9	4.500	18.1	7.500	23.4
0.300	5.1	1.200	9.7	2.400	13.4	5.000	19.1	8.000	24.2
0.400	5.8	1.400	10.4	2.600	13.9	5.500	20.0	8.500	25.0
0.500	6.4	1.600	11.1	3.000	14.9	6.000	20.9	9.000	25.7
0.600	7.0	1.800	11.7	3.500	16.1	6.500	21.8	9.500	26.4

Hydro-Brake Optimum® Overflow Control

Unit Reference	MD-SHE-0155-1000-0300-1000
Design Head (m)	0.300
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	155
Invert Level (m)	56.140

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Hydro-Brake Optimum® Overflow Control

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	10.0	Kick-Flo®	0.275	9.6
Flush-Flo™	0.204	9.9	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	0.800	15.8	2.000	24.5	4.000	34.1	7.000	45.3
0.200	9.9	1.000	17.6	2.200	25.7	4.500	36.2	7.500	46.9
0.300	10.0	1.200	19.2	2.400	26.8	5.000	38.2	8.000	48.5
0.400	11.4	1.400	20.7	2.600	27.8	5.500	40.1	8.500	50.0
0.500	12.7	1.600	22.0	3.000	29.8	6.000	41.9	9.000	51.5
0.600	13.8	1.800	23.3	3.500	31.9	6.500	43.7	9.500	52.9

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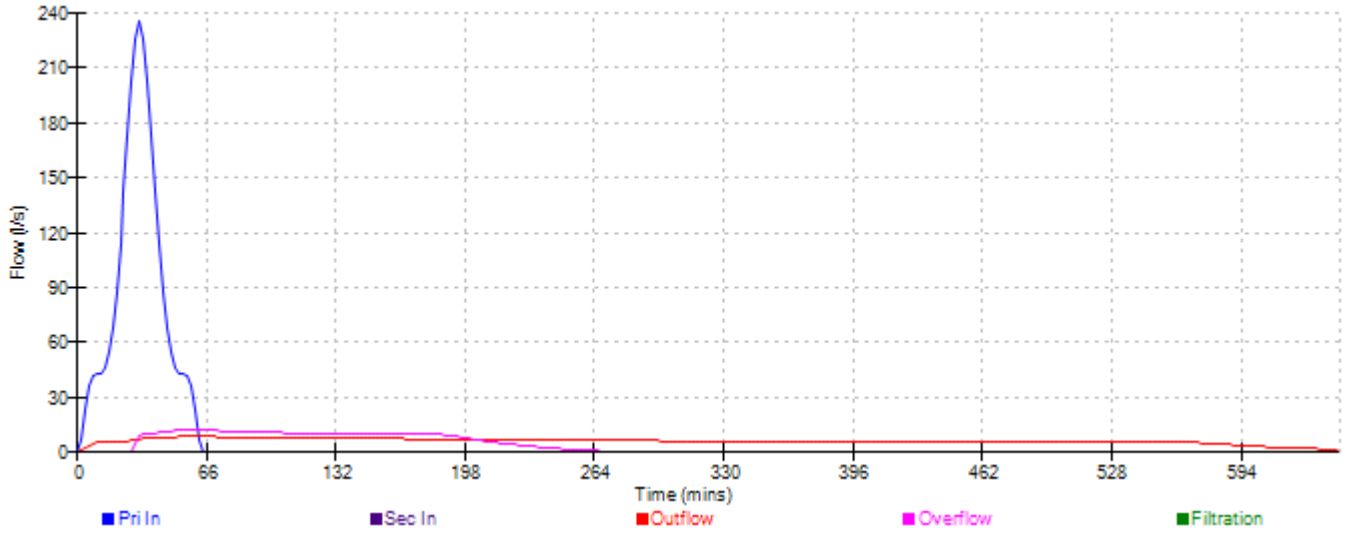
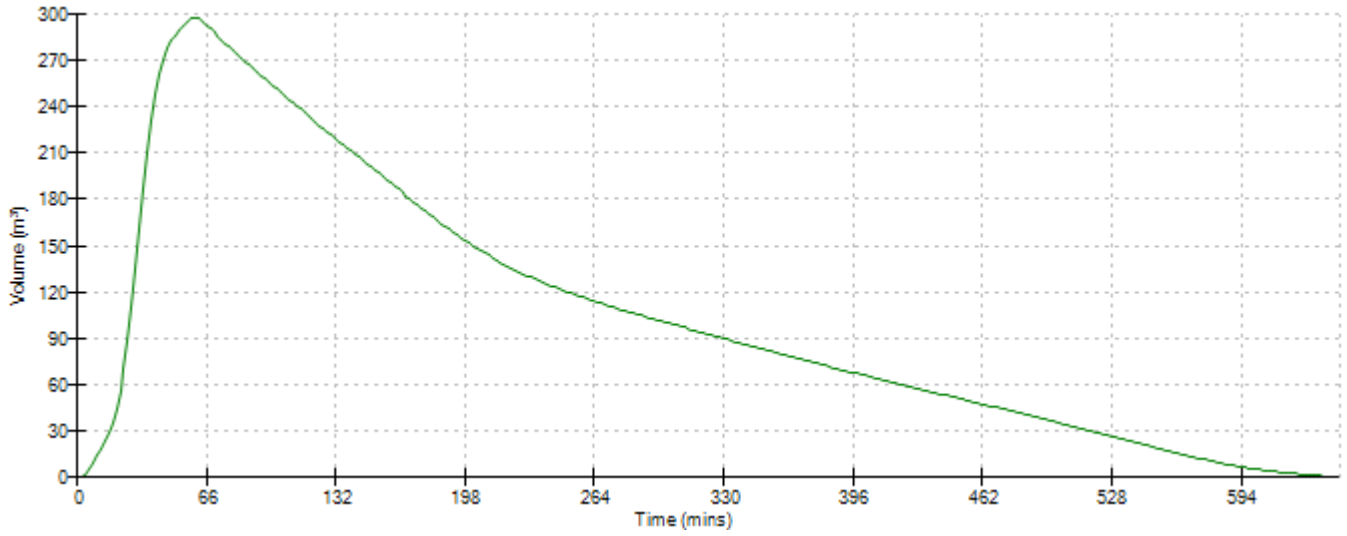
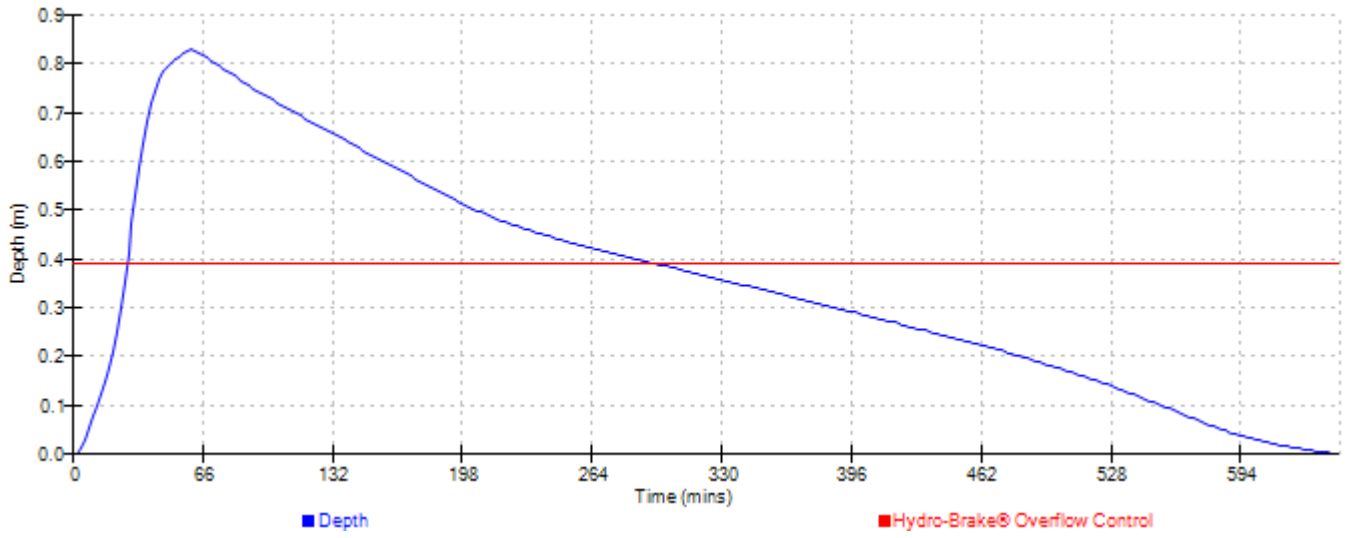
Event: 60 min Winter







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APPENDIX F

Ditch Photographs